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The Future of Work in Central and West Africa

Digital Technologies, Climate Change Mitigation and the Future of Work in Agri-based Economies in Central and West Africa: A Research Agenda

A Framework Paper

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Abstract:

As countries in the West and Central African (WCA) subregion prepare for technological advancements and other disruptions caused by climate change impacts, fragility, economic integration, and population transitions that will fundamentally alter their labor landscape, experts predict that increased digital technology (DT) adoption will have a potentially positive effect on these Agri-based economies. They believe that if DTs gain widespread acceptance, they will boost African businesses, creating more jobs for everyone. At the same time, the impact of these technologies, combined with existing challenges in SSA and the WCA sub-region, particularly climate change risks, appears to be exacerbating existing inequalities in terms of the future of work for marginalized groups, particularly women. However, rigorous quantitative and qualitative evidence about the impact of DTs and climate change on the future of work in Africa's Agri-based economies, particularly the WCA region, is limited, with many open research questions. We develop a framework for these issues and propose a research agenda to help guide policy and practice.

Keywords

Digital technologies, Future of Work, Agri-based Economies, Marginalized groups, Climate Change mitigation, Informal Sector, Digital Infrastructure, Digital Skills, Social Protection

Contents

1. The Impact of DTs on the Future of Work in Agri-based Economies and Socioeconomic Groups.

1.1 Introduction

Digital technologies (DTs), including cell phones, artificial intelligence (AI), robotics, the Internet of Things (IoT), automation, and others are altering people's social and economic lives, as well as the nature of work itself (Mulrean, 2020; Ticona, 2022),. Assessing these technologies in various sectors of the economy reveals a broad range of applications in mining, agriculture, services, manufacturing, financial services, and health care, among many others (Gaus & Hoxtell, 2019). While DTs are expected to boost productivity, provide better services, and improve user satisfaction, they are likely to disrupt the labor market by replacing previously human-only jobs in these sectors, resulting in wage cuts and increased inequality (Abdychev et al., 2018). For many industrialized economies where labour supply has been stagnant or decreasing, automation is a viable solution to the limited workforce challenge (Gaus & Hoxtell, 2019). In contrast, the complexities of the African context make the situation in Sub-Saharan Africa (SSA) and the West and Central African (WCA) sub-region starkly different (Lam et al., 2019).

The interplay between technological advances, climate change impacts, and global economic integration is expected to transform the future of work in Africa, including the WCA sub-region; however, the precise nature of this change remains unclear (Abdychev et al., 2018; Cilliers, 2021). This uncertainty stems from the various developmental challenges faced by the countries in the sub-region such as, the large informal work landscape and the smaller manufacturing base (Hien, 2023; World Bank, 2022), the prevalence of rural poverty among women and young people who have less access to employment opportunities, land, and financial resources (Diagana, 2021; Foresight Africa, 2015), the high vulnerability of the sub-region to climate change impacts (Adeola et al., 2024; Awiti, 2022), having the youngest growing population in the world (World Bank, 2022), and the poorest human capital outcomes (World Bank, 2021). Despite these challenges, experts anticipate that the uptake of digital technologies in SSA and the sub-region may create more employment opportunities for the fast-growing youthful workforce, instead of displacing workers over the coming years (Abdychev et al., 2018; Morgante & Wallace-Stephens, 2021; World Bank, 2019).

Furthermore, digital technology adoption can help businesses reduce their costs and prices, enabling them to expand their production and employment across all sectors, while access to internet and mobile apps can help low-skilled workers to learn better farming practices or sell more effectively in markets in Agri-based economies. All these innovations have been possible because many African countries have been able to adopt and adapt to the new DTs, helping them to leapfrog infrastructure while creating emerging sectors, particularly in services. Leapfrogging occurs when countries skip intermediate stages of technology that other countries have traditionally encountered during their development processes (UNCTAD, 2018). According to Abdychev et al(2018) African countries leapfrogged fixed telephone lines to mobile telecommunications; a move necessitated by the low fixed costs and minimal infrastructure requirements of mobile networks. In the early 2000s, countries like Côte d'Ivoire, Gambia, Ghana, and Mali had less than three fixed-telephone subscriptions per 100 inhabitants, which was well below the global average of 23.1. Mobile subscriptions were also marginal in these countries (UNCTAD, 2018). However, according to

UNCTAD (2018), by the year 2017, these countries had bypassed the landline infrastructure and reached levels of mobile subscriptions that were above the global average.

The mobile revolution has accelerated innovation in various sectors of the economy and created new markets. In the agriculture sector, it has enabled farmers to receive real-time weather and market data, as well as advice on seeding, fertilizing, harvesting, pest infestation detection and management, secure financial transactions, alternative value chain linkages, and risk reduction, among other things (Abdychev et al., 2018). Furthermore, through advances in technology some African hospitals rely on medical drones, which offer an inexpensive solution, to expand health-care access to patients restricted by distance or infrastructure (McCall, 2019). Additionally, these technologies are also helping people in Africa build houses in just a day at relatively cheaper costs (Moghayedi et al., 2024)

This mobile uptake has also led to proliferation of mobile payment systems and digital banking apps, bringing financial services to the unbanked, broadening financial access, and driving economic growth (Morgante & Wallace-Stephens, 2021; Mugume & Bulime, 2022). According to Yayboke & Carter (2020), mobile banking has provided significant gains in terms of financial inclusion, as it allows African countries to leapfrog the credit-card based systems that are still dominant in most developed countries and adopt a more efficient alternative. In 2017, SSA countries had the highest percentage of adults with a mobile money account, with a regional average of 21%, compared with 4% worldwide (UNCTAD, 2018). Gabon, Ghana, Côte d'Ivoire and Senegal in the WCA sub-region, are among the countries leading mobile financial inclusion in Africa (UNCTAD, 2018).

The rise of mobile payment systems is promoting entrepreneurship, which is helping to reduce unemployment, particularly among women and young people in SSA. This was confirmed by Kedir and Kouame (2022), who found that mobile money use was positively associated with self-employment and entrepreneurship among Cameroonian and Burkina Faso women, although more likely to benefit urban residents. Increasing use of mobile payments is also accelerating the growth of e-commerce both in SSA and the WCA sub-region. E-commerce enables retailers and entrepreneurs to reach prospective clients via digital platforms, thereby circumventing investment in physical retail (Okeleke et al., 2021). These platforms are boosting inclusivity in labour markets because more women entrepreneurs are operating businesses electronically. For example, women owned one-third (in Côte d'Ivoire) to more than half (in Nigeria) of the businesses on Jumia, Africa's largest e-commerce platform with operations in 11 countries across the continent (IFC, 2021).

Furthermore, mobile telephony in the region and sub-region has also led to the proliferation of the gig economy which provides flexible employment opportunities particularly for women, young people, and low-income groups that would otherwise be excluded (Ng'weno & Porteous, 2018; World Bank, 2023). To Ng'weno and Porteous (2018), the informal sector, including the gig economy is Africa's present and future source of employment opportunities. They assert that although the sector is perceived as being unproductive and tasking for workers, it has been and will continue to be the primary source of employment for the growing labour force on the continent. This is because of the minimal capital required to start an informal business and the negligible losses incurred upon exit (Etim & Olawande, 2020), as well as the low education and skill demands of the sector (Ng'weno & Porteous, 2018).

Despite the many employment opportunities DTs are creating for the African workforce, challenges regarding inaccessible digital infrastructure, poor digital literacy, poverty, limited social protection mechanisms continue to plague the African workforce, particularly marginalized groups, preventing them from benefiting from these opportunities. Regarding the fintech space, for example, evidence shows wide digital gender and spatial gaps in access and use of mobile financial services (Awiti, 2022; GSMA, 2023; Rowntree & Shanahan, 2020; UNESCO, 2022). Similarly, Okeleke and colleagues (2021) observe that a lack of access to mobile internet services for women and low-income rural populations, limited use of online payment services, poor residential address systems in both urban and rural areas, and a difficult business and macroeconomic environment for e-commerce start-ups are the main factors threatening the viability of e-commerce services in the WCA subregion.

Additionally, while the gig economy may be seen as an avenue for job creation, these digital platforms are also associated with deteriorating working conditions and labor standards (Abdychev et al., 2018; Anwar & Graham, 2019, 2021; Cilliers, 2021). In a study in Nigeria, Ghana, and a few other African countries, Anwar and Graham (2021) discovered that the structural and technological design of digital platforms, which resulted in social isolation, high work intensity, wage nonpayment, and unfair dismissals, contributed to the precariousness of gig jobs. Furthermore, Mwendwa and colleagues (2023) found that gig workers face a fundamental language barrier since the apps and programs assume English literacy as the internet's lingua franca. They also noted that whereas women intending to engage in gig work faced barriers in terms of obtaining the requisite devices to reliably access gig platforms, women employed in gig work grappled with discrimination from clients by virtue of being women and lack social protection on the jobs.

The distributional implications of DTs and climate change on work prospects and climate change risk resilience constitutes a major research gap with implications for policy, particularly in the WCA sub-region. There is need for rigorous empirical evidence on the digital gender and spatial impact of DTs on labour dynamics and climate change mitigation in Agri-based economies to ascertain the potential of these technologies to act as a catalyst for job creation and resilience building, as well as integrating them with social protection strategies to enhance employment opportunities and support marginalized groups in the WCA sub-region and similar contexts. We develop a framework for these issues and propose a research agenda to help inform policy and practice. We organize our framework around four key themes: (i) impact of DTs on Agri-based economies; (ii) DTs and climate change transitions; (iii) DTs, platformization and the Gig economy; iv) Digital skills and education; and (iv) policy and practice.

1.2 Impact of DTs on Agri-based Economies

Digital technology has become an important factor in modern agricultural production and is expected to transform Africa's agricultural sector (Kudama et al., 2021). According to Wang et al., (2024), the growth of the digital economy in SSA benefits agriculture by increasing agricultural productivity and human capital. They point out that farmers in SSA can improve their economic activities by actively using DTs to access information and obtain necessary services. These

technologies make it convenient for them to learn best practices in land management, the use of new seeds, and fertilizer use (Kaila et al., 2019).

DTs use is observed to also increase income and improve household welfare among some countries in SSA. According to Marwa et al. (2020), the use of digital platforms increased household income by 22%. When household incomes increase, it affords farmers the opportunity to invest in more advanced technologies in agriculture, thereby building their resilience against climate change impacts. The proliferation of smartphones and computers in SSA has also enabled farmers to maintain mutual communication with experts and related institutions and receive more accurate suggestions on agricultural production and climate change risk mitigation (Aker and Dial, 2011).

