14

DIGITALISATION AND TRANSFORMATIVE LEARNING FOR SUSTAINABLE FUTURES IN RURAL AFRICA

Leaving No One Behind

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14.1 Introduction

The COVID-19 pandemic has highlighted the interdependent nature of a globalised world. It has also shown the significance of digitalisation for global connectivity trade, and cooperation. Unequal access to digital tools, technologies, and connectivity – the so-called digital divide – affects both Europe and Africa at different levels. This divide exists not only between continents, but also between urban and rural areas. The latter are particularly at risk of being left behind during the next stage of technological development (Cowie et al., 2020). This digital divide hinders growth and trade and reduces learning opportunities for those with little to no access to internet and digital tools. Hence, this chapter shows that digital learning can support informal education, provided practical issues faced by communities are accounted for, discussed, and platforms are customised for continued uptake.

Increased access to digital technologies will have a positive effect on gross domestic product (GDP) growth on both continents, especially in Africa. It is estimated that for Africa, a 10% increase in mobile internet penetration will result in a 2% increase in GDP per year and improved youth employment (Google and IFC, 2020; Abdulkadir and Asongu, 2022). Scores of publications by United Nations (UN) entities, academic journals, and other sources engage with the question as to how to improve access and quality of connectivity, infrastructure, data governance, and technology transfer (ITU, 2020a; ITU 2021; Ndubuisi et al., 2021; Al-Ruithe et al., 2019). However, the literature rarely looks at the social context in which these initiatives and projects are implemented and which also governs the uptake and continued use of such solutions. Hence, understanding the social context of rural agricultural communities is crucial as it either catalyses or hinders transformative learning and the uptake of digital solutions.

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Agriculture will play a role in facilitating green transitions and sustainable futures in both the AU and EU. Approximately 54% of all workers in sub-Saharan Africa (SSA) are employed in agriculture while in some countries the number is as high as 70% (Gwagwa et al., 2021). Also, in the EU the role agriculture plays in green transitioning and sustainable futures cannot be ignored. About 4.3% of the EU's population works in the agricultural sector, ranging from below 5% in Germany and France to 17.5% in Bulgaria and approximately 23% in Romania (Eurostats, 2018). This is due to mechanisation and increasingly also digitalisation or "smart farming" (Wolfert et al., 2017), leading to fewer people being employed in the sector. This differs considerably from agro-based economies especially in sub-Saharan Africa (Bruzzone, 2021). Agriculture is also a major contributor to climate change, biodiversity loss, and land degradation in both Africa and Europe. For example, greenhouse gas (GHG)-emissions coming from the agricultural sector in Europe account for 12.74% of total EU GHG-emissions (EEA, 2021), while in Africa, the agricultural sector accounts for 18% of total GHG-emissions (AfDB, 2020).

In both Africa and Europe, land is a factor in addressing environmental and development challenges by combating desertification, adapting to climate change, land degradation, and mitigation of the effects of droughts. Addressing these issues will not just require policy interventions but also resilience building through transformative learning approaches in small-scale agricultural communities, which depend on land for their source of income. This requires a combination of innovation, ambition and pragmatism among youth, the private sector, and international organisations who are deploying new tools and technologies such as agri-innovation applications to assist small-scale farmers. These tools can effectively facilitate learning for small-scale farm holders on sustainable agricultural practices and methods of reducing food waste in communities while building resilience to climate change. With this view in mind, the authors focus on new and emerging trends along AU–EU cooperation, namely two areas: (1) green transition (2) digital transformation from a vantage point of inclusiveness.

Our argument is that AU–EU cooperation in digitalisation should include dialogues on low-cost and effective digital solutions which can be deployed in rural agricultural communities. These dialogues should be tailored to benefit both continents by facilitating mutual learning of experiences and practices. Mutual learning is needed as rural communities in both SSA and the EU are in dire need of low-cost and effective solutions. Furthermore, we highlight that these solutions, which have the potential to address global challenges, such as climate change, land degradation, and biodiversity loss, should be adapted to the social context of rural communities for their continued uptake.

