Twin Transition

Digital Transformation and Climate Policy in Development Cooperation

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Background: The rationale behind the Twin Transition

What the Twin Transition is about – Digitalisation and climate-compatible societal transformations already bring about significant, often even disruptive changes, and these changes are interconnected in many ways. Taken collectively, the areas have been increasingly referred to as twin transition. Not only are they defined by profound challenges and opportunities, but given their interconnectedness it is important to identify major interfaces to avoid incoherence, inefficiency and lost opportunities related to successful transformations.

WHY THE TWIN TRANSITION IS RELEVANT FOR DEVELOPMENT COOPERATION

Developing countries are most susceptible to the impacts of climate change and environmental change in general (including biodiversity losses) and least responsible in terms of historic emissions of greenhouse gases – the co-relation to digitalisation is that they are also those with least digital access. Digital technologies have come to the forefront of development policies due to the positive enabling effects that they can provide for climate change mitigation and adaptation as well as for sustainable growth and social inclusion. In line with development and growth there will equally be higher demand for energy in developing countries. Therefore, collaborative action is needed to avoid lock-in effects of fossil fuel-based infrastructure which could lead to missing opportunities of coupling sustainable energy and digital technologies.

KEY INTERESTS OF THE EU AND ITS MEMBER STATES

Ambitious climate policies and decarbonisation on the one hand and the acceleration of digital transformation on the other are key objectives of a successful Green Deal. However, the need of twin transition is even more profound in developing and emerging economies where development of digital infrastructure and the implementation of climate-sensitive and resilient transformation are still in their early stages.

WHAT IS THE RATIONALE OF ACTION ON THE TWIN TRANSITION IN THE CONTEXT OF DEVELOPMENT COOPERATION?

Both transition processes and their interrelations need proactive steering, with profound implications for development policy and cooperation - that are yet to be fully accounted for. The EU and its Member States together with other partners need to address two basic rationales with main consequences for mitigation and adaptation:

1. **Making digitalisation trends climate-compatible** and
2. **making full use of digital tools and trends for climate action.**

WHERE TO BUILD ON GLOBAL ACTION AND PROCESSES?

There are numerous initiatives around the world that can contribute to address the twin transition in the context of development cooperation. Driver of a comprehensive EU engagement, for example, can be the Global Gateway investment initiative[1]. This ambitious EU policy programme has been designed to mobilize up to €300 billion in public and private infrastructure investment by 2027. The EU has two overall objectives with the initiative: First, the implementation of concrete projects in key areas such as digitalisation, climate action and renewable energy; transport; health and education and research. So, the creation of smart, and clean connections for digitalisation and climate protection is a focus area. Second, the Global Gateway aims at building strategic partnerships through the investments and its focus on just transition processes worldwide. This scope creates new momentum for development cooperation – urgently needed given the geostrategic challenges of our times.

Another example, is the Global Innovation Hub (GIH), launched in November 2021 hosted by the United Nations Framework Convention on Climate Change (UNFCCC). The GIH aims to promote transformative innovations for a low-emission and climate-resilient future and at the same time facilitates solutions that support the climate-related Sustainable Development Goals (SDGs). It leverages the convening power and climate leadership of the United Nations with the dynamism of the private sector.

A third example is the UN-led Coalition for Digital Environmental Sustainability (CODES) an open stakeholder coalition established to firmly anchor environmental sustainability needs within the UN Secretary's General Digital Cooperation Roadmap. This initiative aims at accelerating a digital planet for sustainability based on the values of natural ecosystems, human wellbeing and community resilience through a number of joint activities. These are only three examples of processes and initiatives that are important collaborations on the twin transition with additional ones listed below.

Key Trends

FACTS AND FIGURES RELATED TO THE TWIN TRANSITION WITH A SPECIFIC FOCUS ON THE DEVELOPMENT CONTEXT

CLIMATE CHANGE TRENDS IN A NUTSHELL:
The average increase of global temperatures between 1880 and 2012 was 0.85°C. Global warming is 'proceeding at a rate that is unprecedented over decades to millennia' according to NASA,[2] with 2021 being the planet's fifth warmest year ever recorded. During the 2010s, Europe suffered at least €12.5 billion of economic damage, and last summer, it was hit by severe and deadly climate-related events, including floods, heatwaves, and droughts.[3]

THE LATEST IPCC FINDINGS ARE MORE THAN CLEAR:
The world will probably reach or exceed 1.5 degrees Celsius of warming within the next two decades. Even with stringent emissions-reduction measures, we have already caused significant warming of the climate system, making it highly likely that we will face increasingly dangerous and destructive extreme weather events. The remaining global carbon budget to have a likely chance of limiting warming to 1.5 degrees C – only 400 gigatonnes of carbon dioxide ($GtCO_2$) – will be used within the next decade, if no significant global transformation is achieved.