In addition to the innovations and opportunities created by DTs in the agricultural sector, there have been some discussions about whether advances in technology will also influence growth and employment opportunities in the manufacturing sector. According to one school of thought, some countries in SSA are experiencing premature deindustrialization as employment in the African agricultural sector is slowly on the decline (Ortiz-Ospina & Lippolis, 2017). They add that the emergence of DTs will further hinder prospects for industrialization on the continent in this new era, than it did in the past. This is because the technological demands of the manufacturing sector today have made it more capital and skill intensive, which has reduced the sector's scope of labor absorption. This means that countries who are late industrializers and those at the intermediate level of development may no longer benefit from manufacturing the same way as early industrializers (Szirmai and Verspagen 2015).

Even though the hike in labor costs in China could open offshoring opportunities for many African countries, these countries could still miss out because they lack the complementary foundational infrastructure, a good working environment, and efficient institutions. Furthermore, the success of other emerging Southeast Asian economies as alternative investment destinations could also be problematic for African countries (Cadot et al. 2016; Gelb, Meyer, and Ramachandran 2013; Rodrik 2016).

Therefore, to prepare for the digital future, some scholars recommend that African countries continue to boost traditional exports, which are more labor-intensive in nature, by moving into sectors less affected by global technological change such as paper and products, wood and wood products, basic metals and non-metallic minerals. It is believed that once they have built up industrial capabilities in these sectors, they could then move into higher value-added manufacturing and services. These industry growth model proponents note that they would, however, first need to address the basic constraints on manufacturing, notably, improving transport infrastructure and securing reliable access to power. Contrarily, many other scholars and experts are of the view that instead of an overreliance on manufacturing and industrialization, which may not favour the needs of the future of work in the 4IR, there should be a plan to pivot to other sectors, including the green and care sectors (Morgante & Wallace-Stephens, 2021; ILO, 2011),

In the face of all these predictions and fragmentary information on the future of work in Africa, empirical evidence on a large pool of Africa countries is needed to provide a holistic picture of employment prospects in Africa. It is problematic to rely available literature which rely only on a handful of tech savvy African countries because of the heterogeneity of the continent which is influenced by country complexities and contextual differences. Hence the need to expand the scope of the research to other regions and sub-regions in Africa besides SSA, particularly the WCA sub-region, to understand how DTs would influence job creation, displacement, and overall labor market dynamics, and enhance the resilience of the workforce and agriculture sector against the impacts of climate change.

1.3 Impact of DTs on Socio-economic Groups

Africa's Internet access has increased over the last two decades, owing to widespread deployments of connectivity infrastructure and mobile communication devices that have brought millions of Africans online and are creating new economic opportunities. The World Bank reports that 160 million Africans gained broadband Internet access between 2019 and 2022.

As a result, the majority of the poor have gained access to social media, independent information channels, mobile banking, and e-commerce, among other things. The introduction of new economic opportunities, such as pay-as-you-go businesses, as well as an increase in the flow of information, has boosted people's self-esteem, sense of belonging, and citizenship. The smartphone has become the primary source of internet access, bridging the geographic divide between urban and rural communities. Digital technologies could reduce income inequality by contributing to economic growth, providing a multifaceted approach to fighting poverty and strengthening economic development, and improving both social and human capital (Waverman et al., 2005).

Reducing inequalities in technology access and use, as well as promoting inclusive DT diffusion, is especially beneficial in terms of facilitating access to resources and information. It also allows firms to increase their productivity and improves income-generating opportunities for poor people and households (Aker and Mbiti, 2010; Qureshi, 2011). Furthermore, as Downes (2009) demonstrates, equal access to new technologies has particularly significant positive network impacts, limits rent accumulation, and reduces existing wealth concentrations (Antonelli and Gehringer, 2017; Richmond and Triplett, 2018).

However, in environments marked by inequalities in opportunity, education, gender, and wealth, increased distribution of DTs could further broaden disparities in wealth (Lindsay, 2005). Here, the haves can broaden their opportunities at the expense of the have nots, who are increasingly marginalized and excluded from the advantaged class (Tewathia et al., 2020). According to Acemoglu (2002) and Piketty and Saez (2003), this ever-increasing income inequality in most developed countries could be traced back to the diffusion of information technology, which increased the sources of income for people who had access to DTs. Nowadays, DT-enabled services are focused more on usage than access due to the lack of skills and resources required to

use them. Furthermore, Aghion et al. (2019) conclude that the recent evolution of income inequality in the upper brackets is largely attributed to innovation. According to them, when Forbes magazine ranked the richest people in America, 11 out of 50 were inventors and US patent holders, while the majority were owners of trademarked companies.

Based on these, one would wonder how DTs can act as a catalyst for job creation, particularly for vulnerable groups, within the agricultural context in the WCA sub-region. Experts have recommended robust reforms to bridge the digital gap to stem income inequality and achieve Sustainable Development Goal 10, which calls for the reduction of inequality of all kinds. To do so, they explain that these reforms must ensure inclusive access to and use of digital technologies, as well as improve digital skills. To facilitate access, scholars note that the policies must ensure that individuals can afford the purchase and maintenance of digital technologies. It has acknowledged that once people have easy access to DTs, their use becomes easy. However, improvement in digital literacy will facilitate effective use.

Expanding digital infrastructure is one of the most significant challenges that African governments face (Fox & Signé, 2022). Africa's infrastructure deficit, including electricity, is long-standing and dates back to colonial times. The impact on employment and earnings, especially in the informal sector, is well documented (Begazo et al., 2023; Bond, 2016; Caldarola et al., 2023; IFC, 2020). Data from Nigeria, the largest mobile market in Africa, found that extreme poverty decreased by about 4% after one year of mobile broadband coverage, and about 7% after two or more years (IFC, 2020). Bridging the physical and digital infrastructure gap requires adopting new technologies that offer less expensive solutions, such as reducing electricity infrastructure scarcity.

1.4 DTs and Gender Impacts

For the past thirty years, participation of women in the labor force in Africa has consistently been estimated to be around 60% according to the World Bank. Yet, this statistic only tells part of the story. The majority of women in the labor force in Africa remain in low-income, labor-intensive jobs such as agricultural work, which lack value-addition and growth opportunities and contribute to keeping many women in poverty. Nevertheless, African women continue to lead the world as entrepreneurs and business owners. Despite being the only region in the world with more female entrepreneurs than men, SSA's female-owned businesses are overwhelmingly microenterprises. Furthermore, women-owned businesses generate 34% less profit than those owned by men (Aseidu et al, 2023).

In the 4IR era, work in the agricultural sector is gradually shifting toward renewable energy, sustainable agriculture, and conservation, with the green economy creating more jobs, particularly for women. The energy, construction, and agricultural sectors are expected to create the most jobs (UN Women, 2021). According to the UN Women (2021) report, women currently hold quite a number of jobs in agriculture, forestry, and tourism, all of which have high female employment rates and are key growth sectors for green jobs in the region. A positive development is that women

are carving out niches in male-dominated sectors, often as small women-led businesses in indirect jobs like green construction, renovation, and energy efficiency.

However, there is still a lack of women in key sectors of the green economy that will provide the best green jobs, such as energy (particularly wind and solar), transportation, construction, and some niche fields of services like green consulting. Women are more concentrated in agriculture, waste management, and specific fields of renewable energy such as biomass, which are more likely to generate low-wage jobs (ANRC, 2022). This is not unique to the African continent. The global participation of women in tech sectors remains low globally. Still, compared to record rates of women's entrepreneurship, African women's participation in the tech industry is woefully behind.

A key cause of the digital gender divide is a lack of access to mobile internet, which is linked to not owning a smartphone. In 2022 the GSMA found that women in sub-Saharan Africa are 30% less likely to own a smartphone than their male counterparts and 20% less likely to use mobile Internet than men. Women consistently have less access to internet and mobile phones than men for two key reasons: women receive lower levels of education and, partly as a result, earn less on average. A GSMA (2022) study found that literacy and digital skills, particularly basic literacy, were the second most commonly cited barriers to smart phone ownership in SSA. The report identified five sub-barriers, with reading and writing difficulties being the most commonly reported by female respondents. The second most commonly reported reason was a lack of knowledge about using mobile internet. While this is also true of men of similar socioeconomic status, the disparity can be particularly pronounced for women. For instance, 36% of women surveyed in Senegal cited reading and writing as a barrier to mobile access compared to 12% of men who cited this problem.

The cost of internet connectivity is also observed to deter usage. The cost of both fixed and mobile broadband connections in SSA is the highest when compared to other regions (Abdychev et al., 2018). In Senegal, 61% of women and 46% of men who are not online cite the cost of a smartphone and internet connectivity as a primary reason (Rowntree & Shanahan, 2020). Further research has revealed that gender pay disparities and women's lower employment rates means that these phones are already more expensive for women than men (Women Business and the Law, 2022). A GSMA digital gaps analysis discovered that, on average, the cost of an entry-level smart phone represented 25% of women's monthly income in SSA, compared to 15% for men (GSMA, 2022). Similarly, Begazo and colleagues (2023) observe that 40% of Africans fall below the global extreme poverty line, meaning the cost of even basic mobile data plans would represent about one-third of their incomes. Only about 5% of extremely poor households access the internet.

Access to digital banking and identification remains a barrier for women in many countries and presents a particular challenge for women entrepreneurs that want to break into the digital economy. In developing economies, women remain 9 percentage points less likely than men to have a bank account. Across Africa, it is estimated that 60% of the 400 million people that do not have access to digital financial services are women. Women who own small- and medium-sized enterprises (SMEs) but do not have access to mobile phones or digital banking are not able to take advantage of digital payment applications that could significantly scale their businesses to reach

new markets. Additionally, digital banking platforms can provide a range of value-added services such as risk estimation, which enables further investment. Women are also excluded from digital jobs, networks, and business associations that connect job seekers to the tech industry. Exclusion from job networking opportunities means that women-led tech startups have a more difficult time finding and successfully pitching funders, impeding the ability to start and scale digital businesses.

In terms of literacy, women and girls are not only excluded from access to training and education in STEM, but also from education that promotes general digital literacy. UNESCO estimates that only 30% of women in Sub-Saharan Africa receive STEM training and participate in the tech sector. Fewer girls than boys possess the critical digital skills needed to compete in the modern labor force. An estimated 230 million jobs in Sub-Saharan African will require digital skills by 2030. Therefore, not having equal access to digital education systematically prevents girls from being part of the fastest-growing sectors of the economy, which could dampen job growth and entrepreneurship opportunities overall. Patterns of gendered exclusion are intersectional, meaning that structures of power and inequality affect women from different backgrounds in compounding and overlapping ways.