14.2 The Nexus of Education, Sustainability, and Digital Innovation for Small-Scale Agriculture

An emerging body of research focuses on the nexus of education, sustainability studies, and digital innovation (Albrecht et al., 2014; Leal Filho et al., 2021; Cerone and Persico, 2014; Selwyn, 2012; Nickerson and Zodhiates, 1989).

Having said this, there is still a significant knowledge gap on the deployment, uptake, and continued use of digital applications and platforms aimed at small-scale agricultural communities. These communities face practical day-to-day challenges related to old mobile equipment, high data costs, or little memory storage capacities. Hence, this chapter navigates such practical challenges faced by small-scale agricultural communities, which are usually the target audience of such platforms, yet often cannot access them.

One of the most comprehensive reports on digital transformation, *Towards our Common Digital Future*, by the German Council on Global Change (WGBU, 2019), takes a holistic approach to digitalisation, learning, and education, which it also applies to the agricultural sector. The authors of the WGBU report advocate the use of digital platforms while also giving a range of applications for citizen-science and lifelong learning initiatives. The WGBU 2019 report (pp. 225) also underscores that, "the promotion of digital skills is a necessary but insufficient prerequisite for transformation education". It argues for a shift from education for digitalisation and sustainability to "future proofing" education (WGBU, 2019). Accordingly, it emphasises the need to systematically incorporate digital learning tools into educational and lifelong learning programmes within a wider paradigm of "placing digitalisation in the service of global sustainability" with investment in common good-oriented technology and infrastructure being crucial (WGBU, 2019). However, the report takes a holistic view and does not incorporate low-cost and effective digital solutions for rural agricultural communities.

Academic literature (Pick and Nishida, 2015) and the recent UNESCO policy on education for sustainable development – 2030 corroborate the WGBU report and stress the need to give attention to the implications of digitalisation for the education sector. The UNESCO report emphasises cooperation and partnerships between the education sector, sustainability science communities and ICT communities, and equal sharing of the benefits of technological progress (UNESCO, 2020; 2021b). However, as outlined below, rural communities in both Africa and Europe are currently grappling with digital learning and teaching while addressing digital divides (Fuchs and Horak, 2008; Oyedemi, 2012). Hence, the deployment of low-cost and effective digital solutions is a key area where AU–EU cooperation could benefit rural communities through policy and practice knowledge exchanges.

In relation to our chapter and unlike the WGBU, the literature review conducted by Rolandi et al. (2021) on existing impacts of digitalisation on agriculture in rural areas in Italy does not provide a holistic picture of the potential impacts in rural areas. For Germany, a study exists on the unintended side effects of digitalisation in agriculture (Scholz et al., 2021), but it does not consider the special situation of smallholder farmers. At the same time, a study conducted in France states that little has been done so far to address the relation between digitalisation and agriculture, while also concluding the need to include diversity in Agricultural Innovation Systems (AIS) and the need for further research (Schnebelin et al., 2021). In contrast to the above, studies conducted in Benin, Mali, Nigeria, and

Kenya within local stakeholder groups by Daum et al. (2021) state that megatrends, such as mechanisation of agriculture, digital agriculture, and youth engagement in agriculture, are favoured. However, there are serious concerns in terms of digital divides, failure of state-led digital agriculture programmes, and regarding the quality of digital services as well as the exclusion of smallholder farmers in rural Africa. Having said that, Daum et al. (2021) call for policy dialogues on digitalisation and inclusive agricultural transformation in Africa.

Building upon these insights, this chapter seeks to establish pathways forward for AU–EU cooperation for low-cost mobile digital solutions meant for learning and education for rural agricultural communities to address digital divides. However, it should be noted that African rural small-scale agricultural communities are more impacted by the digital divide than their European counterparts, owing to even less digital access and mobile internet penetration, high data costs, and poverty.

