CODES

COALITION FOR DIGITAL ENVIRONMENTAL SUSTAINABILITY

Accelerating Sustainability Through Digital Transformation

Use Cases and Innovations

Supplement Number 1 to the CODES Action Plan for a Sustainable Planet in the Digital Age

UN environment programme

Umwelt Bundesamt

Republic of Kenya
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futurearth
Research. Innovation. Sustainability

UNDP

Sustainability in the Digital Age

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The global voice for science

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COALITION FOR DIGITAL ENVIRONMENTAL SUSTAINABILITY

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Introduction

This Supplement Number 1 to the CODES Action Plan for a Sustainable Planet in the Digital Age reflects the outcomes of a collective intelligence process across the CODES community to identify use cases and innovations that showcase the 3 Systemic Shifts and associated priorities. These use cases and innovations are meant to be indicative in nature to offer examples that help ground the CODES Action Plan in practical actions. The following criteria were used:

- Use case or innovation offers a relevant example of actions on one of the 3 shifts identified in the Action Plan
- Existence of a website where the use case could be validated
- Use case identified by a member of the CODES community of practice or the CODES co-champions
- Geographic diversity and balance in the final selection of the use cases

This list of use cases will become a living document to be further developed over time. They will be published on **www.sparkblue.org/CODES**.

Further information on this map can be obtained from **CODES@un.org**

Examples of Sectoral Transformations from Digital Sustainability Applications

BOX 1

Digital power concentrations

Increasing reliance on digital technologies for our purchasing, education and social interactions has led to an increasing shift of economic power to digital companies. According to one estimate by Forbes, less than 20 companies own or control 80 per cent of our essential global digital infrastructure in terms of cloud storage and compute.[1]

In terms of capacity to engage in and benefit from the data-driven digital economy, two countries stand out: the United States and China.

Together, they account for half the world's hyperscale data centres, the highest rates of 5G adoption in the world, 94 per cent of all funding of AI start-ups in the past five years, 70 per cent of the world's top AI researchers, and almost 90 per cent of the market capitalization of the world's largest digital platforms.[2]

The largest such platforms – Apple, Microsoft, Amazon, Alphabet (Google), Meta (Facebook), Tencent and Alibaba – are increasingly investing in all parts of the global data value chain: data collection through the user-facing platform services; data transmissions through submarine cables and satellites; data storage (data centres); and data analysis, processing and use, for instance through AI. These companies have a competitive data advantage resulting from their platform component, but they are no longer just digital platforms. They have become global digital corporations with planetary reach; huge financial, market and technology power; and control over large swathes of data about their users.[3]

The combined value of the seven largest digital "super platforms" is estimated in January 2022 at nearly $10 trillion. This comprises Apple (2.64 trillion), Microsoft (2.23 trillion), Google (1.73 trillion), Amazon (1.47 trillion), Facebook (858.76 billion), Tencent (572.85 billion) and Alibaba (328.52 billion). The US and China host 90 per cent of the market capitalization value of the world's largest digital platforms.[4,5] This means seven companies represent approximately 8 per cent of the $120.4 trillion global equity market capitalization.[6] Digital power concentrations of that extent can pose huge challenges for a whole-of-society approach, e.g. regarding growing private-public capacity divide or growing inequalities within and between societies.

BOX 2

Digital disruption can help tackle the triple planetary crisis

Preliminary estimates suggest that digital technologies can make significant contributions to tackling the triple planetary crisis by 2030 aiming to stabilize the Earth system to stay within the planetary boundaries.[7] While assessment methods are still in their infancy, some early estimates on the positive impact have been calculated:

Decarbonization for Climate Action: For example, in 2015 the Global e-Sustainability Initiative and Accenture Strategy estimated that digital information and communication technologies (ICT) can enable a 20 per cent reduction of global CO_2 emissions when applied to five sectors: mobility, manufacturing, agriculture, energy, and buildings. ICT solutions can help cut nearly 10 times more CO_2e than they emit.[8] A similar assessment was conducted by GSMA, looking at the impact of mobile communications technologies on carbon emission reductions.[9] This study concluded that mobile technologies had a 10:1 enablement ratio compared to the footprint of the industry.

Dematerialization to Protect Nature: The "Rethinking humanity" series estimated that digital technologies and improved design can help reduce natural resources and other materials used in products by 90 per cent - through efficiency, tracking and tracing as well as by turning products into services in a circular economy. This can help reduce the impact of material extraction on nature and the environment.[10]

Detoxification to Prevent Pollution: The "Rethinking humanity" series also estimated that digital technologies can help reduce waste & detoxify supply chains by a factor of 10-100 times through improved design, resource substitution and circularity.[11]

However, these studies and estimates do not fully account for rebound effects. Changes in production and consumption behaviour caused by digital transformation might limit digital technologies' mitigation effect and entail additional negative environmental effects ("digital rebound effect"). Such counterproductive effects need to be taken into account when designing policy interventions.

Reducing our use of natural resources can minimize our impact on the environment
Photo: UNEP