Economically marginalized groups, especially rural women living in the most remote settings, face multiple barriers to digital access, including network availability, device, and data affordability, and low levels of awareness, literacies, and agency. This is particularly true for women in SSA and the WCA sub-region who are the most underserved, including those with low literacy or incomes, who live in a rural area or have a disability. Older women are at greater risk of exclusion as they often have lower levels both of digital literacy and access to Internet and mobile phones.

Recent experience shows that using digital solutions along the social protection delivery chain can yield a range of benefits. Indeed, it is observed that digitalization can promote awareness of social protection schemes and access to several benefits and services without having to apply for each one separately. Digitalization can also reduce travel time and transportation costs when applying for programs and collecting benefits, while facilitating access to information about programs. At the same time, the use of digital technologies for implementing social protection programs faces several challenges in rural areas. The main risk lies in the potential exclusion of individuals or households deprived of access to the required digital technologies or even to basic infrastructure and hardware—or lacking the knowledge on how to use them. This may especially affect women, elderly people, migrants, ethnic minorities and indigenous peoples. Other obstacles and risks worth considering in connection with digital social protection include data privacy concerns, the lack of physical addresses or personal identification, and the lack of digital ecosystems that accept digital payments. While these obstacles are not unique to rural areas, they tend to manifest themselves more acutely among rural populations than elsewhere.

Social protection access is extremely limited in SSA where only an average of 17% of the total population receive a form of social protection benefit in comparison with a global average of 47 percent (ILO, 2020). The share of the population without social protection falls into the category termed the ‘missing middle’. Workers in the informal economy make up a significant share of the

population without access to social protection. According to the ILO's social protection platform, public expenditure on social protection is 0.7% (Nigeria), 1.2% (Cote d'Ivoire),1.6% (Ghana), and 1.8% (DRC). Reasons for such low expenditures include the fact that in many SSA countries, social assistance which is government funded or publicly provided benefits, in cash or in kind, is mainly disbursed as a form of emergency relief (ILO Social Protection Platform). Also, less than 10% of the population in SSA is covered by social insurance due to low employment levels, a high level of informal employment and self-employment (ILO, 2020).

Over the last decade, and especially in more recent years, African governments have made significant efforts to develop a range of contributory social protection schemes that cover workers in the informal economy (Guven, 2019; ILO, 2019). In a UNDP (2021) report on the social protection schemes covering informal workers in seven African countries, including from Ghana and Togo, it was revealed that some promising strides had been made. These include the collection of national statistics on informal employment and engagement with informal workers to inform program design and implementation. Efforts to lower and allow for more flexible contributions, improve the benefits packages available and draw on the power of technological innovation to reduce transaction costs (although this should proceed with care to ensure the inclusion of those unable to access DTs). Some governments have also been ambitious and intentional about building trust and awareness regarding contributory social protection schemes.

However, the report also highlights significant challenges and gaps still to overcome. Many of the schemes reviewed were perceived as vulnerable because they solely targeted informal workers. This meant that the risk pool was too narrow, and the benefits of cross-subsidization between formal and informal workers were absent from these schemes. The authors proposed that more conscious attempts be made at linking contributory and non-contributory schemes. They believed that doing this could have a significant impact on bringing more women into the social protection system. Moreover, they noted that institutional representation through tripartite structures and bottom-up approaches were critical for informal workers to perceive the Government as a collaborator in this process. The authors additionally recommended that greater representation by informal workers' organizations, particularly in sectors where women dominate – such as agriculture, street vending and market trading, and domestic work – may give rise to more demands for maternity protections which are currently missing from most of these schemes.

1.4 Research Questions

- How will DTs influence job creation, displacement, and overall labor market dynamics in the Agri-based economies.
- How will DTs enhance the resilience of the WCA sub-region workforce and agriculture sector against the impacts of climate change.
- How can DTs be made accessible to the information poor in Agri-based economies in the WCA sub-region?
- How can DTs act as a catalyst for job creation, particularly for vulnerable groups, within the agricultural context in the WCA sub-region?

- To what extent do DTs influence the evolving labor landscape within the agricultural context, considering the ecological shifts caused by climate change adaptations?
- What is the role of social safety nets in the evolving digital and environmental context?

2. DTs and Climate Change Transitions (Green Economy) in Agri-Based Economies

2.1 Introduction

The effects of climate change in the WCA sub-region are diverse and quite severe. The region encounters several issues including droughts, coastal floods, desertification, and a decrease in agricultural output resulting in food shortages (Anugwom, 2021). The environmental changes mentioned have a direct impact on public health, leading to an escalation of vector-borne illnesses such as malaria, as well as other health hazards (Opoku et al., 2021). Furthermore, the area undergoes alterations in precipitation patterns, with a predicted rise in the amount of woody plant covering that may impact future variations in evapotranspiration and soil moisture levels (Erfanian et al., 2016). Research has indicated that these impacts will have severe adverse impacts on agricultural yields (Roudier et al., 2011; Wang & Alo, 2012).

In vulnerability of countries in the WCA sub-region to climate change impacts is deepened by their limited ability to adapt (Ayodotun et al., 2019). The sub-region's overreliance on agriculture as a primary source of income renders it particularly vulnerable to the adverse impacts of climate change (Olofin, 2016). The exposure of the sub-region to climate change impacts has further led to increased climate-induced migration in the area (Teye & Nikoi, 2022).

2.2 Climate Change Transition (Green Economy)

The adverse effects of climate change impacts on many African countries together with the digital revolution on the continent have led many countries to shift towards climate change transition, also known as a green economy. This has been described as an economy that is low carbon, resource efficient and socially inclusive (Bulkeley, 2010; Boyd & Juhola, 2014). Primarily, six main sectors contribute to the green economy – renewable energy, green buildings, sustainable transport, water management, waste management and land management.

While climate change has compelled many countries to rethink their commitment to the environment along with economic growth, the COVID-19 pandemic, followed by the war in Ukraine, has exposed many economies worldwide to the shocks of supply chain disruption, highlighting the futility of a ‘growth-only’ paradigm. This has pushed countries to realize the importance of a more sustainable and greener economic pathway, with many now seeking a

different approach towards economic growth which is not decoupled from environmental protection and social justice.

Africa is in a great position to harness the benefits of transitioning to an inclusive green economy. In fact, more than 83% of national climate plans include greenhouse gas reduction targets, with focus areas including energy, agriculture, waste, land use and forestry - which are also the main sectors for green economy interventions. The continent is endowed with abundant natural resources, specifically lithium, graphite, cobalt, nickel, copper, and rare earth minerals—all are key components of the e-mobility transition and represent new market opportunities for net-zero targets as well as sustaining livelihoods.

Seven countries in Africa are predicted to be in the world's top ten fastest growing economies: Uganda, Kenya, Tanzania, Madagascar, Senegal, Malawi and Zambia. This means a large increase in energy demand from households, industry, transport, and power generation. A green economy approach allows African countries to transition to a greener energy generation pathway and cater to their growing energy demand at the same time, supported by falling renewable energy costs, with solar panel prices dropping by 80% in the last decade and wind energy prices by 40%.

The UN estimates the annual investment gap for renewable energy infrastructure to be between $380 billion and $680 billion. With focused policy interventions on the green economy, African countries have a huge potential to close the financing gap. So far, Nigeria has been able to tap the green, social and sustainable bond market to raise finance. Direct policy measures are required to attract such financing for more African countries. Burkina Faso, for example, has implemented a new investment code that lowers the performance obligations for investors in green and renewable energy sectors. Africa is also likely to embark on rapid urbanization which needs better planning to develop more compact, resource-efficient cities.

Transitioning to Green Economy would create newer jobs as well as bring in more investment to Africa. This is crucial for Africa with approximately 70% of the population below the age of 30 and newer entrants joining the workforce every year. For example, UNEP estimates that the expansion of solar and wind capacity in Senegal will create up to 30,000 additional jobs by 2035.

The downside of the transition includes high initial investment costs, low capacity (skills and technology) for implementation, the projected insignificant rise in real GDP in the short term, and a general increase in carbon emissions as Africa develops. Some stakeholders who lose out in the transition may need to be compensated. In Kenya, for example, in spite of costs associated with green economy investments, growth in GDP would not be substantially different from business as usual in the short term (between 2010 and 2020). Employment in certain sectors may also suffer from a green transition. While overall employment is set to increase, certain sectors such as coal mining will inevitably suffer a loss of jobs. Governments will need to support such segments of the population during the transition.

Overall, the green economy offers an opportunity to address poverty, economic stagnation, unemployment, and vulnerability to environmental risks and ecological scarcities. The studies that have been conducted across a number of African countries in both small and larger economies with different resource endowments, demonstrate positive and significant impacts. However, the transition to a green economy will not happen automatically. It needs to be facilitated by various enabling conditions, including financing, capacity development, green technology development and transfer, policy instruments, and institution and policy frameworks.

2.3 The Impact of Climate Change Transition on Traditional Jobs in Agriculture

In Africa, agriculture remains the mainstay of the economy, with over 60% of the population working in agriculture, far beyond the world average of 13% (FAO, 2017). However, 227 million people (a fifth of the population) in Africa face chronic food security problems. Africa has 15% of the world's population but nearly a third of the world's famine population (Carlos Lopez and Jun Liu, 2015). It is not difficult to speculate that the reasons behind this are closely related to the characteristics of current African agriculture. According to Carlos Lopez and Jun Liu (2015), Africa is predominantly a smallholder economy with poor agricultural practices, resulting in low food production. For example, maize yields in Africa were 2t/hm2 in 2018 while the Americas and Europe were producing 8t/hm2 and the world average was 6t/hm2. (FAO,2018).

Traditional agriculture was seen as the first evidence of increased greenhouse gas emissions into the atmosphere (Paustian et al., 2016). 50-60% of nitrous oxide (N2O) and methane (CH4) are derived directly from human agricultural activities (Awais et al., 2021). The misuse of pesticides and manure on the continent also leads to excessive nitrous oxide (N2O) emissions, which have a 300 times greater impact on global warming than carbon dioxide (CO2). In addition, farmers often cut down surrounding vegetation to provide more light to their arable land and prevent fertilizer run-off, leading to a reduction in vegetation. These factors further exacerbate global warming (Wenjiao Shi and Fulu Tao, 2014).