14.2.1 How Low-Cost Digitalisation Can Benefit Africa

Vulnerable communities still struggle to access basic goods (water and food) and services (education and learning opportunities) while simultaneously facing new challenges such as climate change (UNDP, 2019; 2020). Addressing these basic needs is central to achieving the SDGs (UN, 2015). Participation in key economic sectors, information sharing, and formal as well as informal education are factors that influence the well-being of current and future generations (UNESCO 2020; 2021b). The COVID-19 pandemic has shown how important digital technologies are in education. While COVID-19 was a driver for innovation, it also resulted in the exclusion of communities on the margins of digitalisation. For example, post-COVID-19 statistics show that 85% of children did not have learning opportunities due to lockdowns (UNESCO Institute for Statistics, 2020; Angrist et al., 2021). At the same time, research conducted in Ethiopia, Kenya, Liberia, Tanzania, and Uganda confirmed a significant loss of learning due to COVID-19. The insights shared by Angrist et al. (2021) demonstrate a half-year of learning loss in school children. Hence, this proves the need to introduce low-cost and effective solutions which facilitate learning at all levels.

The influence of disruptive technologies, especially mobile phone technology, is producing entry points for wider populations including rural communities in SSA to participate in education, learning opportunities, employment, and information sharing (GSMA, 2019; 2020; Breuer and Groshek, 2017). Since the pandemic created disruptions in formal education systems all over the world, it also proved to be a driver for informal learning and online participation and exchanges (Li and Lalani, 2020; ITU, 2020b; Albrecht and Zschiegner, 2020). Recent technological advances have shown a growing demand for new digital skills to participate in learning, employment, and digital markets, with this need emerging also amongst rural agricultural communities in Africa (OECD, 2019; Myovella et al., 2020).

14.2.2 Education and Learning for Implementing the SDGs

To achieve the SDGs, there is a need to focus on learning that complements formal education. Low-cost digital learning tools have the potential to deliver on SDG 4 and its indicators, especially Target 4.7 which emphasises ESD as a lifelong process.

This space for learning under new conditions offers interesting possibilities for establishing cooperation between the AU and EU in the areas of the green transition and digitalisation (UNESCO, 2016; 2021b; AUC/OECD, 2021). This is particularly pertinent now as the COVID-19 pandemic has increased capacities of learners and tutors for using e-learning platforms, internationally and in Africa (AUC/OECD, 2021; UNESCO, 2021a). These platforms are rapidly transforming how we acquire skills and knowledge (Abugre et al., 2021). However, exclusions and inequalities remain a reality, especially for learners in low-income countries and rural areas, since even the best digital solutions do not work if there is no access to internet (Affouneh et al., 2020; Abugere et al., 2021; UNESCO, 2021a).

14.2.3 Digital Divides and the Need to Focus on Low-Cost and Effective Technologies

Regardless of the recent increase in digital and internet use referred to above, there is still a prominent digital divide both within and between AU and EU countries, including urban and rural areas (Fuchs and Horak, 2008; Brown and Czerniewicz, 2010; ITU, 2020c). Rural areas in both continents generally have much slower internet at their disposal. Data from the International Telecommunication Union (ITU) in 2020 shows that only 22% of rural population in Africa has access to 4G internet services in contrast to 77% of the urban population. In Europe, 86% of the rural population have 4G internet services in contrast to 100% of the urban population. The digital gender divide is also apparent, as women in least developed countries are 33% less likely to have internet access than men (ITU, 2020c). This means that access to internet and digital learning opportunities remains vastly uneven in both continents, posing a challenge for small-scale farmers, learners, and agricultural businesses.