CLIMATE CHANGE CONSEQUENCES FOR DEVELOPMENT ARE SIGNIFICANT:
From a climate change perspective, Low and Middle Income Countries (LMICs) are hit hardest by impacts of climate change – and the co-relation to digitalisation is that they are also those with least digital access in the world.[4] Most under threat are Small Island Developing States (SIDS) and Least Developed Countries (LDCs) which include many vulnerable communities.[5]

DIGITALISATION AND CLIMATE ACTION DEEPLY INTERLINKED:
Information and communication technologies (ICTs) are a significant contributor to greenhouse gases, but if harnessed correctly, also provide more efficient climate solutions. The goal needs to be to use ICTs (e.g., smart electricity grids, intelligent transport systems, Industry 4.0 and precision agriculture) to efficiently reduce GHG emissions.[6] Already back in 2015, a report by the Global Enabling Sustainability Initiative (GeSI) estimated that "ICT can enable a 20% reduction of global CO_2e emissions by 2030, holding emissions at 2015 levels".[7]

THE INTERRELATIONS BETWEEN DIGITALISATION AND DEVELOPMENT AND CLIMATE ACTION:
Seven years later, the world is more connected than ever before – and digital tools are ever more accessible. "[T]he digital divide between developed and developing countries is shrinking, as investment in ICT networks and services continues to grow while prices fall."[8] In other words, most mobile users are currently in developing markets.[9] At the same time the digital divide is still huge: Nearly 3 billion people are offline, 96 per cent of whom live in developing countries.[10] So while the demand for digital technologies is growing like never before, developing countries are still disproportionately being left behind. Over time this inequality will grow not only in terms of access to digital technologies, but also in the ability to utilise those technologies to facilitate climate transitions, leading to, if not addressed, a twin disparity. Plus, without appropriate policy measures for green and just transitions, the wealthier parts of the population of developing and emerging countries might contribute to increased emissions through use of rapidly spreading technologies, while their poorer populations suffer disproportionately from climate change impacts and not profiting from digital technologies to the same degree. This would further complicate the (international) political economy of a twin transition.

TECHNOLOGY GROWTH AND ITS CARBON FOOTPRINT:
The carbon footprint of the global tech giants is growing particularly fast – one striking example is the exponential growth of data centres. The resulting rising energy consumption due to digitalization is incompatible with the climate goals of the Paris Agreement.[11] The carbon footprint of an increasingly digital society is still enormous: "the share of the global carbon footprint of our digital gadgets, the internet and the systems supporting them is 2.3 – 3.7 per cent, roughly the same as global air travel".[12] And: The high demand for digital tools requires an increase in extraction of rare earth elements and metals (cobalt, lithium among others). This cannot only lead to new resource dependencies but will also have profound effects on biodiversity and the environment. However, using a circular economy approach in the area of ICTs could increase gross domestic product (GDP) by 7 per cent and save a lot of waste.[13] Equally the relationship is not always as straightforward. Empirical findings suggest that digitalization will help decrease emissions in low-digitized countries in the medium and long term but can initially lead to an increase in emissions; there is a parabolic relationship with emissions reductions over time as a result of digitalization.[14]

DIGITALISATION AND SDGS:
Digital technologies will have a high impact across at least 10 of the UN's SDGs. There are estimates that 70 per cent of 169 targets base-lining the world's sustainability goals can be positively influenced using digital technology applications.[15]

THE ROLE OF ECONOMICS – THE ROLE OF CONSUMERS:
Digitalisation of economy is leading to "new dimensions of cost optimizations, operational efficiencies, and extremely fast and cheap expansions of products and services, incentivised by rapid growth and profit while accelerating unsustainable lifestyles and values."[16] Rise in consumerism is coupled with the growing climate crisis. And, consumerism is facilitated and harnessed by digital tools. At least 1.5 billion people consume products and services through e-commerce platforms, and 60 per cent of the global population is anticipated to engage with social media by mid-2022. Apart from the potential benefits of such a development, there are also costs in terms of increased energy use to be expected.[17]

THE MAIN TAKEAWAYS – TWO BASIC IMPERATIVES FOR THE TWIN TRANSITION:
Both processes and their interrelations need proactive steering, with profound implications for development policy and cooperation - that are yet to be fully accounted for. This results in two basic rationales with main consequences for mitigation and adaptation

- → Making digitalisation trends climate-compatible
- → Making full use of digital tools and trends for climate action

For the field of development cooperation, it is of outmost relevance to explore how these rationales can be further adapted to the conditions in partner countries of international cooperation and how the highest impact can be achieved by making well-directed use of proven and context-adapted digital solutions?

1 See https://ec.europa.eu/info/strategy/priorities-2019-2024/stronger-europe-world/global-gateway_en
2 ITU, 2019, Turning digital technology innovation into climate actionp.3.
3 EU 2022: Destination Earth, Brussels.
4 GSMA, 2021, The Role of Digital and Mobile-Enabled Solutions in Addressing Climate Change, p.7.
5 ITU, Turning digital technology innovation into climate action 2019.
6 See, e.g Muench, S., Stoermer, E., Jensen, K., Asikainen, T., Salvi, M. and Scapolo, F., Towards a green and digital future, EUR 31075 EN, Publications Office of the European Union, Luxembourg, 2022; GeSI, 2020.
7 GeSi 2015, p.8. In a recent study for Germany on behalf of Bitcom, the estimate of the CO_2 impact of accelerating the use of digital technologies by 2030 is a emission reduction of up to 41 percent . See https://www.bitkom.org/Klimaschutz .
8 ITU, 2019, Turning digital technology innovation into climate actionp p.2.
9 GSMA, 2021, The Role of Digital and Mobile-Enabled Solutions in Addressing Climate Change, p.11.
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Main target areas and actors of the Twin Transition

As the following profiles of five key target areas illustrate[18], the main potentials for mitigation and adaptation are in the broader areas of green data, green tech, public digital Infrastructure / digital public goods. Additionally, it is important that the twin transition is discussed and implemented in the broader context of the just transition debate. For example, one of the first Digital 4 Development (D4D) flagships launched was the EU-Africa D4D Hub, which aims to match demands from African countries with expertise and support from different European development partners across the four areas covered by the 2019 DETF Report: connectivity, skills, regulation and e-services. This approach has promising components also to address the context of a just transition, but there are also aspects that remain to be clarified and challenges that will have to be tackled head-on for the D4D Hub to fulfil its potential.[19]

INTEGRITY AND TRANSPARENCY OF CLIMATE ACTION – AND DIGITAL INFRASTRUCTURES

Digital technologies can help to ensure the GHG reduction targets needed to reach the 1.5-degree target of the Paris Agreement. To this end, significant changes are needed. Key principles of the implementation of the Paris Agreement are to provide integrity and transparency of ambitious climate action. Digital technologies offer different options to support these processes, for example, through the establishment of national data systems to enable greenhouse gas registers/inventories or climate risk information systems in a secure and transparent way.