The first drive for green economy transition in African agriculture is the attempt to offset the effects of climate vulnerability on agriculture. This would mean adopting best practices and embracing DTs that would ensure efficiency and productivity and minimize any harmful effects on the environment. Ultimately, the smallholder model will be replaced. While this move will benefit African agriculture, the digital divide regarding access to infrastructure, skills, and social protections must be addressed to tackle the challenges of financing, climate change mitigation, and meet changing consumer demands in Agri-based economies.

2.4 Creating Opportunities in Green Sectors.

The agriculture, forestry and fisheries sector, as well as the entire system of food production, is both the highest GHG-emitting sector in sub-Saharan Africa and the most vulnerable to climate change. It is also the largest employer, with 53 per cent of jobs,22 and a large employer of women

across the continent. It accounts for an estimated 20 per cent of the region's GDP in 2021.23 According to the ILO, more than 217 million jobs in Africa relied on agriculture in 2014 (ILO, 2018). The number of agriculture jobs in Africa is expected to grow for the next several decades (Christiansen, & Brooks, 2018), even though other sectors are growing faster.

The agriculture sector will need to shift fundamentally to more sustainable practices in order to reduce GHG emissions and enhance resilience to climate change. Green agriculture involves shifting both industrial and subsistence farming towards ecologically sound practices such as efficient use of water, extensive use of organic and natural soil nutrients, optimal tillage, and integrated pest control. Building green agriculture requires physical capital assets, financial investments, research, and capacity-building. In addition to the progressive greening of conventional agriculture by promoting a more efficient use of resources, a shift towards conservation and organic farming is another important path for the greening of the sector. Conservation agriculture is a farming system that encourages minimum soil disturbance, safeguards permanent soil cover, and diversifies plant species (FAO, 2021)

In terms of job quality, the shift to sustainable agriculture may boost the productivity of agricultural labour in low- and middle-income countries. Green practices in agriculture help to increase workers' incomes by lowering input needs, increasing yields, and fetching higher prices or a combination of these factors. This has been seen for small farms in Africa, where use of synthetic inputs (fertilizers and pesticides) is limited (ILO, 2013).

The sectors likely to provide the most promising economic potential in relation to the green economy in SSA are in agriculture, energy, forestry, fisheries, tourism, transport, construction and waste management (UN Women, 2021). In the agricultural sector, areas such as trade in biodiversity-based businesses or biotrade and organic agriculture are identified as niche markets for the sector, even though these are still in their infancy in the region.

Green jobs are likely to be concentrated in the above sectors and subsectors, and at the same time these sectors are likely to generate or regain the most jobs in the post COVID recovery in sub-Saharan Africa. Thus, a shift to greener processes and products and overall job growth may have a synergistic effect in these sectors. In general, the areas likely to produce the most green jobs are the energy and construction sectors, the circular economy and sectors related to ecosystems – agriculture, forestry and tourism.

2.5 Potential for New Sustainable Green Jobs for Women

Agriculture is the biggest source of women's jobs in sub-Saharan Africa, estimated in 2019 as employing 53 per cent of working women (ILO, 2021). Women's prominent role in the sector often does not translate into economic gains, however, as women are employed mostly in informal, vulnerable jobs at the early, low-productivity stages of agricultural value chains (ILO, 2020).

Greening conventional agriculture will produce green jobs for which women are well positioned to take them. However, these are likely to be low-quality jobs, as the vast majority of jobs in the sector. The shift to conservation agriculture may reduce employment in net terms, but the jobs created are likely to be higher quality, and women are also well positioned to access these jobs. Data limitations make it difficult to assess the potential of the forestry sector to create green jobs in sub-Saharan Africa and to assess women's participation in certain types of jobs/areas of forestry (for example, reforestation). However, there is evidence that in sustainable forestry working conditions are better and the quality of jobs is higher than in conventional forestry, and women are well positioned in niche markets and as community forestry managers. There are important opportunities through payments for environmental services and other mechanisms to assign economic value to women's unpaid work in this particular sector.

There is also a dearth of data on fisheries sector, but aquaculture seems to be an area where significant opportunities for women could emerge. However, there is a risk of women being marginalized in low-quality jobs, judging by the current high levels of informality in the sector, and co-option of new opportunities by men, as seen in other countries. This is a critical sector to open up opportunities for women in rural and/or poor areas, and it therefore deserves the attention of policymakers. Women make up the majority of workers in the tourism sector, and the potential for greening the sector is large. Currently, women's participation in green tourism activities is driven mainly by their entrepreneurship and by community-based tourism initiatives (Hamilpurka, 2021).

Women's opportunities for green jobs in the tourism sector are numerous, both as self-employed and wage workers. Women are well positioned, as per their participation in the tourism sector is already high. However, informality and poor working conditions in conventional tourism may indicate that new jobs for women arising from the greening of the tourist industry 33 tourism sector do not have formal contracts (ILO, 2011) At the same time, tourism offers plenty of opportunities for self-employment. Women's green job opportunities in tourism Women make up the majority of workers in the tourism sector, and the potential for greening the sector is large. Currently, women's participation in green tourism activities is driven mainly by their entrepreneurship and by community-based tourism initiatives (Hamilpurka, 2021).

Women's opportunities for green jobs in the tourism sector are numerous, both as self-employed and wage workers. Women are well positioned, as per their participation in the tourism sector is already high. However, informality and poor working conditions in conventional tourism may indicate that new jobs for may be of low quality. The substantial potential for entrepreneurship, including by women, may mitigate poor working conditions to some extent. Examples of women creating new positions as climbing guides and park rangers suggest that there are also interesting opportunities from the point of view of changing perceptions about women's jobs and for role-modelling. Quick-win opportunities for women can be realized by addressing issues such as informality and lack of financing for micro, small and medium-sized enterprises for women entrepreneurs. Overall, measures to support the development of women-led MSMEs in this sector would help more women take up jobs in this area of the green economy.

While the number of green jobs created is not comparable to other sectors, the circular economy can create significant high-quality jobs. Women are important actors in the sector, and while data to assess the full extent of their participation are lacking, women will be well positioned to access jobs in the sector in a number of cities across sub-Saharan Africa. A number of opportunities in sustainable waste management and waste-to-energy will also exist for women. The quality of those jobs will depend on the extent to which policies and programs to support formalization in the sector take place. Innovative women-led SMEs are very active in the recycling sector in the region. With the necessary economic incentives from governments, this could be another quick win for women.

The shift to more and more efficient public transport will create some new green jobs in sub-Saharan Africa, but not a large number. These jobs will be to some extent good-quality jobs (for example, public bus drivers) but ones for which women are not necessarily well positioned, given their very limited participation in the sector currently. Promoting women's entry into public transport, particularly sustainable municipal transport, might have value however, by creating very visible positive role-models of women's incursion into a male-dominated area of employment.

Renewable energy, as a distinct subsector within the energy sector, may open up opportunities for increased women's participation and for breaking into male-dominated areas of employment. Existing data support this potential: Women's participation is higher in renewable energy than in conventional energy. Investments in mentoring and promoting women's organizations in the sector (see examples in Box 9) can help consolidate this trend. The quality of jobs varies across renewable energy subsectors, and women are better positioned to seize opportunities in solar power, which is expected to create a number of high-quality jobs, and bioenergy, where the jobs are likely to be low-quality. Women are less well positioned in the wind industry in the region, but the growing potential of this subsector provides long-term opportunities for increasing women's presence, if the right policies are implemented.

Although a difficult sector for women to enter, the coming shift to green building will create opportunities for women. Areas such as renovation, solar panel installation, insulation and energy efficiency are likely to grow as the green building market expands. These areas may present much lower entry barriers – an advantage to women entrepreneurs – than large construction projects. Women also may find job opportunities in indirect jobs associated with construction, many of which are mid- to high-level jobs in terms of pay, stability and working conditions, such as jobs in architecture, landscape design, urban planning, energy auditing, solar panel installation and sustainability consulting. The new green skills required will be learned mostly through training rather than on the job, as most conventional building trades skills are learned. Some of these jobs require advanced academic qualifications, while a high school or a technical and vocational education and training (TVET) diploma might suffice to enter other jobs. The need for schooling should put women on a more equal footing with men competing for construction jobs in the green building sector. A number of women-led businesses are already seizing this opportunity across the region.

2.6 Barriers to Women's Participation in Green Jobs

However, women are underrepresented in key sectors of the green economy that will offer the best green jobs. Those sectors most likely to create higher-end green jobs include energy (especially wind and solar), transportation, construction and some niche areas of services (e.g., green advisory). Women are overrepresented in agriculture, waste management and certain areas of renewable energy (biomass), which are likely to create mostly lower-end jobs. The mix will depend to a certain degree on country policies.

Skills mismatch is probably one of the major obstacles women face to obtaining green jobs, particularly as wage employees and especially in higher-end jobs. The analysis in section 3 has shown that a number of new jobs with a technical profile will be created across different sectors (for example, as engineers and architects). Given current gender segregation in education systems and labour markets in most African countries, these new opportunities are currently accessible to a narrow pool of women who have the necessary skills and qualifications. For example, in 2013, women represented only 7 to 12 per cent of engineering students in Africa.115 Approximately 30 per cent of tertiary-level engineering students in Niger are women, while in Mali women constitute just 6 per cent of engineering students. Across sectors, the gender gap in skills training is more evident in certain areas, such as construction, transport and certain areas of energy, where women currently participate in very low proportions. These also are some of the sectors where the highest numbers of green jobs, including higher-end jobs, will be created.

Women face several barriers that may limit their full access to green jobs in the coming years. Some of these barriers are sector-specific, such as social norms that deem construction jobs inappropriate for women. Others permeate all sectors. These include barriers to women's and women-led businesses' access to land, finance and technology; gender segregation in the education system and labour market; laws that limit women's access to certain tasks and jobs; and structural inequalities reflecting social norms dictating that women should shoulder the great majority of unpaid care work, effectively depriving them of opportunities for other jobs.

Improving gender inclusivity in Africa's growing tech sector is essential for harnessing innovation and leadership potential across the continent. Eliminating gender discrimination and exclusionary patterns in entrepreneur access to start-up and growth capital will make markets more dynamic and competitive. Women's full participation in the digital and tech economy will result in more diverse product creation, higher financial returns, and access to new markets and sectors. Given current trends, a gender inclusive tech sector will require policymakers and African development institutions to prioritize equitable access to STEM education and digital education for all girls, including those in underserved communities and rural or remote areas. This would mean integrating more STEM requirements into the national curriculum and providing more digital learning opportunities in the classroom, in addition to guaranteeing basic numeracy and literacy skills, the foundation for digital inclusivity.