Even where the digital divide seems less severe, such as in South Africa (one of the countries in Africa with the highest level of smartphone penetration), in-field observations reveal that one must avoid equating access to a smartphone with meaningful participation in digital education and learning systems (Durr, 2020; Lotz-Sisitka et al., 2021). Some of the major barriers facing smartphone users include:

Old mobile phones being incompatible with recent operating system updates;
Low-cost mobile phones with limited storage space and processing power;
Data costs associated with operating system upgrades, downloading and running new apps;

Data bundles that provide affordable access exclusively to key social media apps, such as WhatsApp and Facebook;
Difficulties in learning how to use new apps, particularly for older users; and
Lack of electricity leading to high costs for recharging batteries.

14.3 Illustrative Case Studies of Low-Cost Green Transitioning, Digital Learning, and Agricultural Practices in Rural Africa

The literature review points to the need for research into low-cost and effective solutions, which can be deployed for learning around the green transition in rural areas for small-scale farmers. Our two case studies focus on the use of low-cost and low-data social messaging services as these have emerged as a powerful transformative force, even in the face of unequal data access, distribution, and beneficiation (GSMA, 2020). In Africa, with 46% mobile device infiltration, mobile phones are the primary and often only point of entry to gaining access to necessary information and digital learning resources. There is also recognition that an increase in access to internet as well as digital tools with suitable training and education will enable small scale farmers to benefit from digitalisation, and that this can contribute to food security, sustainable development, and economic well-being (Ordu et al., 2021).

We see interesting, often youth-led, digital innovations emerging in Africa, especially around low-cost mobile technology innovations coupled with electricity infrastructure, e-commerce, e-health, and online education and learning solutions (PWC, 2016; Duarte, 2021). With the demographic dividend of a young population in Africa, there is already a surge in use of disruptive technologies such as ICTs, mobile applications, and big data analysis that is unconstrained by legacy, and much potential for further innovations. According to the "We are Social" 2017 Digital Yearbook, seven of the ten highest growing mobile adoption countries in the world were in Africa (We are Social, 2017). In many developing nations, where the installation of earlier technology was too expensive, mobile phones were the first pieces of digital communication technology to infiltrate rural areas (Aker and Mbiti, 2010).

Digital technologies have also provided ICT-based solutions for Sustainable Development as co-learning and information sharing platforms and mobile phone applications are an increasingly popular mechanism for supporting learning in rural areas. For example, in Malawi, some of the ICT-based agri-innovation apps that have recently emerged include the Regreening Africa App (European Commission, 2021), Kilimo Salama (Safaricom and UAP insurance, 2010), E-mlimi, and Mlimi hotline (World Vision, 2019) which connect agricultural communities and facilitate co-learning among farmers. Other examples include Kurima Mari, which is an integrated agricultural learning app launched in Zimbabwe and now expanding into Malawi and Uganda (FAO, 2017). These examples of applications for mobile phone–supported green transition and digitalisation seek to catalyse learning in rural areas at grassroots level. Many have

been made possible through partnership with European organisations, showing that there is already AU–EU cooperation emerging in this field. These are interesting examples because they facilitate wider social learning in communities, and they have a reach beyond the formal educational institution (Metelerkamp and Ferguson, 2021); a process also illustrated by the two case studies below, which offer further insight into these developments.

14.3.1 Case Study 1: Food for Us (FFU), South Africa

The FFU project focused on design, development, introduction, and use of a new mobile application in a rural agricultural community to address on-farm food waste and market transformation to a local green economy. The main goals of the project were to reduce food waste, to address the disconnect in local supply chains, and to facilitate sustainable production and consumption opportunities in local communities by connecting producers and consumers of fresh produce within a given geographical radius. The 18-month FFU pilot project was initiated in 2017 by partners supported by the UNEP, with funding from the EU and Japan. The project also supported community learning to enable increased employment opportunities using a mobile technology solution. Several social infrastructures, networking, and social learning support activities were applied in the project, including an introductory workshop, an application training, a local supply chain "Match-Making" event, a project debriefing event, and an active open communication channel (WhatsApp group) between the application trial users and the app developers and researchers (Durr, 2020).