One concrete example refers to the further evolution of carbon markets internationally. Not only that the EU's experience in emissions trading by capping emissions, pricing pollution, and generating revenues to speed up the decarbonisation and support the most vulnerable could inspire other countries to use similar schemes. Carbon markets are becoming increasingly complex and past experiences have shown that accounting systems and registries can be flawed or their lack of precision exploited. This can reduce trust in and efficiency of market-based approaches to reduce emissions with tremendous consequences for transparency as well as environmental integrity of the climate regime.[20]

Digital technologies such as blockchain can play an important role here and help securing that trading systems are established in a secure and transparent way. This can be an important building block for Under Art. 6 of the Paris Agreement to enable participation of developing economies in global market mechanisms and support, at the same time, the increase of capacities.[21]

In addition, further innovative digital technologies – such as artificial intelligence, Internet of Things (IoT), Machine Learning or Smart Contracts – can increase the capacities to better monitor, verify and report traded emission reductions. More concretely, data flows can be transferred from the project/company level, via national authorities to the international level. Used in this way, digital technologies offer an efficient, integrated and transparent information infrastructure for global CO_2 trading.

Rural Property in the Rural Environmental Registry (CAR) / Brazil

While no specific initiatives on carbon market transparency could be identified during this study, GIZ Brazil has significant experience with large data base that can be used to improve transparency of climate and environmental policies. CAR gathers information on every farm in Brazil from individual farm owners, who are legally obligated to restore and conserve certain parts of their land. This data has not been connected to climate policies and reporting obligations of Brazil yet, but there is significant potential to do so to monitor land use patterns, for instance. Most importantly, the process of gathering and improving data – that are voluntarily provided by individual farmers of the whole national territory but centralised, managed and provided to the public (anonymised) by governmental institutions – offer important learnings on governance, data protection and other challenges that might emerge when piloting large market-based mechanism platforms, for instance. Furthermore, the experience of data triangulation with deforestation monitoring tools for law enforcement can be valuable for establishing compliance mechanisms, whenever these depend on other available data sources.

EMISSION REDUCTION – MOBILITY AND ENERGY TRANSITION VIA DIGITALISATION

There are significant opportunities for digital technologies to contribute to GHG emission reduction – be it for energy, mobility or housing approaches:

COORDINATION OF DEMAND AND SUPPLY SIDE

At the core of all climate mitigation efforts, most prominently, in Nationally Determined Contributions (NDC) and Long-term Climate Strategies, is the sustainable transition of the energy system. One key option here are smart grids a technology option that can facilitate a chance in the way we use energy: Smart grids help increase flexibility and facilitate the paradigm change to consumption following production. Smart grids refer to variety of technologies applied to optimise the energy system including sensors, sensor networks and IoT, (wireless) communication, data modelling as well as information analysis, integration, and optimisation. Technology can also help facilitate demand side management (DSM), whereby electricity consumers, through the use of digital tools can optimise electricity usage to shift demand to hours when there is less load/more renewable generation available (e.g., automatically setting cleaning appliances, dishwashers, washing machines, to run midday or at night, or briefly switching off smart refrigerators to idle for 30 minutes during peak demand). This thinking can also be extended to industrial

Selected examples:

Electricity

With the expansion of energy communities (i.e., community solar and wind), the use of interconnected smart microgrids can increase the efficient use and sharing of electricity helping to balance demand.

Industry

Assuming a higher share of renewables in the electricity mix, increasing the role of electrification of industrial processes can replace the role of fossil fuels driving down emissions. Electrical arc furnaces are one example where scrap steel is melted using electrical processes significantly reducing the emissions intensity of the production.

Transport

Beyond the electrification of transport, using digital tools to better traffic system management can reduce emissions and increase system efficiency.

Buildings

Digital monitoring and tracking of energy usage through the use of sensors and controls and smart meters can reduce energy consumption.

Source: Based on Muench, S., Stoermer, E., Jensen, K., Asikainen, T., Salvi, M. and Scapolo, F., Towards a green and digital future, EUR 31075 EN, Publications Office of the European Union, Luxembourg, 2022

uses – also in development cooperation. Another example, this time of supply side management is virtual power plants that - depending on the grid's necessities - offer to manage a certain amount of power to the grid (switching generation and consumption units on or off).[22]

AUTOMATIC CONTROL

Increasing efficiency through automatic control is another digital mechanism that can improve energy systems. Much of this has been tailored to an industrialised country context. However, many developing countries also have a lot of high-consuming homes and buildings, with consumption projected to grow in line with steadily increasing demand for air condition in developing countries[23]. Automatic control includes applications in smart homes and intelligent buildings (e.g. steering lighting, heating, ventilation and air conditioning based on occupancy)[24], smart cities (e.g. optimising the different systems of the city such as traffic flows by adding ICT to traditional infrastructure and thus saving energy) as well as smart agriculture – relevant for both mitigation and adaptation (supporting early warning for pest infestation, robots for weeding, precision irrigation, digitally supported crop diversification, etc.).[25]