BOX 3

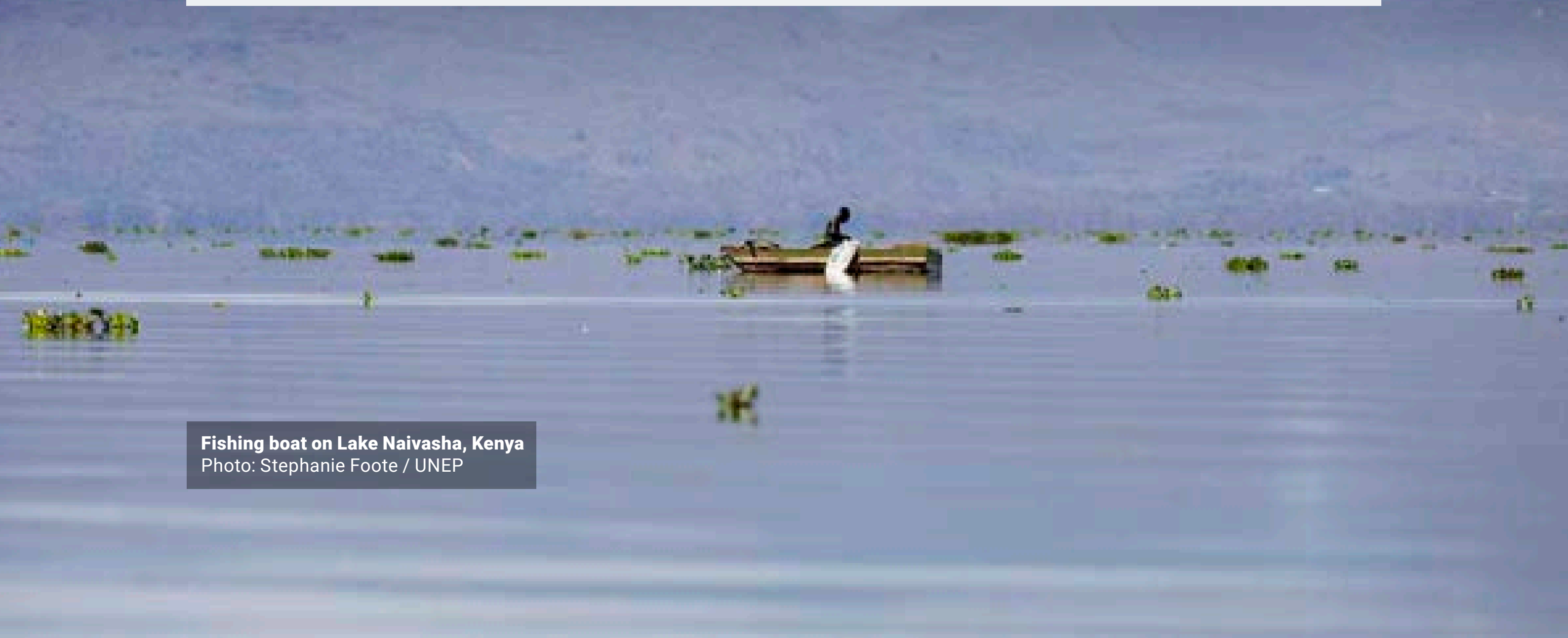
Digital transformation in the water sector

Despite the fact that about 71 per cent of the earth's surface is covered with water, less than 3 per cent is freshwater and only about 1 per cent is readily accessible for human use.[12,13] Population growth, geopolitics, economic development, industrialization and climate change are some of the factors that have intensified the pressure on the already scarce resource. Global water demand is projected to rise by 55 per cent from 2000 to 2050[14] and therefore there is a need to promote and advance the use of digital technology in the water sector not only to meet future human water demand but also for the attainment of SDG 14.[15] The following are major applications where digital technologies are currently transforming the water sector:

Water Management: Remote sensing services and technologies can facilitate mapping, assessing and monitoring of water resources both fresh, marine and coastal resources. These technologies can also be used to monitor and track illegal, unregulated and unreported wildlife and marine product exploitation; controlling water hyacinth; flood and drought management; surface and ground water monitoring and sustainable wetlands management just to mention but a few of the space-based technology capabilities.[16]

Payment for Ecosystem Services: A new type of financial technology (FinTech) – 'mobile money' – could offer a novel and available solution to Payments for Ecosystem Services (PES) frameworks linked to water management and the protection of watersheds. Mobile payments have been used successfully in development projects related to micro-credit, micro-insurance, and humanitarian relief. In certain circumstances, benefit distribution via FinTech may lower transaction costs, enable higher frequency payments, and provide new socioeconomic benefits. It could also improve the privacy, transparency, traceability, and security of disbursements, contributing to more efficient and equitable PES schemes.[17]

Digital Water Diplomacy: Developments made in the use of social media – Twitter, facebook, Instagram, blogs, YouTube – have led to a shift of diplomats,[18] Ministries of Foreign Affairs (MFAs) and embassies to these platforms so as to engage the public,[19,20] advance national interests and policies while at the same time enhance strategic communication for transboundary water cooperation. The use of technology in diplomacy fosters water peace and cooperation in hydro-diplomacy[21] through data sharing, minimising misinformation, and enhancing transparency and trust among riparian states.[22]



Fishing boat on Lake Naivasha, Kenya
Photo: Stephanie Foote / UNEP

BOX 4

Digital transformation of the energy sector

The energy sector today accounts for 40 per cent of carbon emissions worldwide, or 13.6 GtCO_2e, and is expected to rise further as the global population grows and demand increases, including from digitalization.[23] Three key renewable energy technologies are critical for realizing a net zero carbon future and powering the digital economy over this century: wind, solar, & energy storage.[24] A range of digital technologies are being used for managing the transition to renewable and low-carbon energy.[25]

Data to Plan and Coordinate Integrated Energy Planning: Energy plays a critical role in national, regional, and local development. Data to understand the sector and the interconnection with other sectors are critical for understanding gaps and solutions. In understanding the gaps, AI/ML can play a critical role in supplementing traditional data systems. For example, given the cost of mapping electricity access through a census, AI/ML can help guide where to focus data collection effort and also effectively map access and frequency at a lower cost. Data and analytics also play a critical role in making a case for investments (given competing needs and tradeoffs) and understanding the optimal mix of options for sustainable energy access in a community. This is important for moving from macroeconomic energy planning to localized microplanning and policies.

Coordination, Balancing and Monitoring: coordinating localized energy grids involving various distributed and variable renewable power generation sources. This is combined with smart monitoring of supply and demand as well as artificial intelligence to optimize loads for grids to work properly.[26] Moreover, by allowing energy prices to respond to market signals in real-time, smart monitoring has the potential to optimize electricity consumption by not just key sectors but also households and governments.[27,28] Together with other technologies such as high-speed connectivity and IoT, blockchain technologies have been proposed to help address this challenge by managing, in a decentralized way, the distributed energy value chain, from the generation of electricity, to distribution, to final consumption. It can serve as an enabling technology for scaling energy systems powered by distributed energy resources that lack a central grid operator, enabling participation in collective, local energy structures.[29]

Energy Access: Digital technologies enable exciting new ways of connecting to the electrical grid in rural areas. At present one billion people still lack access to electricity, 85 per cent of whom reside in rural areas.[30] In areas distant from the main grid, innovative new technology and processes have increased the potential for previously unfeasible off-grid electrification projects and investments. These include crowd-financing and blockchain-enabled carbon credit mechanisms, mobile phone-enabled payment options, fintech solutions like end-user credit assessments, and new business models like pay-as-you-go.[31] These have opened up new options to rural and indigenous communities for reaching universal energy access.