The uptake of the application was not as successful and far reaching as intended due to the common problem of "short-term investment" in innovations by international funding agencies. There was little natural expansion of its adoption within the community and the developers stopped working on the initiative when the funding ran out. This resulted in the traditional "failed development project" situation, a common problem when cooperation interventions fail to integrate well into local economies and value chain systems. One can ascribe this to the donor environment, but what also became clear was that there were other factors shaping the outcome. These included challenges, such as a lack of trust in new forms of technology, inadequate digital literacy, poor signal, and high data costs, which point to a complex range of issues influencing the digitalisation context. The investment into the social relationships between stakeholders was one of the more positive features of the FFU app project, as this led to an interesting co-engagement between the new digital technology and those leading its development. This led to the adoption of a more common and culturally familiar digital technology to support FFU's aims – namely WhatsApp (Lotz-Sisitka and Durr, 2019). This engagement on both the FFU application and WhatsApp supported farmers to achieve their goals, that is, increasing revenue through finding new customers. However, it was ultimately the social learning across the two digital platforms (FFU and WhatsApp), together with the on-site engagements,

that helped to achieve the intended purpose of the specifically designed FFU app. Over time, relationships between buyers and sellers of produce developed and fresh produce was marketed to a larger audience. Transactions were increasingly made through the active WhatsApp group as the FFU app was unsuccessful in sustaining its initial "high flying" promise as being the "new technology" of preference. While the process of attempting to develop and introduce the FFU app led to the development of a new set of valuable social relationships, WhatsApp ultimately outperformed the FFU app as the platform capable of sustaining and operationalising these relationships.

Interestingly, this led to a process of merging the existing low-cost, culturally accepted, and widely used digital platforms that speak to the local context (local supply chain and market demands) with introducing and developing new digital technologies. It is also important to couple technological innovation with adequate investment (including short-term investment) alongside a robust understanding of the social context to assist in facilitating learning around the innovation, and develop a sustained use culture around the new technology to encourage effective use thereof. In such contexts, it is therefore necessary to adopt a combination of digital and other social learning practices for effective outcomes to emerge, instead of only relying on one digital mechanism or tool only. Substantive sustainability planning for cooperation and investment in such initiatives is necessary (Lotz-Sisitka and Durr, 2019; Durr, 2020). These reflect some of the contextual dynamics necessary when selecting digital tools in learning and development initiatives.

14.3.2 Case Study 2: Imvotho Bubomi Learning Network (IBLN), South Africa

The IBLN is a community-based agricultural learning network that emerged out of the Amanzi [Water] for Food Training of Trainers Course that started in 2014, growing exponentially over time in a rural farming context in South Africa. A WhatsApp group served as the learning network's primary means of communication since its inception in 2016, providing a space to share ideas and organise meetings. The learning network includes farmers, agricultural officers, agricultural students, NGO workers, and teachers, amongst others. Over a four-year period (2017–2020 included), the WhatsApp group chat volume calculated in words per year increased dramatically from 25,000 in 2017 to an estimated 125,000 in 2020, providing an expanding virtual space to facilitate knowledge sharing and discussion between the diverse participants. The WhatsApp group grew to include more than 100 participants, including farmers (50%), NGOs and academics (38.4%), government extension officers (5.8%), and agri-training institution personnel (5.8%). The virtual exchanges did not replace face-to-face meetings organised by the learning network, but instead extended them, offering evidence of the learning value of these long-term relationships. Often these engagements centred around a specific problem a network member had come across, and its resolution (Lotz-Sisitka et al., 2016; 2021).

Like the FFU case above, this uptake and sustained use of WhatsApp as a multimedia tool for seeking and sharing knowledge illuminates the power of using simple applications in digitalising learning in rural farming education processes. The cases also show that there are diverse factors affecting the sustainability of such initiatives. These include the way in which investments in the technologies are conceptualised, and ways in which social infrastructure operates within a digital and social ecology to facilitate sustained engagement with digitalisation in marginal rural areas. Issues related to the relevance and experienced value by digital users are another factor to consider (Lotz-Sisitka et al., 2021).