AI

The potential of AI for climate protection is often emphasised and can be central to achieving the necessary mobility and energy transition. There is an increasing focus on exploring AI use cases with a positive climate impact.[26] Promising sectors are sustainable mobility, renewable energy and sustainable agriculture and forestry. Starting points are, for example, the AI-based analysis of data of urban areas for evidence-based sustainable mobility planning, AI-supported promotion of the expansion of renewable energies and effective standards. Another good entry point is the support for partner countries on forestry and agriculture, as this sector is particularly affected by climate change and employs about 60 per cent of the of people on the African continent."[27]

GREEN DATA CENTRES

Green data centres will be a key contribution of the twin transition. Overall demand for data centres is increasing and they are often operated with fossil fuels, but here too there is great potential for the use of renewable energies[28] as well as standards for more efficient data centres.[29] Additionally, the industrial heat waste produced by data centres can serve as a major source of heating for industry or in households. In Africa this potential remains largely untapped whereas in Europe, 50 per cent of the residual heat is already being used. Reticence from private investors and operators to tap into these potentially huge savings often stems from the lack of access to attractive financing models and incentives, complex regulatory requirements of the local energy sector and the lack of experience of local regulators and ministries in dealing with data centres. Here international support

is needed – provided, e.g. through exchange, advisory services and training formats but also advising companies on the creation of suitable business cases. Actors in the International climate policy sphere can support through the build out of renewable energy supply and expansion of energy efficiency, the creation of measures for existing and future data centres or through strengthening local regulatory authorities in building and funding sustainable data centres.[30]

REAL-TIME DATA AND PREDICTIVE ANALYTICS FOR EVIDENCE-BASED DECISIONS: ADAPTATION AND BEYOND

The strengthening of resilience through climate change adaptation measures is another main imperative of the global climate agenda and as action area is key to build trust with many countries of the Global South. The required information and data sources to inform comprehensive risk assessments are still not in place, digital technologies can therefore play a crucial role to inform National Adaptation Planning processes (NAPs), the adaptation communication requested under the Paris Agreement, or even climate finance proposals which often are based on information related to the specific vulnerabilities of and climate change risks for a certain country.

Overall, digital technologies can fill data gaps at global and national levels, generate real-time information and inform predictive analytics that lead to better decision making and priority-setting. When used in project implementation this can also help to draw conclusions about the effectiveness of policy interventions.[31] As a map of digital technologies for climate adaptation on behalf of SIDA is indicating, there are over 70 distinct applications of digital technologies for climate adaptation with their impact denoted on mitigating priority risk areas.[32] Based on this mapping, different functional areas exist in this action area:[33]

THE COLLECTION OF DATA

Digital technologies that track, measure, monitor, store information or resources can support climate change adaptation. Examples include sensors, IoT, remote sensing, satellite imagery, drones, or databases. Remote sensing can help in the real-time management and assessment of flood risks assisting in effective early warning and enhanced disaster management. In the same context, AI and drones can also be utilised to assess eventual damage.[34] Microwave Induced Rain Monitoring (MIRM) as one example systems can provide more precise weather measurements with lower costs than installing weather stations and support adaptation of flood or drought – a key for various climate vulnerable developing and emerging countries. Another example is Flowkit that uses anonymized data on calls and SMS messages from mobile telecom companies and open source analysis software to identify the location of people and their movements. This can help humanitarian responders to understand where best to target relief efforts for floods, droughts, or cyclones and can be used to identify population centres more accurately than national censuses for developmental planning purposes. In general, environmental monitoring and tracking of real time data such as soil quality can optimise resource usage and increase productivity and crop yield. In addition, digital monitoring for LULUCF can increase the efficiency of tracking carbon sequestration.

DATA ASSESSMENT

For the assessment of data, digital technologies can offer the capacities to analyse, predict, evaluate, visualise, map, and model data. They can inform decision making by testing theories or simulating data trends. Examples include algorithms, big data, statistical analysis, data science, digital twins (a digital virtual replica of the actually existing process in order to simulate and test the real-world entity) for scenario planning, and geographic information system (GIS). One use case example is Precision Development (PxD) – a non-profit US organization that uses various technologies and methodologies to pilot and scale support to smallholder farmers in changing behaviours to increase farm yields in developing nations. Another example is the million neighbourhoods map, a new global tool designed to detect gaps in services in informal settlements, valuable in helping to identify communities with limited access to street networks, which can be a good proxy for access to other services, such as power, water, sanitation, and other infrastructure.[35]

DATA CONNECTION AND DISTRIBUTION

Digital technologies can take a matchmaking function. It brings parties together, aggregate, match demand with supply, coordinate, pool resources, transact, and/or support trade of information or resources. Here, examples include matching algorithms, machine learning, websites, marketplaces, and social media to be used to enable climate change adaptation. Another key function of technologies can be to inform and communicate data. Through sharing of information or resources populations affected by climate change can be educated and get the capacities needed to improve their resilience. Examples include mobile phones, social media, SMS, broadcast networks, mobile money, crypto currency, lend, and digital insurance. Especially, the example of insurance has gained some prominence in climate risk management.