Modeling and Prediction: Digital twins – virtual representations of physical assets – will also be an important digital tool to optimize the use of renewable energy and increase predictive accuracy. They have already helped increase the yield of some wind farms by up to 20 per cent.[32]

BOX 5

Digital transformation of the agricultural and food commodities sector

Agriculture currently accounts for around 20-30 per cent of global carbon emissions[33] and 70 per cent of all freshwater withdrawals. By 2030, around 8.3 billion people will require water, food and shelter, placing increasing strains on a finite amount of land, freshwater reserves, and other natural resources.[34] As agriculture becomes more knowledge-intensive, access to accurate and timely data relevant to specific conditions and locations is becoming increasingly critical to improve agriculture efficiency. A range of digital technologies are contributing to the transformation of the agricultural sector.

Vertical and Indoor Farming: Vertical farming involves producing food in vertically stacked layers commonly integrated into other structures like a skyscraper, shipping container or repurposed warehouse, while indoor farming allows year-round growing and increased protection against inclement weather, and climate disasters. This approach uses Controlled Environment Agriculture (CEA) technology to optimize the control of temperature, light, humidity, gas exchange, and nutrition. Vertical farming supports increased crop production from the same square footage of growing area with fewer inputs and can be conducted all year round. For example, vertical farming uses 70 per cent to 97 per cent less water than required for normal cultivation due to high levels of retention and recycling.[35]

Precision Agriculture: This involves the use of real-time data, analysis and automated application technologies to optimize the use of inputs such as fertilizer, pesticides and water enabling farmers to produce more and waste less.[36] It is referred to as “precision” because it is possible to perform the right intervention, in the right place, at the right time, responding to the specific demands of individual crops and individual areas of land with superior levels of precision. Digitalization of food production could potentially increase agricultural crop yields by 30 per cent, or close to 900 kg per hectare per year – also helping to save 250 trillion liters of water and significantly reduce pesticide use.[37] Using remote sensing such as drones and satellite technology to harness data to guide agricultural decision-making offers benefits for both large scale commercial agriculture as well as smallholder farms.[38]

Tracking, Tracing and Transparency: About 30 per cent of all food is wasted each year,[39] costing the world around $750 billion a year and reducing the global food supply.[40] Digital technologies including near-field sensing on farms and remote sensing by drones and satellites enable the recording of environmental information. Mobile phones and drones, allow for the tracking and monitoring of agricultural activities, while RFID (Radio Frequency Identification) tags enable the tracking of food products in supply chains.[41] Developments in monitoring technologies along with innovations in data analysis such as artificial intelligence (AI) and machine learning, and new technologies such as blockchain are being used to ensure the fidelity of collected and shared information. Collectively, these technologies could help avoid 20 per cent of food waste across the supply chain by making food chains more transparent and providing real-time information on individual products and waste streams.[42] They can also help better detect illegal activities such as child labour, slavery and inequitable compensation to workers.

BOX 6

Digital transformation of the buildings sector

The construction and operation of buildings remains highly resource and energy intensive, with buildings accounting for around 40 per cent of global energy consumption.[43] A range of digital technologies are transforming the buildings sector.

Smart Buildings: One of the most important applications of digital technologies is often described as “smart buildings” or “intelligent buildings”. This concept refers to any structures that use data collection, integrated processes, smart engineering or creative design to self-regulate and optimize the building’s environment and operations. Every sensor, automation and monitor used in smart buildings is integrated into a main building management system which can capture changes within the building and enable the building to self-learn and automatically modify or customize its settings. The global emissions abatement potential from Smart Buildings is approximately 2.0Gt CO_2e or around 3.4 per cent of GHG emissions by 2030. Smart buildings could also save up to 5 billion MWh of energy and 300 billion liters of water.[44]

Digital Building Passports: adopt a range of technologies in order to encourage the production, collection, and maintenance of digitized records for each building. Rather than a single dataset, the digital building passport links multiple different datasets about the building throughout its lifecycle - offering full transparency and accountability. They would also allow city planners to link performance data to planning data, so that they can validate assumptions and better monitor the performance of planning policies.

3D Printing of Buildings and Components: While 3D printing of buildings and their components has not yet reached commercial scale, the technology has achieved a number of important milestones. Dubai recently announced the completion of the world’s first 3D-printed office building. It is a full-scale, commercial office building that is fully operational. The printer used to create the structure was 20-feet-high, 120-feet-long and 40-feet-wide. It took 17 days to build and assemble — a near record timing for a structure of its size.[45] If 3D printing technologies can be made commercially viable, they could disrupt nearly every facet of the building sector, including commercial and residential.

Eco-sustainable 3D printed house inspired by wasp nests in Ravenna, Italy
Photo: WASP / Cover-Images.com via Reuters Connec

Smart crossing lights the way for pedestrians in Suzhou, China
Photo: Oriental Image / Reuters

BOX 7

Digital transformation of cities

While cities occupy just 3 per cent of the Earth's land, they account for 60-80 per cent of global energy consumption and 75 per cent of global carbon emissions.[46] Rapid urbanization also imposes challenges to waste management, land use, water and consumption patterns. A range of digital technologies are contributing to improved city management.

Smart Urban Management: Combining IoT, sensors and AI enables "smart" urban management. This involves- including smart traffic lights and street lights, smart waste disposal, smart utilities and smart buildings – all of which optimize energy usage and reduce the environmental impact of cities.

Collaborative urban governance: Cities are a mix of formal and informal economies, dwellings, waste streams and intellectual activities. Urban planning and governance could be improved with the use of augmented reality, mobile-based citizen science or inclusion of the informal economy and tracking of waste and pollution.

Smart Sustainable Cities: Sitting one layer above this is the concept of a Smart Sustainable City, a digitally-enabled amalgamation of all or some of the above digital services, where all relevant data is collected and controlled from a "digital command centre".[47] According to the ITU, "A smart sustainable city is an innovative city that uses information and communication technologies (ICTs) and other means to improve quality of life, efficiency of urban operation and services, and competitiveness, while ensuring that it meets the needs of present and future generations with respect to economic, social, environmental as well as cultural aspects".[48]

Urban Digital Twins: Urban digital twins are a virtual representation of a city's physical assets, using data, analytics and machine learning to develop simulation models that can be updated and changed (real-time) as their physical equivalents change. This allows the users of the digital twin to manipulate it and see how those changes would be expected to play out in the real world.[49] City digital twins can improve planning activities such as public engagement, scenario planning, and zoning and development. They have the potential to assist planners in reaching local climate resilience, economic development, and housing goals.