14.3.3 Key Insights from the Cases

Experiences in supporting digitalisation and sustainability-oriented learning processes suggest that the process of digital innovation is far more akin to weaving a fine quilt than viral dissemination (Metelerkamp and Ferguson, 2021). The process of learning is deeply connected, respectful of the individual, and relational. Relationships exist between learners in the group, each learner and the facilitator, and between each learner and the technology platform. In both the IBLN and FFU, each user was carefully introduced to the apps by another user who referred them to the community project. Achieving scale in low-tech rural environments was a result of active human agents working as advocates, nodes, and multipliers for digital technologies. Thus, our work with digitalisation and learning for sustainable development demonstrates that the often "invisible work" of developing stakeholders' understanding for digital innovation is as important as the digital innovation itself (Cruz-Jesus et al., 2014; Durr, 2020; Lotz-Sisitka et al., 2021; Metelerkamp and Ferguson, 2021).

Table 14.1 shows a summary of the two cases, which offers a framework that considers both digitalisation and learning in a context of sustainability.

14.4 Implications for AU–EU Cooperation

Learning in the areas of green transition and digitalisation can occur along the lines of:

Developing transformative literacies and capabilities for reaching into communities that would otherwise have been difficult to engage due to their remoteness and smaller scales of their practices (that is, they fall outside of the mainstream "Smart Agric" and AIS digitalisation movements).

Developing anticipatory literacies, especially sharing expertise and knowledge on market transformation approaches and the use of ICTs, as well as value chain development within localised green economy systems.

Developing ICT literacies, with emphasis, as we have indicated above, on understanding localised ICT cultures, preferred tools, and developing ICT innovations from this vantage point in ways that remain accessible to those who

TABLE 14.1 Summary of Key Insights from the Case Studies

	Transformative literacy		*Sustainability literacy*		*Anticipatory literacy*		*ICT skills*	
	FFU	*IBLN*	*FFU*	*IBLN*	*FFU*	*IBLN*	*FFU*	*IBLN*
Similarities	Networks and relationships/ ecological sensibility.		Organic farming.		Consideration of local green economies and value chain thinking improved.		Posting produce on a platform.	Posting questions about practice on a platform.
Differences	Market transformation.	Food sovereignty dialogues.	Organic farming with focus on food surplus management.	Organic farming with focus on rainwater harvesting and conservation.	Improved attention to quality of food production (unexpected outcome from posting produce on ICT platform).	More extensive and systematic uptake of sustainable agricultural practice esp. water harvesting and organic production.	Younger community members had to mediate with other members of the community.	All community members were able to easily use the platform, unless they did not have phones.
Implementation challenges and key lessons	Market transformations need to be supported by wider structural changes in local economies.	Multipronged approaches are needed for supporting smallholder farmers who are victim of droughts and severe weather impacts.	Challenges connecting buyers and sellers around food surplus issues – needs simultaneous communication and co-learning.	Droughts and severe weather conditions affect farmers' practices, despite communications gains from ICTs.	Stronger relations between consumers and producers in local food value chains need to be pro-actively established for the ICT tools to work.	More attention to market creation for smallholder farmers, thus stronger focus on local food value chains to be pro-actively developed to support farmers learning with ICTs.	Platform too elaborate, data too expensive, required smartphones. Application updates produced instability and required many data for regular updates.	Need for face-to-face communications to include those without phones.
Potential for AU–EU cooperation	ICT platforms can create spaces for transformative relations and literacies to develop. They also create access to communities that would otherwise not be included in sustainable development praxis.		There is need for cooperation to develop ICT-supported approaches that also support organic/more sustainable forms of agriculture – sharing of knowledge resources is a high area of potential.		There is need for tools to support market transformations and developing localised green economies that are supported by suitable ICT tools that are locally relevant and widely used.		Keep ICT platforms simple and aligned with current ICT use practices, avoid overelaborate technology solutions; check assumptions before designing digital solutions.	

do not have easy access to data or internet platforms, smartphones and other technology tools.