There would also be the need to build equitable infrastructure for internet access in communities and in schools. Furthermore, national governments and public institutions would need to promote

regional collaboration across digital technologies. The Africa Continental Free Trade Area has the potential to open up new opportunities for digital trade between countries. The digital regulatory environment and architecture should have a focus on gender inclusion. In addition, there should be co-investment in public-private partnerships that are mutually beneficial to achieving gender inclusion in tech. Private sector technology and telecommunications companies have a shared interest in improving internet access and digital learning that promote a more gender-inclusive workforce. Finally, policymakers should collaborate with the private sector to collect better data on women in tech. There is a need for better, more consistent, and more transparent data on African women in tech in order to accurately measure the current underrepresentation and account for progress moving forward.

2.7 Research Questions

- How can women and girls be prepared for the green economy?
- How can we take advantage of the opportunities offered by the green transition to improve gender equality and women's empowerment?
- How can gender segregation in education be undone to promote women's participation in science, technology, engineering and math (STEM) fields?
- How can the playing field be leveled for a gender-responsive green economy?
- How can the playing field be leveled for a gender-responsive green economy?
- In what ways can women's transition towards the formal economy be supported to facilitate women's movement into better-paying green jobs with better working conditions?

3. DTs, Platformisation and the Gig Economy

3.1 The rise of the gig economy

In recent years, the gig economy has gained significant momentum across Africa, driven by a number of factors such as technological advancements, increased internet penetration, and changing consumer behaviour. This shift has been particularly noticeable in the transportation and delivery sectors, where motorbikes have emerged as a popular mode of transportation due to their flexibility, speed, affordability, and ability to navigate through congested urban areas. Digital gig work is becoming increasingly important as a potential pathway to socio-economic development and unemployment alleviation. This promise is important given SSA and the WCA sub-region's simultaneous status as the region with the youngest population but the highest youth unemployment rate – a potential socio-political threat.

There are already about 300 active digital platforms in Africa, employing close to five million workers (Morawczynski & Porteous, 2019). They include e-commerce company Jumia, which was established in Nigeria and now operates in 14 countries on the continent. The rise of such platforms has intensified the debate about the demise of the traditional employment contract and the persistence of widespread informal employment in Africa (Morawczynski & Porteous, 2019)

The gig economy has a number of benefits for workers, businesses, and governments. For workers, it offers the flexibility to work when and where they want and the opportunity to earn more money than they would as traditional employees. Platforms like Uber, and others have provided opportunities for individuals to offer their skills and services on a freelance basis. For businesses, it can be a cost-effective way to get work done without having to hire full-time employees. For businesses, it helps in formalizing certain sectors and promoting compliance and adherence to rules and regulations.

In Africa, the growing gig economy is considered a gift to millions waiting for non-existent jobs in the formal sector. Following the economic downturn faced by many African nations, unemployment has steadily increased. This has made job creation in the traditional sector quite difficult, but with the introduction of the gig economy revolution, there has been an impressive increase in employment opportunities. The COVID-19 pandemic spurred the growth of the gig economy in Africa even more, serving as a stopgap for consumers when businesses shut down, and offering employment for those shut out from formal and even informal opportunities.

The gig economy has been providing the freedom to work and live more efficiently. Smit et al. (2019) demonstrates that in 7 SSA countries, including Ghana and Nigeria, there were 4.8 million workers deriving income from digital platforms. Heeks et al. (2020) argued that work linked to platform mediated engagements is growing at 30% per year in SSA. The growth in mobile phone subscriptions and apps has resulted in additional jobs and new business opportunities in SSA (Boateng et al., 2017).

A recent trend is to open up more traditional professions and occupations for offshoring and remote work, including radiography, medical diagnosis, accountancy and the like (Beerepoot and Lambregts, 2015). Unfortunately, it appears that Africa is losing in terms of its relative position globally in respect of knowledge economy, with other developing (especially Asian) countries improving faster than most African countries; reasons given include lack of R&D funding, eroding educational systems, brain-drain and corruption (Asongo, 2017).

3.2 Challenges to Job Security and Workers' Rights

As with the informal sector, the conditions of gig workers are marginalized, and for crowd working, those in Africa are placed at the end of the business process outsourcing model that utilizes surplus labour to support advanced economy businesses such as data entry (Anwar, 2017). In terms of the conditions of gig work, the ILO survey on global online work reported that workers from Africa receive the lowest hourly rates of pay globally (Berg et al., 2018). They also face delays in payment and even non-payment for work, long search processes that are unpaid, occasional, and unpredictable assignments, and aggressive rating and control processes (Heeks, 2017a, 2017b). In Africa while there are large numbers of registered participants on the digital work platforms, the numbers receiving assignments is less than 10% of those who are registered on the platforms. Evidence suggests that SSA is not a recipient of the professional and well-paid gig jobs (Berg et al., 2018; Tsibolene et al., 2018). Many of the additional gig jobs are routine, low paid, and requiring limited skill (Berg et al., 2018). Furthermore, the gig economy is relatively unregulated in many African countries, leaving workers vulnerable to exploitation and unfair treatment.

In terms of the impact of gig work on the economy, while it appears to be creating employment opportunities, it deprives governments of substantial tax revenues. According to the International Labor Organization, 85% of workers in Africa are employed informally, and therefore do not declare their income or register their businesses. This loss of potential revenue affects countries'

ability to invest in education, health, and basic infrastructure, all of which are vital for boosting the productivity of the workforce and sustaining broader economic growth.

In a context of persistent labour surpluses and minimal labour regulations, SSA is ready for business process outsourcing that requires large and cheap supplies of labour (Anwar and Graham, 2020a). There are, however, constraints to the development of gig work in SSA. First, infrastructure limitations, especially around computer and internet access (Asongu and Le Roux, 2017), which are not evenly distributed across Africa, creating disparities in who can participate. Second, shortages in skills limit the types of jobs that SSA can access towards the low end of the skills (and pay) spectrum of crowd work professional opportunities (Tsibolene et al., 2018). The skills limitations extend to IT training across the workforce and hence limit the ability to take advantage of the potential offered by digital working through professional freelancing (Kässi and Lehdonvirta, 2018). Third, the global gig work is a winner take all process, so there are other regions and countries in Asia and South America with large supplies of surplus labour and extensive IT infrastructure are also competing for the available jobs (Anwar and Graham, 2021) and SSA has a low share of crowd work employment (Berg et al., 2018).

These gaps have led to calls for better labor laws and protections for gig workers a situation major stakeholder, institutions of higher learning, and research bodies must focus on to help unearth practical solutions to help address this ever-growing economy – the gig economy in Africa. To ensure its sustainability of the gig economy, it is crucial to address the identified gaps and challenges. This can be done through a combination of government regulations, industry standards, and individual initiatives such as advocating for fair labor practices, promoting financial literacy, and expanding access to resources such as affordable healthcare and retirement options. Additionally, creating platforms for networking, skill development, and mentorship can empower informal workers to thrive in their chosen fields.

Recently, Gig workers are increasingly putting pressure on employers to rethink about outdated models of compensation and benefits. Uber, for example, has recently lost a series of lawsuits in the United Kingdom instigated by drivers seeking access to basic benefits like minimum wage and holiday pay. In an effort to appease their workers, platforms are experimenting with additional incentives for contract workers. For example, drivers working for ride-hailing company Lyft in the United States get a voucher giving them a discount when they visit a doctor, while TaskRabbit workers are provided with liability protection of up to $1 million. But these perks are still a far cry from the healthcare and retirement benefits that companies traditionally offer their full-time employees.

With digital commerce estimated to benefit at least 80 million young Africans by 2030, opportunities for gig workers will increase (Morawczynski & Porteous, 2019). If access to a range of valued benefits, from health insurance to pensions, is made conditional on registering their business and paying taxes, gig workers will have a powerful reason to formalize their work. Furthermore, digitization could enable the formal sector to offer a spectrum of benefits for workers and responsibilities for employers. African labor-market regulators and tax authorities can play a

significant role in recognizing and incentivizing progress along this spectrum. This means taking stock of which benefits workers value most, and then designing effective policies that encourage digital platforms to offer them. Moreover, such policies should ensure that benefits are portable and tied to the worker rather than the platform, so that people can choose the ones that suit them.

3.3 Women and the Gig Economy in Africa

African women, often assuming dual roles as caregivers at home and providers for their families, perceive gig work as a new market as it affords them the flexibility to choose when and how much they want to work, striking a balance between professional and family life. The spectrum of jobs available in the gig economy is vast, meaning that women from various backgrounds, both educated and uneducated, urban and rural, can find gigs suited to their skills. With every gig, women are not just earning money, but independence as well. They are becoming entrepreneurs, decision-makers, and contributors to their families and societies. This empowerment often transcends the economic realm, leading to greater voice and agency in personal and community decisions.

Working on online gig platforms enables women to earn higher incomes, especially if they engage in remote work which affords them the opportunity to collaborate with foreign clients and receive payment in foreign currencies. This is particularly advantageous in countries with unstable economies or high living costs. The gig economy offers an alternative path to financial independence for women facing limitations in traditional jobs, where earning potential may be restricted. In Africa, evidence suggest that people join gig platforms because they are unemployed (ILO, 2021) and are struggling to find sustainable paid income (Anwar, 2022), and these platforms would afford them the opportunity to earn extra income (Graham et al., 2017). In spite of these benefits and employment opportunities, some scholars believe that the gig economy's contribution towards African workers' long-term livelihoods remains questionable (Anwar, 2022). They highlight the economically insecure nature of the platforms (Anwar et al., 2022a, 2022b; ILO, 2021; Otieno et al. 2020). For example, they note how ride-hailing offers extremely low hourly rates, and remote gig work could be footloose, that is, workers tendency to easily lose contracts when they demand higher wages.