In 2019, Shenzhen's first smart road, opens to public in Shenzhen city, China
Photo: Oriental Image / Reuters

BOX 8

Digital transformation of the transport sector

Across the globe today, there are one billion vehicles on the road. As a result of globalization and of a rapidly rising middle class this number is expected to double by 2035.[50] The transportation sector accounts for nearly 15 percent of current emissions worldwide.[51] There are three major applications where digital technologies are currently transforming the transport sector:

Traffic Control and Transport Demand Management: Digital solutions can significantly support the controlling and optimization of traffic. Connectivity between cars, roads, lights and control systems allows for the gathering of real-time information on traffic conditions. Traffic control and optimization platforms can use this data to generate insights for drivers, such as the optimal driving speed to avoid congestion and the best route to avoid a traffic jam. They can contribute to safety and convenience through, for example, collision alarms and lane-keeping-systems.

Mobility as a Service (MaaS) and Mode Integration: Connecting people and vehicles that have similar origins or destinations. While not all smart or shared mobility options are sustainable, smartphone enabled bike- and car-sharing, demand-responsive public transport systems or pooling platforms can help create modern mobility systems that maximize convenience while reducing the footprint of individual transport.[52]

Smart Logistics and Fleet Management: Connecting vehicles, products and load units, thereby improving route and load optimization and reducing the amount of waste in the system.

A combination of real-time traffic information, smart logistics and fleet management, and other ICT enabled solutions could abate 3.6Gt CO2e, or around 6 percent of GHG emissions by 2030.[53]

BOX 9

European Green Digital Coalitions and Political Declarations

The European Union’s (EU) Green Deal is the EU’s main new growth strategy to transition the EU economy to a sustainable economic model. It is the first regional strategy that is aiming to unify the twin transformations of digitalization and sustainability.

Presented in December 2019, the overarching objective of the EU Green Deal is for the EU to become the first climate neutral continent by 2050, resulting in a cleaner environment, more affordable energy, smarter transport, new jobs and an overall better quality of life. There are a number of funding mechanisms in place to facilitate the EU Green Deal, totalling over €1 trillion. This investment will fund the delivery of the policy reform needed for the EU’s economic growth and climate neutrality. Two political declarations have recently been adopted to further the goals of the EU Green Deal.

European Green Digital Coalition: In March 2021, 26 CEOs of companies have joined a Green Digital Coalition committing on behalf of their companies to significantly reduce their carbon footprint by 2030, and to become climate neutral by 2040. Solutions include investing in the development of more energy and material efficient digital technologies, working with relevant NGOs and expert organizations to measure and monitor the net environmental impact of green digital solutions and many more. Finally, they commit to co-create deployment guidelines of green digital solutions together with other industry leaders, in order to accelerate the transition to sustainability of sectors such as energy, transport, building and agriculture.

Declaration on ‘A Green and Digital Transformation of the EU’: Twenty-seven EU countries plus 2 additional member states signed an EU declaration committing them to leading the green digital transformation. Member States will work together to speed up the deployment and development of advanced digital technologies, such as 5G and 6G, fibre optics, high-performance computing and Internet of Things, as key solutions to achieve climate neutrality and drive the green and digital transitions in priority sectors, such as energy, transport, manufacturing, agri-food and construction. Other areas of action include the promotion of green cloud, Artificial Intelligence (AI) and blockchain technologies, as well as sustainable hardware, green public procurement, support for green tech start-ups and SMEs.

Workers laying fiber optic cables in Schulenburg, Germany
Photo: Moritz Frankenberg / Reuters

Technosreda Festival of Science and Technology in Moscow
Photo: Artyom Geodakyan / TASS via Reuters Connect

BOX 10

Digitalization for Sustainability – Science in Dialogue (D4S)

The European research network “Digitalization for Sustainability – Science in Dialogue” (D4S) is dedicated to develop a progressive vision for a digitalization that fosters environmental and social sustainability using systems thinking.

The project aims at enhancing the science-policy discourse by: delivering a comprehensive analysis of opportunities, risks and governance options regarding digitalization and sustainability. It will also develop guidelines, design principles, policies and new institutions to shape digitalization towards deep sustainability transformations outlining an inter- and trans-disciplinary research agenda.

At the very core of the research network stands a group of 15 renowned experts, consisting of European researchers as well as practitioners representing a variety of institutions and schools of thought. The Expert Panel consisting of researchers from European academia, think tanks, and civil society organizations includes different scientific disciplines and reflects diverse thematic and national backgrounds.

The dialogue aims at integrating various topics regarding digitalization/ICT (e.g., data governance, platform economics, surveillance/privacy, AI) with topics regarding sustainability transformations (inter- and intra-national justice, sectoral transitions in energy, mobility and agriculture, sustainable production & consumption) in order to synthesize these into an integrated, comprehensive analysis of prospects, risks, governance options and policy solutions for a sustainable digitalization.

BOX 11

Sustainable digitalization standards by the ITU

ITU-T Study Group 5 (Environment, climate change and circular economy) has been an important center of gravity to developing ICT standards linked to digital sustainability, climate action and a circular economy. The Study Group developed the standard recommendation ITU-T L.1470, which provides operators of mobile networks, fixed networks and data centres with guidance to set science-based targets (SBTs), approved by the science-based target initiative (SBTi), to reduce GHG emissions at a rate that is in line with climate targets set in the 1.5°C scenario of the Paris Agreement. In addition, the subsequent standard ITU-T L.1471 provides guidelines for setting and reporting net zero targets. Recommendation ITU-T L.1050 provides a guide to different network architectures, while ITU L.1410 provides guidance for assessing the environmental impacts of goods, networks and services while L.1420 focus on organizational footprints. In addition, ITU-T L.1023 provides an assessment method for circular scoring, which allows ICT designers to determine the multiple facets of circularity such as durability, reparability, ability to refurbish, recycle material or critical raw material content by using a single scoring method. Together, these ITU standards are providing authoritative guidance to put the ICT sector on a decarbonization pathway towards net zero emissions based on circular economy principles, ensuring environmental sustainability in digital transformation.