MANAGEMENT OF DATA

Digital technologies can support the management of data by informing planning, regulating, designing policies or simply nudging people through information or resources. Examples include smart contracts, decision support tools, templates, sensor management or workflow systems. Relevant sectors include food security, natural systems, human settlements, human health among others. For

example, soil sensor data provides real-time data on soil moisture, salinity, and temperature which helps farmers make better decisions on whether to adjust potential re-fertilisation or watering efforts. One such technology developed by CropX has led to 40% water savings and 10% yield increases in different crops in Europe.[36]

BARRIERS

Among the barriers often identified were money and affordability, the accessibility of digital solutions, and also more generally the awareness and capacity of users. Furthermore, the readiness to use a technological solution or the necessary infrastructure is not existent. For these and other barriers, concrete support through elements of international climate governance is needed – for example, through financing instruments such as the Green Climate Fund or the Adaptation Fund.

ECONOMIC INCENTIVES AND BUSINESS MODELS RELATED TO THE INTERFACE OF THE CLIMATE CRISIS AND DIGITAL SOLUTIONS

Digital transformation requires a shift of economic incentives and business models towards full costing, transparency, environmental sustainability and circular economy."[37] A better integration of incentive structures can help make full use of this potential, also as part of supporting climate finance structures. The large channels of financing climate action, e.g. Global Climate Fund, green finance options provided by development banks, can offer more incentives for proposals that aim at businesses piloting scalable digital solutions for climate action. The respective expert community has gathered substantial knowledge in the past decade on how to establish quality benchmarks for climate action projects, make financing sources more attractive for enterprise and which initiatives can support SMEs in designing green project proposals or business plans.

This knowledge can be applied to the purposes, firstly, of making green digitalisation solutions as attractive for businesses as conventional ones and, secondly, of leveraging business potential for expanding the use of digital tools to comply with climate action needs (analogue to how capital flows and private sector interest should be redirected to sustainable and low-carbon business models). The SEED initiative, for example, has been successful in enabling green entrepreneurship by offering "tailored business and capacity-building support, networking, and profiling at the national and international level".[38] The initiative offers both direct support to the enterprises on wide array of issues and promotes conducive financing and policy structures through Practitioners Labs. In Vietnam, for example, the Green Tech Hub of the Digital Transformation Centre of the GIZ has a broad support portfolio for green digital start-ups in the areas of energy and circular. Such work can provide lessons and be expanded for encouraging SMEs to work in the area of twin transition. It can help identify areas of climate action that can profit from scaling digital solutions or explore viable ways of making digital SMEs greener, in the specific country context, by supporting networking and generating ideas, e.g. through establishing incubators or competitions.

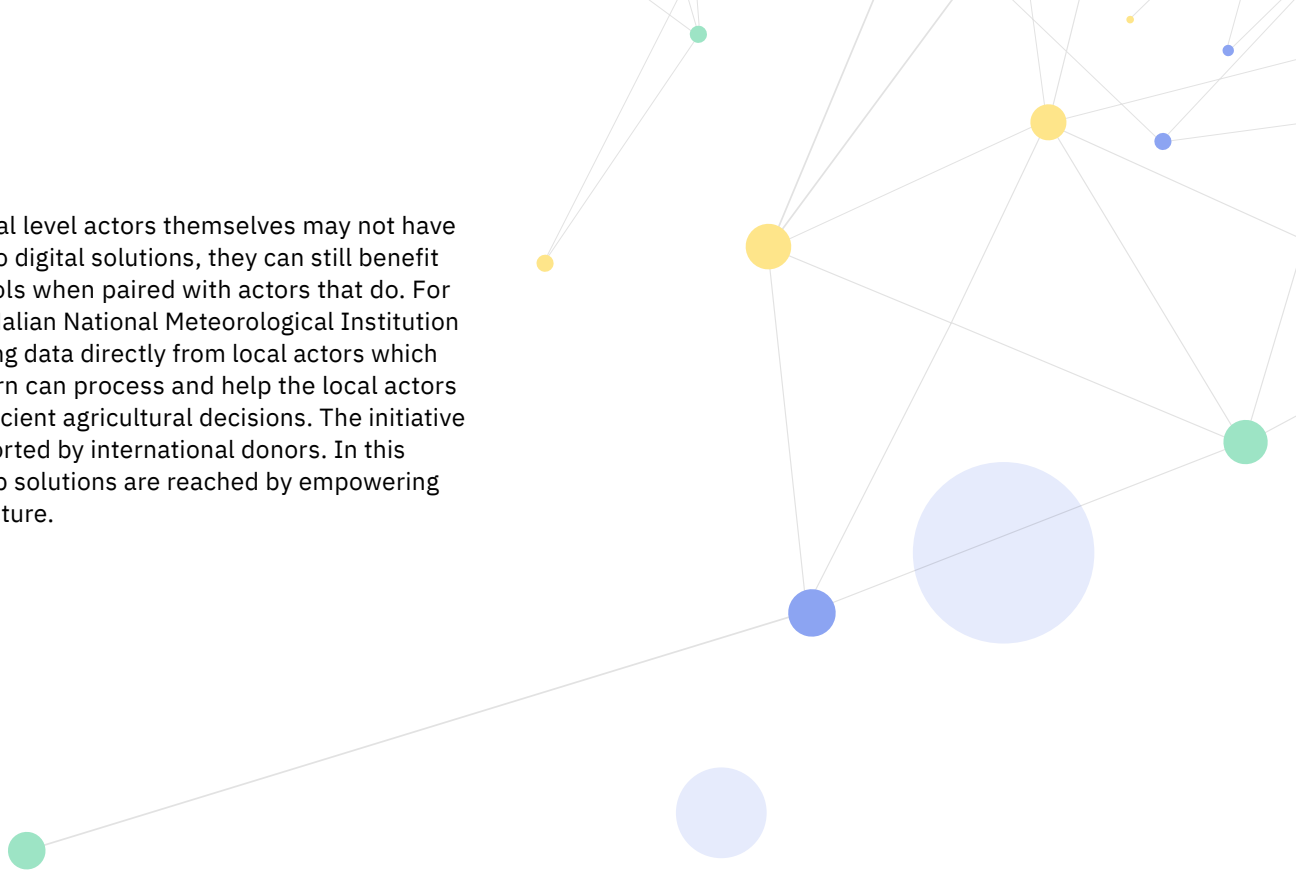
A challenge known from climate and sustainability action is leveraging the potential of large enterprises, e.g. in climate-smart agriculture, sustainable mobility, energy provision, without negative knock-on effects of public-private partnerships, of market dominance or of disrupting local value chains in developing countries. Large providers of digital technology and services will need to be involved in promoting twin transition at scale. The available good practice and learnings with regard to risks from cooperation with the private sector on sustainability agendas should therefore be considered in the context of the twin transition.