While Africa workers face precarious working conditions in the gig economy, African women face an even dire situation. For instance, the ILO (2021) report notes that ride-hailing remains male dominated area in the gig economy, although in recent times, a few women-only platforms have emerged such as An-Nisa Taxi and Dada Ride (in Kenya) and Local (South Africa). Nevertheless, many women still prefer to use Uber as their main gig platform, highlighting the network effect and market dominance enjoyed by Uber (Anwar, 2022). Further, whereas women operate these platforms as their main source of livelihood, their male counterparts usually have multiple streams of income (ILO, 2021). According to Anwar (2022), most of these women are single mothers who engage in gig work to make ends meet. However, night times, which are usually more lucrative periods because of the less traffic, high demand, and high rates, are rarely available to these women because of security concerns. In addition, customers would often patronize the services of male

drivers, with the excuse that they were better drivers than the women. Consequently, women tend to earn lower income than their male counterparts (Anwar, 2022).

For the above reasons and more, while ride-hailing may offer economic opportunities for the Africa's workforce, the sector's sustained income-generating potential, particularly for African women has been questioned. Furthermore, the low levels of participation of women in the remote gig economy is reflective of gender-based inequalities that exist in society like education and ICT access. Women are more likely to be out of school, although more women graduate from universities in the region, there is a clear discipline bias. More women undertake humanities degree than STEM. Yet, remote work depends on information technology infrastructure and digital skills, hence women are more likely to be excluded. Evidence suggests that despite the touted potential of creating a level playing field, remote work is known for gender role differentiation prejudices, which adversely affects women's access to paid work (Leung and Koppman 2018). To improve their incomes, some women diversify their livelihood opportunities, although constantly living in fear that their contracts could be terminated unannounced (Barzilay and David 2016; Galperin 2021).

Based on the aforementioned factors, the gig economy's contribution towards development remains unconvincing, particularly for African women. As it is perceived as perpetuating existing inequalities. Research done elsewhere further confirms that women face higher precarity than men due to the unequal division of unpaid care and domestic work (Gerber, 2022). According to Gerber (2022) in a comparative study between Germany and the USA, it was highlighted that in institutional contexts where welfare policies better protect labour, gig workers face lower risks.

Many African governments and private organizations have bought into the promise of digital gig work, if not in action (or policy), then at least in words or promises; but, from the sparse and very approximate data available so far, the actual incidence and impact of digital gig work has been rather limited and is below what, for instance, many developing countries in Asia are experiencing. Apart from the lack of reliable or comparative statistics, the lack of critical and Africa-specific academic research also severely constrains both the macro- and micro-level understanding of the desirability, dynamics, promise and means to elevate digital gig work into a means for development. Although the overall macro-level barriers and issues to leveraging digital gig work have been enumerated and are widely understood, ways of addressing these through theoretical contingency models or pragmatic policy recommendations relevant to specific country contexts have not been forthcoming. At the micro-level, we have an even larger knowledge gap and our little empirical data is almost purely anecdotal; often biased by the researchers' objectives. It is hoped that with more research on the gig economy and labour dynamics in Africa can direct better policy interventions that target vulnerable groups, particularly women.

3.4 Research Questions

- In what ways can gig work be elevated into a means for development in Africa?
- How have women's online gig workers' experiences changed oner time?

- How does gender intersect with other axes of social difference (class, race, age, ability, and sexuality) generate different platform worker outcomes?
- In the absence of widespread trade unionization of gig workers, what individual and collective strategies and tactics are both men and women gig workers developing to reduce precarity on gig work platforms, to resist and challenge structures of algorithmic constraint, improve platform incomes, and determine better conditions of work?
- How can available social protection mechanisms be made more inclusive and effective for all workers?
- How can DTs be made more accessible to the information and resource poor in Agri-based economies in the WCA sub-region?

4. Digital Skills and Education/Training

4.1 Demand for New Skills

DTs are reshaping the skills people will need to access markets, operate factories, or run their own businesses. Evolving job markets are demanding new skills such as digital literacy, technical skills for green jobs, and soft skills to meet future work demands. Digital literacy involves correctly using and comprehending electronic devices, programs, and information. It enables people to access information, communicate effectively, find work, think critically, navigate the digital landscape responsibly. The technical skills for green jobs, also referred to as green skills, entail skills aimed at fulfilling the requirements of green jobs and supporting the transition to a low-carbon green economy (Kwauk & Casey, 2021). There is growing recognition of the importance of soft skills (such as communication, teamwork, adaptability, and problem solving) for the job market. Developing soft skills is considered to be a key element for improving the effectiveness of ongoing efforts to address the youth employment challenge in Africa and elsewhere.

4.2 Factors Contributing to Skills Gap in Africa

Although it is recognized that these skills impact growth and are needed for jobs in the emerging "tech world", digital literacy, green skills, and soft skills development have not been fully nurtured in Africa (Omoniyi, 2013). Explaining the source of the digital divide between advanced and developing countries, James (2019) points to the origin of digital technologies which were designed for consumers in wealthy Western countries. They are also designed to suit the socio-economic circumstances prevailing in these countries, including the available skills, incomes, infrastructure and attitudes. As such, these technologies tended not to run too far ahead of what is available in terms of digital skills, although even in these countries there is a mismatch between the elements of the technology package among marginalized groups—such as people living in poverty, the elderly and some minority groups—who may not possess the necessary digital skills to use the Internet effectively.

On the other hand, when these technologies are imported into African countries, especially in areas described as rural, the necessary skills to match these technologies become scarce. Evidence has shown a significant relationship between the rurality of a place and the level of the digital skill of the population (ITU, 2018). Highly rural or poor countries are observed to have a lower percentage

of their populations having basic and standard skills (James, 2019). According to GetBundi (2024), the plight of these countries is exacerbated by the outdated nature of the educational curriculum, the lack teachers who are proficient in digital skills, the lack of appropriate educational infrastructure, low awareness of the benefits of digital skills, and insufficient digital training opportunities.

4.3 Impact of Skills Gap

The lack of necessary skills by the African youth will be a major hindrance to their chances of securing jobs. Business managers' feedback demonstrates that they are having difficulties finding the appropriate skills in Africa. In January 2019, PwC issued its 22nd Annual Global CEO Survey, and a whopping 79% of CEOs worldwide expressed worry about the skills gap. This percentage increased to 87% among African business leaders, with 45% expressing "extreme concern". There are actual repercussions for the present skills gap. Of the CEOs who expressed major concern about the availability of essential skills, 59% (global: 47%) acknowledged that their quality standards and customer experience were being compromised, and 65% of African CEOs (global: 55%) claimed the skills deficit was hindering companies from innovating successfully. Furthermore, 54% (global: 44%) acknowledged that their insufficient skill set was preventing them from meeting their growth objectives. Just 3% of the CEOs in Africa (4% worldwide) who were interviewed stated that the growth and profitability of their companies were unaffected by the lack of skills.

Developing the foundations for the continent's present and future labor force necessitates a strategic governmental approach, the dedication of the private sector, and institutional changes. To fulfill future skill demands, all sectors must make investments in skill development, not just for now, but also to create a talent pipeline that will last.

4.4 Need for Upskilling and Reskilling Initiatives

The notion of upskilling is one of the skills enhancements that has become necessary in the age of technology introduction. Employees may be assigned to new responsibilities that call for upskilling. Enhancing an employee's present knowledge and abilities to either better their performance in their current role or position them for future career chances is what it means. It may entail learning novel methods or devices, gaining an understanding of new processes, or building soft skills (Chaaya, Abou Hamad, & Beyrouthy 2019). Technological developments, shifts in the nature of work, and the desire to stay competitive in the labor market are some of the factors that might lead to upskilling. For instance, people must acquire new skills to be relevant as automation and artificial intelligence develop to become more prevalent (Chaaya et al., 2019).

Upskilling can have both beneficial and detrimental effects. Positively, upskilling can raise earnings, job fulfillment, and productivity. It may also result in a workforce that is more resilient and diversified. The drawbacks of upskilling include the potential expense and time commitment, as well as the possibility that not all employees will have equal access to these chances, which might worsen already-existing disparities in the workforce. Furthermore, the need to continuously

acquire and adjust to new technologies and abilities may cause some employees to feel overburdened or worried (Chakrabarti, 2022; Jaiswal, Arun & Varma, 2021; Li, 2022).

However, reskilling refers to learning new skills or improving current ones in order to execute a new role or adjust to modifications in business procedures or technology. According to Penesis et al. (2017) and Sawant, Thomas & Kadlag (2022), the process of reskilling demands giving an employee new skill so they may do a different job or adjust to changes in the labor market. The necessity to adjust to changing laws or industry standards, shifts in the organization's strategic goals or priorities, the creation of new job positions or sectors, and technological advancements are just a few of the many reasons why reskilling is necessary. For instance, in order to collaborate with robots, workers may need to learn new technical skills if some job responsibilities are automated.

On the other hand, workers could need to pick up new soft skills like agility and teamwork if company models shift (Gowrie Vinayan et al., 2020). Reskilling often has favorable effects on businesses and employees. Learning new skills may lead to better job satisfaction, professional progression prospects, and higher remuneration. Investing in workforce reskilling can lead to increased productivity, improved employee engagement and retention, and a more agile workforce capable of responding to market changes (Jaiswal et al., 2021; Yaseen et al., 2022).

According to Payton (2017), traditional hierarchical organizational arrangements do not reflect 21st century skills. Ayentimi and Burgess (2019), opine that, knowledge skills now play a central role in both job experience and compensation. Organizations are adapting and preparing for the future of work. According to Yusuf, Walters, and Sailin (2020), there are now flatter organizational structures, more communication between and within firms, a growing number of individuals who choose to work remotely, and telecommuting is becoming the norm. Organizations must get ready for the changes that are coming in order to stay competitive in the future. The World Economic Forum (2016) asserts that creating a workforce that is multiskilled, adaptable, and flexible is one of the main difficulties facing human resources professionals in the new global order.

The African developing nations, which have comparatively low rates of human capacity growth, are greatly impacted by the implementation of Industry 4.0 technology. Adepoju and Aigbavboa (2021) offered insightful data to reinforce the argument that Africa's labor force needs to be reskilled and upskilled for the industry 4.0 workplace. Africa's most populous and economically developed nation is Nigeria. Approximately one-fifth of all Africans live in Nigeria, and the country's economy contributes roughly 55% of the GDP of West Africa, and 35% of the GDP of Sub-Saharan Africa. Consequently, the economy has gained recognition as one of Africa's fastest-growing digital savvy countries. Nonetheless, Nigeria continues to struggle with a lack of human capital (Adepoju and Aigbavboa, 2021). Retraining and upskilling of the workforce is therefore still essential to the nation's economic progress.