New standards are also targeting methodologies for estimating GHG emissions of induced effects and virtual meetings, for estimating biodiversity related impacts, and for best practices to achieve net-zero using ICTs, energy efficiency, smart energy solutions, digital agriculture, among other related topics.

Looking ahead, ITU will continue to support the ICT sector's circular economy transition. For example, the ITU-T Study Group 5 is developing a new standard that will define the requirements of a global digital sustainable product passport for a circular economy. The concept of a digital product passport has recently generated significant attention, particularly at the European level. ITU UNEP and other actors will also be organizing a series of global dialogues to promote a sustainable digital transformation, in addition to supporting key initiatives that focus on connecting digital technologies with environmental sustainability.

Planting mangroves to help restore the ecosystem. Port Royal, Jamaica.
Photo: Kadir van Lohuizen / NOOR

BOX 12

EU Taxonomy for Sustainable Activities

In order to meet the EU's climate and energy targets for 2030 and reach the objectives of the European Green Deal, it is vital that investments are directed towards sustainable projects and activities. To achieve this, a common language and a clear definition of what is 'sustainable' is needed. This is why the EU's Action Plan on Financing Sustainable Growth[54] called for the creation of a common classification system for sustainable economic activities, or an "EU taxonomy".

The EU taxonomy is a classification system, establishing a list of environmentally sustainable economic activities. It could play an important role helping the EU scale up sustainable investment and implement the European Green Deal, including various digital transformation objectives. The EU taxonomy is built to provide companies, investors and policymakers with appropriate definitions for which economic activities can be considered environmentally sustainable. In this way, it aims to create security for investors, protect private investors from greenwashing, help companies to become more climate-friendly, mitigate market fragmentation and help shift investments where they are most needed.

The EU Taxonomy Regulation from 2020 establishes six environmental objectives:

1. Climate change mitigation
2. Climate change adaptation
3. The sustainable use and protection of water and marine resources
4. The transition to a circular economy
5. Pollution prevention and control
6. The protection and restoration of biodiversity and ecosystems

Different means can be required for an activity to make a substantial contribution to each objective. Under the Taxonomy Regulation, the Commission had to come up with the actual list of environmentally sustainable activities by defining technical screening criteria for each environmental objective through delegated acts.

The Taxonomy will play an important role in standardizing a common classification system that can then be deployed by different digital platforms and algorithms.

BOX 13

The Roadmap to Sustainable Digital Infrastructure by 2030

The Sustainable Digital Infrastructure Alliance is a network of stakeholders committed to sustainability working across the entire digital infrastructure value chain. The goal is to participate in key activities toward sustainable digital infrastructure and set the direction for the development of the sector. This is embodied in the Roadmap to Sustainable Digital Infrastructure by 2030 that has been adopted by the alliance. The roadmap includes a number of key targets on emissions, energy consumption, e-waste, resource consumption, pollution, and the cost of digital power.

BOX 14

The risks of digital nudging powered by AI

Nudge Theory, as popularized by the Nobel Memorial Prize laureates Richard Thaler and Cass Sunstein, is a concept involving indirect suggestions and positive reinforcement as means to influence decision-making behaviours. Today, this theory finds application in digital spheres where, through algorithmic nudging, organizations can collect, parse, and crunch their stakeholders' data on a large scale, and use this data to train their algorithms and target users through personalized nudges, such as push-notifications and rewards. With advances in AI and machine learning, such algorithms can be adjusted in real-time based on user feedback and have proven to be very effective in triggering behavioural change.

A survey by Deloitte of 500 companies found that among all of the retailers that have adopted AI to personalize the consumer experience, 40 per cent of them used AI with the specific purpose of tailoring pricing and promotions in real time based on digital intelligence of user preferences and predictive analytics.[55]

This incredible opportunity for micro-targeting can potentially be harnessed to foster sustainable consumption and more climate-friendly lifestyles and behaviours. Conversely, this unprecedented access to user data also carries the risk of manipulating consumers to options that may not be the most beneficial, or interfere with human privacy and individual agency.

Therefore, it is essential that such algorithmic nudges be designed ethically taking into account regulatory provisions such as the EU's General Data Protection Regulation (GDPR) and various AI regulations, such as the EU AI Act. Creators need to ensure they create a win-win situation and empower users to decide how they want to engage with sustainability nudges. Furthermore, creators should share information about data collection and storage and explain the algorithms' logic and optimization goals.

BOX 15

Verified sources of climate information on social media

Some social media companies and digital platforms are exploring how to address misinformation linked to climate change.

Facebook has launched the Climate Science Center[56] to help users find validated information on climate change from authoritative sources including UNEP, WMO and IPCC. This service is available to all Facebook users to help mitigate the spread of misinformation about climate science.

Google is also teaming up with the UN[57] to offer verified climate information. When users search for "climate change," they will be able to find authoritative information from the United Nations. In addition to organic search results, Google will surface short and easy-to-understand text blurbs and visuals on the causes and effects of climate change as well as individual actions that people can take to help tackle the climate crisis.

Google and YouTube also announced a new policy that prohibits climate deniers from being able to monetize their content on its platforms via ads or creator payments.[58]

Twitter rolled out a new program designed to "pre-bunk" climate misinformation, or get ahead of false narratives about climate by exposing people to more accurate information about the crisis on its platform.[59] Twitter users will be directed to online hubs containing credible, authoritative information. These guides will appear in users' "Explore" tabs, their Twitter search portals, and relevant trends lists.

Despite these efforts, misinformation in general and on climate change in particular, remains a pervasive problem on social media. A recent study by the Center for Countering Digital Hate (CCDH) found that of 7,000 misleading Facebook posts describing climate change as "hysteria", "alarmism", a "scam", or other related terms, only 8 per cent were marked as misinformation.[60] Highly shared articles made false assertions that climate change was not confirmed by science or claimed to debunk it with data. Of these, 69 per cent could be traced back to just 10 "super-polluter" publishers - dubbed the "toxic ten" - the campaign group found.