As argued above, all of this requires investment in both the digital software and hardware, and the less obvious social context and understanding necessary for uptake and use of the digital tools around core practices of sustainability innovation.

Digital transformation is a part of the AU's and EU's COVID-19 recovery plans and climate neutrality plans (Anderson et al., 2020; Agwanda et al., 2021). Digital technologies are perceived as a way to monitor and reduce greenhouse gases while safeguarding livelihoods during disasters. In addition, digital solutions need electricity, but the worldwide trend of electricity production is shifting towards renewable sources (IEA, 2021). In the EU, member states and cities have started taking a much more proactive role in leveraging digital technologies for education (including adults) and reducing their carbon footprint (WGBU, 2019; Shetye, 2021). Furthermore, the EU's green deal intends to leverage digitalisation in urban mobility, industry, energy markets, energy efficiency, sustainable supply chains, and food systems, and views digitalisation as a key enabler for achieving the objectives of the green deal. However, even in the EU, there is a growing need to include rural communities in these plans.

The EU is an integral partner to Africa's development ambitions, particularly through the provision of finance, technology, and capacity building in the ICT domain. The EU is approaching digital partnerships with developing and emerging economies through Digital4Development Hubs (D4D) in some countries and through mainstreaming in other countries. These digital partnerships will include regulatory cooperation, addressing capacity building and skills, investment in international cooperation and research partnerships. However, it should be noted that most of the initiatives under the EU's external digital policy for Africa are surprisingly constructed as a one-way road, in the sense that the initiatives do not give scope for EU policymakers to learn, gain knowledge, and incorporate solutions in the European context. In terms of digitalisation for sustainable development, there are a couple of initiatives which stand out for incorporating low-cost and effective digital solutions for small-scale farmers that can offer insights into co-benefits and mutual learning around enabling a green transition (which benefit all societies) and digitalisation. The initiatives in which such mutual learning is possible include the African European Digital Innovation Bridge (AEDIB) and the Innovation Dialogue Europe Africa (IDEA).

14.5 Conclusion

As indicated in the introduction to this chapter, connectivity through digital means has increased substantively in the past few years. The EU's Africa Strategy (EP, 2021) recognises potential for cooperation in the areas of green transitions and digitalisation within the SDG framework. The AU–EU cooperation is also

effective in terms of learning and agriculture for small-scale farmers in rural areas. We have offered a perspective on such cooperation with a view to placing the most marginalised at the centre of such cooperation potential, namely rural small-scale agricultural communities. While this is not the only possible focus for such cooperation, we have foregrounded smallholder farmers and agriculture in these settings in Africa. We have indicated that digitalisation – using low-cost mobile technologies introduced in social and technological ecosystems, building on adequate sustainability planning and careful engagements in communities of practice – is an important dimension of such cooperation potentials. This requires an ESD and learning as people need to learn how to use technologies in supportive learning-centred processes if they are to successfully shape sustainable development actions in ways that leave no one behind. We have also sketched a positive picture of existing and emerging AU–EU cooperation in this area, highlighting the trend towards expansion of digital competencies, skills, and technology, partly also because the majority of the population in Africa is much younger than in Europe. We have pointed to the possibilities of AU–EU cooperation to develop transformation, sustainability, anticipatory, and digital literacies around key areas of local green economies, food system value chains, and knowledge sharing. Mobile learning is among the fastest growing digital applications in Africa, and leapfrogging has already taken place. Mobile learning therefore offers a centrepoint for future innovation diffusion and expansion for green transitions and digital cooperation.

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