Rwanda is unique in that it uses public-private partnerships (PPPs) to enable the private sector to support youth employment and skill development. As a result of this policy, the nation now has a workforce with higher levels of competence, a more consistent supply, and more robust networks for effective and efficient operations. Major formal sector companies, such as manufacturers and service providers, participate in training programs to upskill workers and offer job placement

assistance. Furthermore, by coordinating employer signals regarding the standards they require for knowledge acquisition, the Ministry of Education's NQF—which improves youth labor market functioning—and the PPP model guarantee that skills are in line with both present and future labor market demands (African Centre for Economic Transformation, 2022)

4.5 Widening Gap in Access to Quality Education and Training

Education is essential to the development of society. Education establishes social norms. High-quality education offers new ideas, methods for implementing different technologies, and many other things that contribute to the empowerment of the country in all spheres (Swati Desai, 2010). 'Educate a man, and you educate an individual; educate a woman, and you educate a whole nation', so says an adage. Not only is education for girls a vital human right, but it also plays a significant role in driving economic growth and technological advancement (Oxfam,2000; Klasen, 2002). However, long-standing institutional, political, and cultural impediments have worked together to bring about and maintain the gender gap in educational access. Consequently, girls make up two-thirds of the 125 million 6–11-year-old children who do not attend school in developing countries, and 148 million (or 54%) of the projected 273 million 12- to 17-year-olds who do not attend school are girls. Once more, women make up two-thirds of the 876 million illiterate people in the entire world, and females make up two-thirds of the 100 million children who leave school before finishing their four years of education (FAWE, 2000; Oxfam, 2000).

While there seems to be widespread discrimination against women in developing countries when it comes to access to education, women in African countries appear to face greater discrimination than men (Evans & King,1991; Evans,1995; Odaga,1995; World Bank,1996). Across the continent, women between the ages of 15 and 49 typically have fewer years of education than men, while women between the ages of 15 and 60 have far greater rates of illiteracy than men (Bloch & Vavrus, 1998). Males appear to benefit from the general quality of curricular programs in school at the expense of girls. While some nations have attained gender enrollment parity in elementary and secondary education, female involvement in higher education is still quite low and institutions do not offer an even playing field (Bloch & Vavrus, 1998; GSS, 2000).

As a result, women in Africa continue to be the least educated globally, frequently falling behind their counterparts in East Asia, Latin America, and the Caribbean. In sub-Saharan Africa, there are around 16 out of the 22 nations where at least 70% of women lack literacy, according to UNICEF's 2000 State of the World Children report. More than 90% of the women in two of them lack literacy (UNICEF, 2000a). Women's access to formal education and, as a result, literacy varies among countries. Even more alarming are the educational statistics from Senegal, Burkina Faso, Niger, and Mali. For example, 84% of females in Mali never went to school, and of those who did, 60% dropped out in the first grade. Less than 30% of females between the ages of six and fifteen are enrolled in school in Burkina Faso, Niger, and Senegal. Adolescent males and girls are generally enrolled in elementary schools at comparable rates. However, in almost every nation in sub-Saharan Africa, by the age of sixteen, fewer females than males attend school (Friedman,1992; Carr,1994; FAWE, 1995). In Ghana, one in three females lack formal education, but one in five

males do. Compared to 66% of males 65 and older, 89% of women have no formal education. This huge gap is a major hindrance to women regarding the future of work.

According to African Centre for Economic Transformation, (2022), several countries have worked hard to develop TVET programs and curriculum that are focused on industry and market demands. While some courses are still out of alignment and don't provide the requisite skills, others are officially mandated by the industry. This is explained by the market's constantly shifting requirements as well as the significant transition costs related to using current technologies to meet labor market expectations. Students and industry stakeholders have voiced concerns about the school-to-work transition, specifically about TVET graduates' preparedness for the workforce. TVET education has always been viewed less highly than traditional secondary education in the majority of SSA nations. TVET institutions deal with the belief that vocational courses are exclusively for people who are unable to achieve secondary school entrance requirements, even though there is a strong demand for TVET graduates. One of the biggest problems that nations continue to face is the poor perceived value of TVET.

Despite having very inadequate technical skill sets, most graduates from technical institutes in Rwanda report having little trouble finding employment. However, the majority of parents think that children who attend TVET colleges do so as a last alternative after being turned down for admission to universities. Participants in the survey from Côte d'Ivoire, Ethiopia, Ghana, Niger, and Uganda had comparable opinions. In Ghana, the TVET sector continues to be perceived by the general public as a haven for students with poor academic standing, despite the government's efforts to promote its use to prepare the nation's workforce with practical skills. In addition, obsolete equipment and courses, a lack of standards, inadequate funding, and a disjointed environment affect vocational schools (African Centre for Economic Transformation, 2022)

Although governments in the studied nations have taken a number of steps to enhance the relevance and quality of TVET programs, there is still a problem with teacher quality. Teacher pedagogical skills, industrial experience, and technical knowledge are the three essential requirements in TVET. sadly, TVET graduates are ill-prepared for the workforce since teachers often lack these foundational skills contributing to the widening gap between those with and without access to quality training. Ghana has four TVET teacher training programs that result in recognized qualifications. According to Ghana's Ministry of Education (2017), 71% of teachers at public TVET colleges have teaching degrees, while just 52% have technical qualifications.Private TVET institutions have less qualified teachers, with just 40% holding teaching certificates and 25% being technically qualified. Poor working conditions cause significant absenteeism and turnover rates (African Centre for Economic Transformation, 2022).

In the context of constantly changing labor markets and dynamic skill requirements as a result of globalization, technological advancement, demographic transformation, and climate change, the demand for high-quality TVET is even stronger to facilitate effortless job transitions and also bridging the gap between those with and without access to technical training as it is one of the easiest ways through which one can acquire technical skills (ILO,2023). Improving the relevance of curricula by strengthening partnerships with the private sector, Improving the quality of TVET education by investing in teacher training and equipment, improving inclusivity by targeting

female students and other excluded vulnerable groups, improving the sustainability of TVET financing and Digitalize TVET by investing in digital infrastructure and STEM uptake are some of the major ways of improving TVET education in West and Central Africa. This will broaden its coverage thereby bridging the gap of access to technical training.

Researchers agree that the relationship between school and work is an important feature of Vocational Education and Training (VET) (Mulder et al. 2015). Many countries have an educational system that maintains a large vocational schooling system as part of their secondary-level education (Eichhorst et al. 2015). In these countries, the schooling system is characterized by the duality between general and vocational education. While the latter provides the youth with practice-oriented knowledge and skills required in certain occupations, the former provides general knowledge for those who wish to further their education. It has therefore become important for governments to supply VET through the educational system as it improves the opportunities of the youth who lack the skill set demanded by the labour market. It has been discovered that many countries that make vocational schooling option compulsory during schooling perceive it as an alternative to equip the youth who may have dropped out of school or are not academically inclined with the right skill set that will help them fit into a technologically inclined field of work (Neman & Ziderman, 1999).

4.6 Ensuring Equal Access for Women and Girls in Education, Training and Employment

Despite legislation prohibiting gender discrimination in education, training, and employment, and limited initiatives to encourage women to pursue a wider range of work opportunities, gender segregation persists in many West and Central African occupations. According to Thewlis et al. (2004), males dominate agriculture, manufacturing, and financial services, whereas women mostly work in the service sector (e.g., health, social work, education). The study indicates that males continue to dominate the IT and scientific, engineering, and technology (SET) sectors in practically all European countries. In SSA, Women are glaringly underrepresented in political parties, the government, the workforce at large, and the fields of science and technology in particular. Masanja (2010) found that 57.5% of women in Rwanda labor unpaid, whereas just 20.2% of males do so since 2006.

In agriculture, the majority of women (55.2%) work as unpaid family workers, whereas the majority of males (41.6%) are self-sufficient farmers. Women hold 18.3% of paid occupations, while males hold 40.5% of them. Men make up 10.3% of the higher education workforce, while women make up 5.7%. Also, in 2009, Aderemi surveyed 1,345 women who had graduated from SMT programs. The results showed that the most common areas of employment were (i) academics (9.4%), (ii) administration (37.5%), (iii) research and development (44%), (v) finance (3.4%), (iv) medical (0.5%), and (vii) security/solicitors (0.1%). Of those surveyed, the majority (53%) were married and stated that their spouses' limitations on their mobility were a factor in or connected to it. It was also discovered that a mere thirty percent of these women worked in scientific and technology divisions.

The distribution of non-science and technology department employees was as follows: 43.3% worked in administration, 33.4% in finance, 22 percent in public relations, and 1.4% in other

departments including libraries. The reasons given for not being in science and technology departments were that there was no other option due to limited mobility (40%), that a career change was desired (20%), and that a career in science and technology was too demanding with low pay, which caused some women to leave the field in search of better opportunities or more appealing environments (20%). Just 0.2% of workers changed positions for reasons related to domestic matters. Most respondents claimed to know more than ten female coworkers who had earned degrees in science and technology.

According to the African Union Commission, 2004, the majority of African nations have included gender equality in their constitutions within the past 20 years. The majority of African states have ratified regional and international agreements and made additional commitments to advance gender equality at the regional and global levels. Compared to 20 years ago, there are now more girls enrolled in all levels of education. More women are working in a wide range of economic areas. Finally, a significant number of African nations are witnessing a rise in the proportion of women participating in different spheres of administration. According to Klasen &Lamanna,(2019), there are several reasons to be worried about current gender disparities in crucial well-being-related factors such as education, health, employment, or compensation.

From a well-being and equity standpoint, such gender discrepancies are problematic since they diminish well-being and constitute a kind of unfairness under most definitions of equality or justice. Equal access to education and employment for men and women in West and Central Africa will go a long way to reducing poverty and unemployment. Apart from concerns about equality of opportunity, gender segregation in job settings leads to two additional problems: gender segregation contributes to the persistent skills gaps in the West and Central African sub-region, which the government acknowledges concerning certain sectors, such as ICT, and gender segregation into different work areas is still a major factor in the gender wage gap (Forth, 2002). Segregation can take place horizontally, with people concentrated in certain careers, or vertically, with people concentrated in the lowest ranks of an organization (Hewitt, 2001). Women are disadvantaged by both types of segregation.

Gender inequality in work is presently one of the most significant development concerns facing countries worldwide, including those in Africa (Anyanwu & Darline, 2014). In 2011, the worldwide male employment-to-population ratio was predicted to be at 72.7%, while the female employment-to-population ratio was around 47.9%. In 2011, the global male employment-to-population ratio was projected to be 72.7%, while the female employment-to-population ratio was about 47.9%. The gender disparity in employment between males and females keeps widening hence governments within West and Central Africa have to begin to look at policies that can bridge this gap (Anyanwu & Darline, 2014).