BOX 16

Destination Earth - a Digital Twin of the Planet

Destination Earth aims to develop a high precision digital model of the Earth to model, monitor and simulate natural phenomena and related human activities. As part of the European Commission's Green Deal and the Digital Strategy, Destination Earth (DestinE) will contribute to achieving the objectives of the twin transition, green and digital.

DestinE will unlock the potential of digital modeling of the Earth system. It will initially focus on the effects of climate change, water and marine environments, polar areas, cryosphere, biodiversity or extreme weather events, together with possible adaptation and mitigation strategies. It will help to predict major environmental degradation and disasters with unprecedented fidelity and reliability.

By opening up access to public datasets across Europe, DestinE represents also a key component of the European strategy for data. At the heart of DestinE will be a user-friendly and secure digital modeling and simulation platform. This platform will provide access to data, advanced computing infrastructure, software, AI applications and analytics.

BOX 17

Digital With Purpose Movement

The Digital with Purpose Movement (DWP) is establishing a series of metrics and a certification scheme that will help companies communicate how their digital products, services and business practices are contributing positively to SDGs and improving the sustainability of society as a whole. Member companies represent billions in market capitalization.

The DwP framework has three main components:

- **Purpose:** Principles and associated metrics to inform a company on becoming a purpose-led business, i.e., connecting core business models to address sustainable development goals, maximizing positive contributions, and minimizing negative effects.
- **Digitally Enabled Solutions:** Principles and associated metrics that reflect how a company contributes innovative digital solutions through its products, services, and core business practices in a way that improves the sustainability of society overall.
- **Responsible Business:** Principles and metrics covering how a responsible company operates with respect to climate change, digital trust and responsibility, the circular economy, digital inclusion, and supply chain. This covers the design, delivery and end-of-life management of products and services, as well as interactions with stakeholders, monitoring performance, and setting targets for improvement.

Equivalent weighting is given to the solution generation component and the component associated with more traditional ESG metrics covering responsible business practices.

Members of the Movement are required to make a public commitment to the “Digital With Purpose Movement” – to pledge to adhere to the four universal commitments that make up the ‘Digital with Purpose Framework’.

The four universal commitments are:

1. We commit to supporting the United Nations Sustainable Development Goals and to establish practical and incremental steps to become a purpose-led business;
2. We take and report concrete action on climate change and report on outcomes every year;
3. We embrace the principles of reporting of impact and outcomes and commit to yearly reporting according to such principles;
4. We develop and deploy digital technology with positive societal impact.

Customers pay for having trees planted around the world using Treedom, Italy's new e-commerce platform, Cameroon.
Photo: Riccardo Grando Treedom Press Office/Handout via Reuters

BOX 18

E-commerce platforms are offering green filters and procuring with purpose options

Three of the largest digital platforms in the e-commerce space are aiming to support greener consumption and lifestyles using digital channels. Amazon has adopted the Climate Pledge Friendly initiative to help millions of Amazon users find climate-friendly products that carry at least one of 34 different environmental certifications.

Google is now highlighting green products and services such as flights and transport routes within search results and navigation tools. These could help influence the behaviours of the billions of people who use Google services.

SAP's Ariba platform is the largest digital business-to-business network on the planet. It has also fully embraced the idea of "procuring with purpose" offering a detailed look at corporate supply chains so potential partners can better assess the social, economic and environmental impact of transactions.

BOX 19

The Green Digital Finance Alliance and the Every Action Counts Coalition

The Green Digital Finance Alliance (GDFA), launched by Ant Group and the United Nations Environment Programme (UNEP), seeks to address the potential for digital finance, and fintech to reshape financial incentives in ways that better align it with the needs of green production and consumption aims to enhance financing for sustainable development. Recently, the GDFA launched the Every Action Counts Coalition, a global network of digital, financial, retail investment, e-commerce, and consumer goods and services companies that have a shared interest in using digital platforms to accelerate green finance and consumption.

It identifies and shares best practices in encouraging individuals to take positive actions in daily life to create planet-friendly outcomes through digital channels. The Coalition has collectively set an ambitious target. The EAC Coalition will creatively leverage technology and partnerships to enhance green awareness and action of 1 billion people around the globe by making greener choices and taking action for the planet by 2025.

For example, financial services providers such as GDFA member Mastercard in collaboration with the Swedish fintech financial technology company Doconomy are enabling their users to buy lower carbon products by providing shoppers with a personalized carbon footprint tracker and insights to help inform their spending decisions.

Mobile apps like Ant Forest, by Ant Group, are also using a combination of incentives, digital engagement and social engagement models to help 600 million make more sustainable choices. Users are rewarded for low-carbon choices through green energy points that they can use to planet real trees. So far, the Ant Forest app has resulted in 122 million trees being planted, reducing carbon emissions by over 6 million tons.

Trees waiting to be remplanted ito help reforestation in Malaysia
Photo: Mokhamad Edliadi / CIFOR

Machine learning can help predict the climate and protect nature
Photo: iStockphotos

BOX 20

Public-private research collaboration in the use of artificial intelligence for climate action

In 2019, a major academic collaboration was conducted between a range of academic and private sector experts on potential applications for tackling climate change with machine learning.[61] The collaboration was unprecedented in terms of bringing together some of the biggest names in AI research from 12 universities (University of Pennsylvania, Carnegie Mellon University, ETH Zurich, University of Colorado Boulder, Mila, Universite de Montreal, Ecole Polytechnique de Montreal, Harvard University, Mercator Research Institute on Global Commons and Climate Change, Technische Universität Berlin, Massachusetts Institute of Technology, Cornell University, and Stanford University) together with senior experts from DeepMind, Google AI, Microsoft Research and Element AI.

The collaborative endeavour covers possible machine-learning interventions in 13 domains, from electricity systems to farms and forests to climate prediction. Within each domain, it breaks out the contributions for various sub disciplines within machine learning, including computer vision, natural-language processing, and reinforcement learning.

The resulting study represents a model of best practice in terms of working across disciplines and between public and private sectors. It should be replicated in other domains such as nature protection and pollution prevention.

BOX 21

Modern digital administration – the German AI Application Lab for Sustainability Solutions

Digitization enables us to think about issues in the context of socio-ecological sustainability in a completely new and different way. In order to take advantage of the emerging transformational momentum through digitization, environmental governance needs new structures, processes and competencies to effectively design in multicomplex and interdisciplinary subject areas. But a government administration can only shape what it also understands.