COLLECTIVE ACTION AND PARTICIPATION: EMPOWERMENT OF LOCAL DIGITAL ECOSYSTEMS FOR INCLUSIVE DEVELOPMENT

Digital applications can play a crucial role in strengthening the empowerment of affected populations and bring them in a better position to tackle the climate challenge. By enhancing the ability of partner countries to create local digital ecosystems they will be in a better position to coordinate stakeholders and to take collective action to achieve climate goals. These processes are crucial for the design and implementation of long-term strategies or planning processes such as National Adaptation Plans which will benefit from increased acceptance through participation. For digital aspects to be integrated in long-term planning strategies, e.g., in UN processes, they in turn need to be specifically called for and supported by the international climate regime. The bottom-up spirit of the Paris Agreement and usefulness of digital solutions allowing for efficiencies when processes are harmonised, calls for standardised frameworks and guidelines for empowering local actors to use digital solutions.

One example where a solution in this intersection is currently being piloted is the Climate Warehouse initiative by the World Bank. The initiative creates an end-to-end digital ecosystem for carbon markets to help create an overview of registered emissions (e.g., through offsetting schemes, ETS, etc.) both on the domestic and international level. The aim is to inter alia help local actors identify double counting and assist them in auditing and reporting of emissions. The initiative is embedded in the "Digital for Climate (D4C)" collaboration which is a joint effort by UN Bodies and MDBs working to digitalise, streamline, and integrate above all monitoring, reporting, and verification processes for emissions.[39]

Even when local level actors themselves may not have direct access to digital solutions, they can still benefit from digital tools when paired with actors that do. For example, the Malian National Meteorological Institution receives farming data directly from local actors which they then in turn can process and help the local actors make more efficient agricultural decisions. The initiative is in part supported by international donors. In this way, bottom-up solutions are reached by empowering local infrastructure.



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30 Scholz, Vera, Axel Klaphake, Gitta Sender, Hannah Müller 2021: DIGITALISIERUNG UND KLIMA. Narrativ: Twin Transition. Mapping der Kooperationslandschaft. Deep Dives Portfolioentwicklung: Grüne Datenzentren, KI für Klimaschutz, und Blockchain für Kohlenstoffmärkte. Internes Dokument der GIZ.
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32 Devfin Advisors 2022. Climate Tech Mapping Study. Study in behalf of SIDA.
33 Devfin Advisors 2022. Climate Tech Mapping Study. Study in behalf of SIDA. See also for this and the following examples https://theexchange.africa/opinion/climate-change-mitigation/
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35 WRI 2022: Seven Transformations for More Equitable and Sustainable Cities, 135-136.
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38 https://seed.uno/about
39 World Bank, 2022. Climate Warehouse End-to-End Digital Ecosystem for Climate Markets. Powerpoint Presentation. Available : https://pmiclimate.org/sites/default/files/downloads/publication/Day%202_Session%202_a_End-to-End%20Digital%20Ecosystem%20for%C2%A0Climate%20Markets_%20by%20Chandra%20Sinha%20and%20Gemma%20Torras-Vives.pdf

Conclusions and recommendations

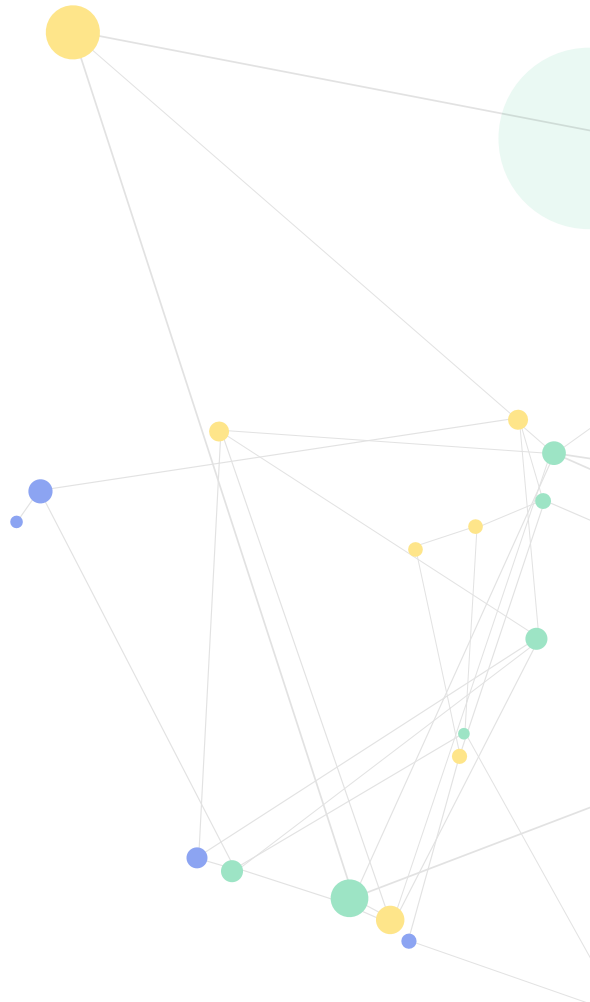
The twin transition requires an acceleration of action to ensure an integrated approach that maximises the possible benefits and enables overcoming the key challenges. To this end, Germany together with other Member States, the EU and existing initiatives need to formulate and implement an action programme together with key enabling partners making sure that the green and digital transitions reinforce each other. A variety of economic, social and political factors will influence these transitions in key sectors such as energy, energy-intensive industries, transport and mobility, industry, buildings and construction or agriculture and biodiversity protection – all crucial to inclusive, climate-responsive development.