4.7 Research Questions

- What digital infrastructure is necessary for the African context?
- What new skills will be required and to what extent will the existing jobs change?
- What kind of upgrade will the educational and professional training need?
- What is the way forward in ensuring equity between men and women in the place of work.

- What innovative ways can be leveraged to finance digital skills training?
- In what ways can DTs be harnessed to make only limited demands on the scarce supply of digital skills in poor regions?

5. Conclusion

We reflect on four broad emerging FoW issues of potential importance to policy makers, researchers, educators, and industry players in the WCA sub-region: i) impact of digital technologies on work in Agri-based economies; (ii) climate change transitions; (iii) platformization and the rise of the gig economy; and iv) digital skills gap and education. We highlight unique socio-economic, and gender issues that are emerging as a result of the uptake of DTs in SSA and the sub-region. We advance a number of hypotheses to speculate on how DTs and climate change impacts would potentially impact employment prospects, particularly for women, in Agri-based economies. We emphasize some open research questions that remain to be answered. These call for rigorous qualitative and quantitative approaches to generate actionable evidence and to justify commercial interventions, policies, and regulations. Pursuing these requires meaningful partnerships between policymakers, educators, researchers, industry players, CSOs, private sector, and local actors.

6. Hypothesized Interventions

Hypothesis

Digital technologies can promote an inclusive future of work for marginalised groups in Agri-based economies while helping to mitigate climate change impacts, but how?

A. Improving access to digital and physical infrastructure to low-income areas

What interventions – public and commercial solutions – will help in the expansion of digital infrastructure to underserved areas? How far into poor areas should this expansion be? What existing technology are available? How can existing technologies be built on to offer services to people? How can these technologies be made affordable and accessible to more information poor groups? How can the use of these technologies be sustained? How can these infrastructure be sustainably financed? How can public-private partnerships benefit this course? Examples of plausible hypothesized interventions:

- Promote governance that strengthens and sustains an open, interoperable, reliable, and secure digital ecosystem.
- Improve access to stable electricity.
- Reduce no-economic cost and risk of market entry and investment
- Provide public/donor funding support for larger, high-cost infrastructure investments to reduce risk and increase commercial viability.
- Expand the market through government procurement and implementation of broadband based digital services, networks, and facilities.
- Provide direct funding support for extending affordable broadband access to commercially challenging rural and remote areas, to women, and low-income users under a Mobilizing Finance for Development approach.
- Increase ICT market commercial attractiveness through demand stimulation and affordability initiatives.
- Promote long-term sustainability by ensuring that appropriate technical skills to operate and maintain digital infrastructure are increasingly available on the continent.

B. Enabling the collection of gender-disaggregated data on digital transformation, climate change, and quality of employment in Agri-based economies.

What interventions – public and commercial solutions – will create an enabling environment for the collection of gender-disaggregated data on the interwoven impacts of digital transformation, climate change, and quality of employment in Agri-based economies?

- Strengthen the capacity of statistical departments to include collecting gender-disaggregated data on emerging technological, climate change, and quality employment impacts at the national and sub-national level.
- Sensitize relevant ministries and agencies on the importance of mainstreaming gender into policies.
- Promote gender-sensitive training for data collectors and respondents to ensure gender data accuracy, confidentiality, and anonymity
- Support local initiatives that supplement supply-side data from mobile service providers with open-source demand-side data directly from consumers
- Incentivize and support rigorous quantitative and qualitative research on gender, technology and society (by academics, non-profits, think tanks, etc.).

C. Creating new skills and employment pathways that can create more employment opportunities.

What interventions – public and commercial solutions – will help to develop digital skills, especially among marginalized groups in Agri-based economies? What skills will be complementary to technology? What skills are needed to develop and/or use technology? What innovative ways can be leveraged to finance digital skills training? How can disparities in access to education, including digital skills be minimized? How can we use other digital technologies that make only limited demands on the scarce supply of digital skills to respond to the acute shortage of digital skills in many poor countries? Examples of plausible hypothesized interventions:

- Governments to explicitly prioritize national budget allocations for achieving education outcomes through concrete medium-term budget plans and encourage the private sector to contribute more.
- Invest in flexible education systems
- Formalize technical and vocational training and other informal and nonformal skilling avenues, including apprenticeships to lift people out of poverty and bring about economic development.
- Develop tailor-made teaching and learning materials that complement the available jobs in specific contexts.
- Enable a new model of digital skills supply where intermediaries are used to bring information from the Internet to those who need it.
- Diversify student financing options to support marginalized and vulnerable youth
- Involve industry-leading organizations in skills building (i.e. curriculum development, hosting of internships, contribution of equipment, and training of faculty) and providing them with benefits such as public funding of the training program, or first pick of training graduates for staff can sustain commitment to and support for educational reforms agenda.

D. Expanding Social Protection coverage to include informal workers.

What interventions – public and commercial solutions – will work to expand social protection coverage to include informal workers? What social protection measures are currently available to workers in Agri-based economies? How can these safety nets be made stronger, more resilient, and

better funded? What new forms of social protection can be leveraged for the informal sector? How can new social protection programs complement existing ones? What effective and inclusive processes and implementation strategy can it adopt?

Examples of plausible hypothesized interventions:

- Designing a means test to identify those working in the informal sector who should be eligible for social assistance schemes and programs.
- Embedding social protection programs in strong legal and institutional frameworks to help secure political and fiscal support.
- Promoting beneficiary participation and consultation with policymakers to ensure that barriers to access are identified and addressed.
- Leveraging on digital solutions for collecting, cross-referencing, and managing data to improve the effectiveness of targeting and identification of beneficiaries, as well as the definition of benefit levels.
- Employing digital systems, especially mobile money, can reduce the operating costs of the schemes and make saving more accessible for the informal economy.
- Financing social protection programs through raising revenues from taxes; including earmarked taxes or replacing subsidies benefiting the non-poor primarily with targeted transfers.

7. Summary of Questions, Identified Actors and Methodology

Questions	Relevant Actors	Methodology
Impact of DTs on Agri-based Economies		
a) How will DTs influence job creation, displacement, and overall labor market dynamics in the Agri-based economies.	Policymakers, educators, private sector, NGOs industry players, researchers	Survey; qualitative interviews. Assessment
b) How will DTs enhance the resilience of the WCA sub-region workforce and agriculture sector against the impacts of climate change.	Policymakers, educators, private sector, NGOs industry players, researchers	Survey; qualitative interviews
c) How can DTs be made accessible to the information poor in Agri-based economies in the WCA sub-region?	Policymakers, educators, private sector, NGOs industry players, researchers	Survey; qualitative interviews
d) How can DTs act as a catalyst for job creation, particularly for vulnerable groups, within the agricultural context in the WCA sub-region?	Policymakers, educators, private sector, NGOs industry players, researchers	Survey; qualitative interviews
e) To what extent do DTs influence the evolving labor landscape within the agricultural context, considering the ecological shifts caused by climate change adaptations?	Policymakers, educators, private sector, NGOs industry players, researchers	Quantitative survey, Assessment
f) How can the use of DT infrastructure be sustainably financed?		qualitative interviews **Assessment**

g) What is the role of social safety nets in the evolving digital and environmental context?	Policymakers, educators, private sector, NGOs industry players, researchers	Survey; qualitative interviews

Questions	Relevant Actors	Methodology
DTs and climate change transitions		
a) How can women and girls be prepared for the green economy?	Policymakers, educators, private sector, NGOs industry players, researchers	**Assessment**
b) How can the opportunities offered by the green transition improve gender equality and women's empowerment?	Policymakers, educators, private sector, NGOs industry players, researchers	Survey; qualitative interviews
c) How can gender segregation in education be undone to promote women's participation in science, technology, engineering and math (STEM) fields?	Policymakers, educators, private sector, NGOs industry players, researchers	Survey; qualitative interviews **Assessment**
d) How can the playing field be leveled for a gender-responsive green economy?	Policymakers, educators, private sector, NGOs industry players, researchers	**Assessment**
e) In what ways can women's transition towards the formal economy be supported to facilitate women's movement into better-paying green jobs with better working conditions?	Policymakers, educators, private sector, NGOs industry players, researchers	Survey; qualitative interviews

Questions	Relevant Actors	Methodology
DTs, platformization and the Gig economy		

a) How have women's online gig worker experiences changed oner time?	Policymakers, educators, private sector, NGOs industry players, researchers	Survey; qualitative interviews
b) How does gender intersect with other axes of social difference (class, race, age, ability, and sexuality) to generate different platform worker outcomes?	Policymakers, educators, private sector, NGOs industry players, researchers	Survey; qualitative interviews
c) In the absence of widespread trade unionization of gig workers, what individual and collective strategies and tactics are both men and women gig workers developing to reduce precarity on gig work platforms, to resist and challenge structures of algorithmic constraint, improve platform incomes, and determine better conditions of work?	Policymakers, educators, private sector, NGOs industry players, researchers	Survey; qualitative interviews
d) How can available social protection mechanisms be made more inclusive and effective for all workers?	Policymakers, educators, private sector, NGOs, industry players, researchers	**Assessment; administrative data**
e) How can DTs be made more accessible to the information and resource poor in Agri-based economies in the WCA sub-region?	Policymakers, private sector, NGOs, industry players, researchers, local actors	Survey; qualitative interviews

f) In what ways can gig work be elevated into a means for development in Africa?	Policymakers, private sector, NGOs, industry players, researchers, local actors	Survey, qualitative interviews

Questions	Relevant Actors	Methodology
Digital skills and education		
a) What digital infrastructures are necessary for the African context?	Policymakers, CSO, private sector, industry players, researchers. Local authorities	Survey; qualitative interviews
b) What new skills will be required	Policymakers, educators, private sector, industry players, researchers	Survey; qualitative interviews
c) To what extent will the existing jobs be altered as a result of the interplay between DTs and climate change?	Policymakers, educators, private sector, industry players, researchers	Survey; qualitative interviews
d) What kind of upgrade will the educational and professional training need?	Policymakers, educators, private sector, industry players, researchers	**Assessment**
e) What innovative ways can be leveraged to finance digital skills training?	Policymakers, educators, private sector, NGOs industry players, researchers	Survey; qualitative interviews
f) In what ways can DTs be harnessed to make only limited demands on the scarce supply of digital skills in poor regions?	Policymakers, educators, private sector, NGOs industry players, researchers, local actors	Survey; qualitative interviews

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