The aim of the German Environmental Agency's AI Application Lab for Sustainability Solutions is to develop and consolidate AI methods as a standard tool in the sustainability transformation toolbox of the German government and to research and demonstrate the sustainable use of the technology.

The Lab will analyze environmental data using AI to better identify complex relationships, tradeoffs and pathways for optimization. It will address pressing issues with an eye toward sustainability research; and ultimately to better derive measures to protect people and the environment.

BOX 22

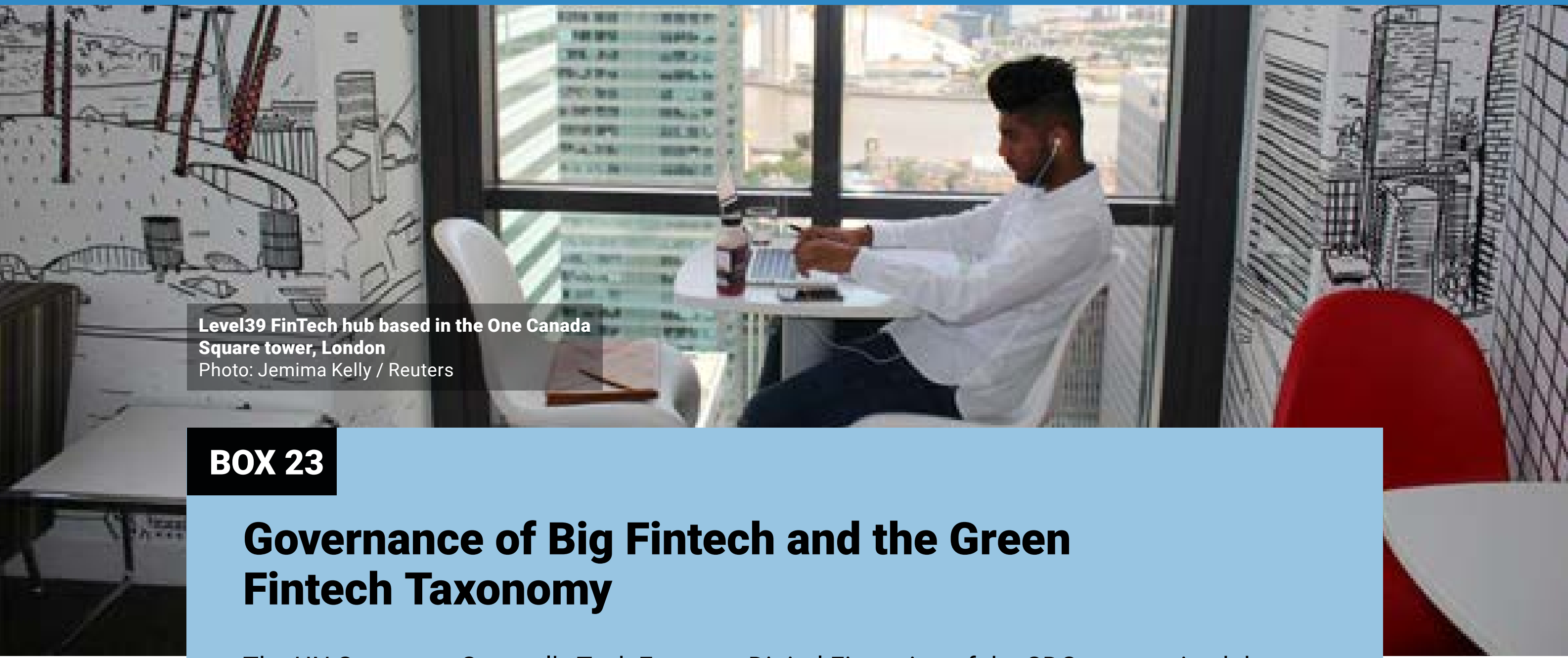
ARIES for SEEA Explorer: The first AI tool for rapid natural capital accounting

Artificial Intelligence for Environment & Sustainability (ARIES), developed by researchers at the Basque Centre for Climate Change (BC3), is an integrated, open-source modeling platform for environmental sustainability, where researchers from across the globe can add their own data and models to web-based repositories.

Thanks to the use of artificial intelligence (AI) – specifically semantics and machine reasoning – ARIES automates data and model integration. A core component of ARIES is the use of a set of consistent, shared semantics, which comprise uniform and unambiguous definitions for the data and models involved, and the relationships between them. These semantics are constructed using an intuitive language readable by both people and computers.

The ARIES technology automates model selection based on a user’s specific request (e.g., an ecosystem service assessment or condition account for a given country and year), matching the requested concepts to the most suitable models and data for the context of interest. The “most appropriate” models and data for the location, time span and spatiotemporal resolution specified are chosen among those provided by contributors to a communally curated, distributed network of participating institutions, and assembled to produce the best-in-class computation that answers the user’s query.

ARIES, UN DESA and UNEP recently produced a joint interoperability strategy document and launched an easy-to-use application to harness data and AI tools for Ecosystem Accounting within the System of Environmental-Economic Accounting (SEEA) framework. This ground-breaking tool enables ecosystem account production anywhere on Earth, making it easier for countries to measure the contributions of nature to their economic prosperity and wellbeing.



Level39 FinTech hub based in the One Canada Square tower, London
Photo: Jemima Kelly / Reuters

BOX 23

Governance of Big Fintech and the Green Fintech Taxonomy

The UN Secretary-General's Task Force on Digital Financing of the SDGs recognized that digitalization is not only reshaping the world of finance; it is also driving the emergence of a new generation of global, dominant digital finance platforms (BigFintechs) with increasing cross-border spillover effects on many areas of sustainable development across the world, particularly in developing economies.

The Dialogue on Global Digital Finance Governance, hosted by UNDP and UNCDF, was established to explore this topic with an aim to catalyse governance innovations that take greater account of the SDG impacts of BigFintechs and are more inclusive of the voices of developing nations. To this end, the Dialogue has produced a series of Technical Papers and principles that bring new, complementary perspectives on the nexus of BigFintechs, sustainable development and governance.