For further joint action, key recommendations can be formulated for the different key areas which require resources at different levels and should be accompanied by flagship initiatives. Future action programmes need to be flexible and agile and strong in communicating successes, prospects, and political needs. To ensure the sustainability and scope, cooperation among EU Member States and European Institutions can be the engine for global outreach and multi-stakeholder integration. Many actors are still developing an understanding of the strong interdependencies between the twin transition and how these might affect their daily work. This has led to significant untapped synergies between financing digital innovation and climate action, as these areas remain largely separate. Germany together with other Member States and the EU have the resources, mandate and networks to not only increase coordination between development cooperation actors working, respectively, on climate and digitalisation topics, but to promote the twin transition approach, a qualitatively different paradigm/principle of work (such as e.g. “digital by default”) for donor agencies and financing institutions from the EU.

WHO AND HOW?

Strong partnership networks are needed to accelerate the twin transition. To this end the cooperation and coordination of a variety of stakeholders is needed. Who can and needs to contribute to such a multi-stakeholder initiative?

- **EU and governments within and beyond the EU.** Here, different contributions are feasible and needed. Relevant are approaches which take a distinct focus of twin transition support and the related networks with the ICT sector, investors and other stakeholders from civil society dedicated to ensure equal access to the benefits of digital and climate-friendly technologies. The 2030 Digital Compass to pave the European way for the Digital Decade with a distinct focus on international partnerships can serve as one element of such an initiative.
- There are already existing activities by EU Member States which could take part in such an initiative – for example), Belgium (Support for a green innovation hub in Sénégal; Wehubit innovation fund), Estonia (Development Plan of Digital Society), Germany (Digitalisation for Development Strategy) or Sweden (Mainstreaming of digitalisation).
- **Further international initiatives such as the**
  - EU Green Digital Coalition as an initiative of companies aiming at harnessing the emission-reducing potential of digital solutions (supported by the European Commission and the European Parliament);
  - UN-led Coalition for Digital Environmental Sustainability (CODES) - Initiative (with the German Federal Environment Agency among others);
- Initiatives, institutions and activities related to UNFCCC such as
  - evolving joint mitigation activities under Art. 6 of the Paris Agreement,
  - financing instruments such as the Green Climate Fund or Adaptation Fund to initiate transformative change toward low emission and/or climate resilient societies,
  - the Global Innovation Hub to promote transformative innovations for a low-emission and climate-resilient future;
  - arrangements and process to support adaptation communication especially in developing economies.
- Different activities of multi-national and national Development banks such as World Bank Group[40], European Investment Bank (EIB)[41] , German KfW Development Bank, Asian Development Bank (ADB) among others.
- Institutional investors and companies in different sectors to help foster innovative solutions and to deploy digital technologies with an understanding of how to increase climate-friendly impact and avoid or manage negative externalities;
- Civil society representatives and academia to bring in a strong focus on responsible digitalisation, to help form multi-sector partnerships with the ICT sector to drive impact and to reach out to consumers to underline the need to take responsibility for positive and negative impacts of personal usage and power use among others.



This list demonstrates that there are existing suggestions to form targeted multi-stakeholder action to promote the twin transition. What has been missing so far in the related discussions, is a comprehensive alignment of these approaches with key processes under UNFCCC to ensure that existing activities are integrated into the evolving arrangement to implement the Paris Agreement. The benefits of such an approach is the prospect of mainstreaming a digitalisation lens into the core international climate governance structure.

01

SUPPORT DIGITAL ENTREPRENEURSHIP

The core (and the driver) of multi-stakeholder action remain digital entrepreneurs. As a critical source of innovation and part of the large group of SMEs they play a central role in the twin transition. This is true for Europe but also for large parts of its partner countries. In different sectors and clusters these entrepreneurs should receive targeted regulatory and financial support. As a source of innovation, digital entrepreneurs need targeted entry points into the international climate governance structure, so they can contribute to concrete climate mitigation and adaption solutions for sustainable energy, industrial transformation, green transport, housing and agriculture – e.g. to use AI for climate protection.[42] An increased focus by UNFCCC's Global Innovation Hub or the Green Climate Fund on digital entrepreneurship can also support research and commercialisation which has been highlighted as core requirements by different donors – together with the need to encourage experimentation and learning.[43]