The Green Digital Finance Alliance (GDFA) and the Swiss Green Fintech network has also launched the world's first green fintech taxonomy. Through the report entitled "A Green Fintech Taxonomy and Data Landscaping",[62] the taxonomy seeks to develop and stimulate the green fintech market by enabling a harmonized approach for policy makers, investors, and market actors to assess green fintechs. The report categorizes green fintech through the following lenses:

1. Green digital payment and account solutions
2. Green digital investment solutions
3. Digital ESG-data and -analytics solutions
4. Green digital crowdfunding and syndication platforms
5. Green digital risk analysis and insure-tech
6. Green digital deposit and lending solutions
7. Green digital asset solutions

A key value add of the report is the mapping of the main databases leveraged by each category of green fintech, and providing an overview of the datasets which, if made accessible, can catalyse an increased supply of green fintech innovation.

Innovations in fintech solutions that seek to better align behaviours of the financial system with green objectives, are critical to achieving sustainable outcomes and taxonomies like the GDFA's are an essential catalyst for this wave of innovation.

BOX 24

United for Smart Sustainable Cities (U4SSC) initiative

The "United for Smart Sustainable Cities" (U4SSC) is a UN initiative coordinated by ITU, UNECE and UN-Habitat, and supported by CBD, ECLAC, FAO, UNDP, UNECA, UNESCO, UNEP, UNEP-FI, UNFCCC, UNIDO, UNOP, UNU-EGOV, UN-Women and WMO to achieve Sustainable Development Goal 11: "Make cities and human settlements inclusive, safe, resilient and sustainable".

U4SSC is working on the following topics:

- City Platforms
- Lessons learned from building urban economic resilience at city level during and after COVID-19
- Compendium of Practices on Innovative Financing for Smart Sustainable Cities Projects
- Guiding principles for artificial intelligence in cities
- Procurement Guidelines for Smart Sustainable Cities
- Digital Transformation for People-Oriented Cities:
    - WG1: Setting the Context: Digital Transformation for People-oriented Cities
    - WG2: Policy Benchmarks for Digital Transformation for People-oriented Cities
    - WG3: Digital Transformation Assessment for People-oriented Cities
    - WG4: Guidelines for Unlocking Net Zero in Cities Through Sustainable Digital Transformation
    - WG5: Methodology for Measurement of GHG Emissions in Smart Sustainable Cities

The U4SSC developed a set of international key performance indicators (KPIs) for Smart Sustainable Cities (SSC) to establish the criteria to evaluate ICT´s contributions in making cities smarter and more sustainable, and to provide cities with the means for self-assessments in order to achieve the sustainable development goals (SDGs). Over 150 cities worldwide are already implementing these KPIs.

BOX 25

Examples of Applications Promoting Food Security and Land Management in Rural Communities

Digital Green, operating both in Africa and Asia, aids smallholder farmers in implementing better farming practices using data and mobile apps. In particular, they promote data sharing and collaboration between agricultural stakeholders, including farmers, experts, buyers etc, to increase productivity, reduce harvest losses, better preserve natural resources and maximize profits. Farmstack, their latest application, increases trust and sense of ownership by allowing farmers and other actors to control how their data is being shared.

Amazon Frontlines is using a variety of data sets and digital technologies, such as drones and satellite imagery, to detect illegal activities and defend indigenous rights to land, life and cultural survival in the Amazon rain forest. The data collected equips communities and forest protectors with the necessary information to help protect their lands.

ABALOBI is a South African-based global social enterprise aiming to support sustainable and climate-resilient small-scale fishing communities, through the joint development of technology for good. They have developed a digital logbook for small-scale fisheries in the form of a mobile application, where they can record and report their sustainable fishing practices, as well as enable consumers to track the origin and sustainability of their seafood meals.

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Digitalization is one of the most important drivers of economic, social and environmental transformation. It has given rise to powerful general-purpose technologies such as artificial intelligence and cloud computing that offer revolutionary scale and potential. Digital transformation is globally pervasive, increasing productivity, disrupting pre-existing business models and leading to diverse innovations with profound implications for the human future. This transformation has enormous potential to support progress towards sustainability however in its current form, it continues to enable and/or encourage unsustainable practices that are degrading natural systems, entrenching inequality and undermining human wellbeing.

There is an urgent need to reverse these negative trends and to utilize the potential of digital transformation as a vital tool in developing globally sustainable economic and social behaviours. We need to move the focus away from the pursuit of short-term, unsustainable gains towards the achievement of long-term values-driven sustainable outcomes. Three systemic shifts are needed to harness digital transformation as a positive and exponential force for progressing environmentally and socially sustainable development.

- **Shift 1 Enable Alignment:** Create the enabling conditions to align the vision, values and objectives of the digital age with sustainable development;
- **Shift 2 Mitigate Negative Impacts:** A commitment to "sustainable digitalization" that mitigates the negative environmental and social impacts of digital technologies;
- **Shift 3 Accelerate Innovation:** Advancing investments in "digitalization for sustainability" to accelerate the development and deployment of sustainability-driven digital innovation.

Within each shift, this Action Plan identifies six strategic priorities that must be addressed during the 2022-2025 timeline together with 9 global Impact Initiatives to catalyse systemic transformations. The Coalition for Digital Environmental Sustainability (CODES) will contribute the implementation of this Action Plan in four ways:

- Convene and connect a global community of common purpose to advance these 3 shifts;
- Identify enabling policies and map stakeholders for each strategic priority;
- Suggest Impact Initiatives as actionable items to concurrently progress strategic priorities;
- Foster and demonstrate political leadership in advocating for and realizing the Impact Initiatives.

All stakeholders are invited to engage in the CODES Action Plan in one or more of the following channels:

- **Catalyser:** Stakeholders seeking to engage directly with one or more of the Impact Initiatives that are proposed in the Action Plan.
- **Action Network:** Stakeholders contributing to and leveraging the 3 shifts proposed in the Action Plan to support the progression of digital sustainability.
- **Advocates:** Stakeholders seeking to contribute their expertise to the CODES community and become an advocate for the CODES vision and values.

More information is available on the CODES Community Page on **www.sparkblue.org/CODES**

UN environment programme
Umwelt Bundesamt
REPUBLIC OF KENYA MINISTRY OF ENVIRONMENT AND FORESTRY
future earth Research. Innovation. Sustainability.
UNDP
SDA SUSTAINABILITY IN THE DIGITAL AGE
International Science Council The global voice for science
United Nations Office of the Secretary-General's Envoy on Technology