02

POOL COMPETENCES – DIGITAL FOR CLIMATE AS ENGINE FOR PARTNERSHIPS

It will be important to support the pooling of competences through collaborative multi-stakeholder cooperation as this is one of the most urgent needs to promote twin transition. The development of robust and scalable AI solutions for climate action, still in its infancy, can serve as an example. The potential for sustainable development needs to be considered from the outset of respective innovation processes. Relevant experiences, data, AI models and analytical methods should be shared openly as a Digital Public Good. To accelerate this, a global exchange on AI innovations for more climate protection needs to emerge in the medium term.[44]

03

BUILD INSTITUTIONAL CAPACITIES – JOIN FORCES WITH KEY INSTITUTIONS OF INTERNATIONAL CLIMATE POLICY

Strengthening institutions in partner countries to help them address the challenges of the twin transition will be a key task for any initiative. Part of the reason is that many partner countries have weaker governance structures and will not be able to address some of the negative trends of digital transformation.[45] Institutionalising the twin transition can help promote rules-based multilateralism and values-based international cooperation. This includes a proactive research and innovation agenda with like-minded partners which will be important to accelerate the development of twinning technologies and to address concerns related to digitalisation.[46] Arrangements for international cooperation need to include the institutions of international climate governance as they can help to direct the fostering of innovation and technological development in line with the perspectives of the Paris Agreement. This can also help to build trust with partner countries, e.g. to ensure a level playing field to implement digitalisation technologies. A crucial need in this regard will be the generation, collection and use of data, especially in the area of vulnerability assessments and selection of appropriate adaptation measures. In this area, trade-offs might arise between the public interest in acquiring precise data on the one hand and data protection on the other. An example for an already existing initiative is the Humanitarian Data And Trust Initiative (HDTI) which is a multi-stakeholder initiative launched in 2020 by the ICRC, the OCHA Centre for Humanitarian Data, and Switzerland to advance the protection and responsible use of humanitarian data.[47]

04

FACILITATE ACCESS TO FINANCE – MAKE DIGITAL DEVELOPMENT A KEY FEATURE OF INTERNATIONAL CLIMATE FINANCE

To support the twin transition, additional investments need to be steered into innovative projects, technologies and infrastructures. The additional private and public investment needs for the twin transition might amount to nearly EUR 650 billion per year up to 2030.[48] Investments are needed in areas such as support for the transition to the circular economy, for the development of urban mines and creation of a market for secondary raw materials – key will be to introduce arrangements to collect, recycle and increase efficiency, in addition to ensuring longer lasting products and higher levels of recycling quality as one example.[49] To further transition in developing countries, start-ups and innovative enterprises, research cooperation, innovation hubs and further multi-stakeholder

projects will need flexible and fast access to investments directed to climate positive impacts. In addition, multilateral and national Development Banks such as the World Bank Group, the EIB or the German KfW Development Bank will be important partners to support the related investment efforts. Support for R&I across critical technologies and sectors can be secured by leveraging additional private and public long-term resources for low carbon and resilient infrastructures. To ensure synergies between the twin transition processes an enabling framework is required. To this end, funds or funding mechanisms are needed that should work closely with partners and the institutions (such as the GCF) to provide international climate finance in a way that respective programmes and projects explicitly reflect on the potential of digital solutions.

Currently, 25 plans adopted under the EU Recovery and Resilience Facility[50] dedicate 40% of their objectives to green and 26% to digital ones, though with a somewhat limited focus on the potential use of digital solutions to achieve the climate goals, whereas at least 30% of the EU Budget will be spent on fighting climate change – the highest share ever, from the largest EU budget ever. Pooling of EU, (inter-) national and private resources can be encouraged through multi-country projects. In addition, green public and private procurement should be expanded to sustainable digital technologies – adding elements such as green bonds to more traditional means such as taxes and levies. Also linking guarantees to funding of scale-ups or providing long-term capital for post-pilot companies are considered as further levers of finance and innovation for twin transition.[51]

05

CREATE A CONDUCIVE ENVIRONMENT – REGULATORY AND BEYOND

For future multi-stakeholder initiatives, it will be the key to push for a better regulatory framework, with incentives for innovation. This will help to empower entrepreneurs, to create enabling markets, to strengthen industrial ecosystems and to ensure the diversity of market players. As outlined above, digital solutions such as digital twins in different sectors or AI for forecasting and modelling impact assessments will help implement the Paris Agreement through low emission and climate resilient transformations. As part of a responsible digitalisation, the solutions will not only be technological but also political: digital tools can only deliver results in a climate-friendly way if they are designed accordingly keeping the climate impact in mind. In this way, it will inherently do a better job of serving a twin-transition purpose.[52] Therefore, policy measures will be required to reap the climate and environmental benefits of digitalisation, while avoiding or limiting its drawbacks. Here, international and national policy making needs to reflect the rapid digitalisation processes as part of key climate policies such as NDCs, National Adaptation Planning, Long-term climate strategies or the various entry points for climate finance. In addition, digitalisation as well as sectoral strategies need to be aligned with the commitments of the specific countries under the Paris Agreement. To this end, further efforts are needed to support data and evidence standards development, to create a common terminology, to provide guidance and toolboxes and to encourage diffusion and distribution of useful tools.[53] Lastly, digital technologies should be regulated for and implemented when they genuinely address the challenges at hand and are not implemented merely for implementation's sake.

40 DDP • Knowledge (digitaldevelopmentpartnership.org)
41 Innovation for inclusive Green and Digital Transition (eib.org)
42 Devfin Advisors 2022. Climate Tech Mapping Study. Study in behalf of SIDA.
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