



The twin transition: a new digital and sustainability framework for the public sector

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and conducted by EY



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Executive summary

Executive summary

Governments across the world are at a pivotal moment for tackling urgent sustainability challenges, such as climate change and biodiversity loss. Public sector actions taken today can mitigate our impact on people and the planet creating a more sustainable path forward to protect lives and livelihoods. Using digital approaches and emerging technology solutions can help accelerate public sector sustainability journeys while simultaneously creating more responsive, intelligent and inclusive governments.

Through consultations with public sector stakeholders and technology experts across 12 countries, Microsoft and EY developed a digital sustainability framework to assess public sector sustainability and digital capabilities. It provides a high-level overview of the dimensions and performance indicators associated with public sector sustainable development.





Sustainability trends in government

The sustainability imperative for the public sector

The public sector is at a critical moment for addressing climate change and achieving environmental sustainability. In the wake of the COVID-19 pandemic, governments across the world are strengthening their commitments for environmental sustainability with a renewed sense of purpose. But with limited time remaining to stabilize the planet's climate and better manage natural resources, governments must accelerate the transition toward a more sustainable and inclusive future.

The impact of the pandemic has underscored the importance of resiliency for governments in face of unexpected shocks and stresses. But it has also proven the transformative role of digital technologies in helping the public sector solve urgent governance challenges and remain resilient during a crisis.

Assessing the public sector sustainability challenge

The scope and urgency of this challenge are immense. According to the World Meteorological Organization, 2020 was the third hottest year on record and saw average global temperatures increase to 1.2°C above preindustrial levels.¹ Rising temperatures and the changing climate are exacerbating the frequency and severity of natural disasters and extreme weather, which displace more than 20 million people from their homes worldwide annually.²

To protect people and the planet, governments have recognized the need to rapidly reduce greenhouse gas emissions in order to keep global warming to 1.5°C above preindustrial levels.³ As of March 2021, 124 national governments have announced net-zero carbon emissions pledges, with hundreds of municipalities, cities and regional governments making similar carbon neutral commitments by 2050.⁴ The

public sector will play a central role for realizing these ambitions by setting concrete targets and clear measures of success, as well as mobilizing resources, investments and capabilities.

Governments must also “walk-the-talk” by improving their own environmental footprints. From greening government buildings through energy-efficiency improvements to electrifying public vehicle fleets, there is growing momentum by governments to track and reduce the climate impacts of their own operations. One of the largest opportunities for the public sector is to include environmental and social criteria when purchasing goods and services. For instance, more than 250,000 public entities in the EU spend around €2 trillion in procurement purchases annually allowing governments to set new standards for the promotion of sustainable consumption and production practices.⁵

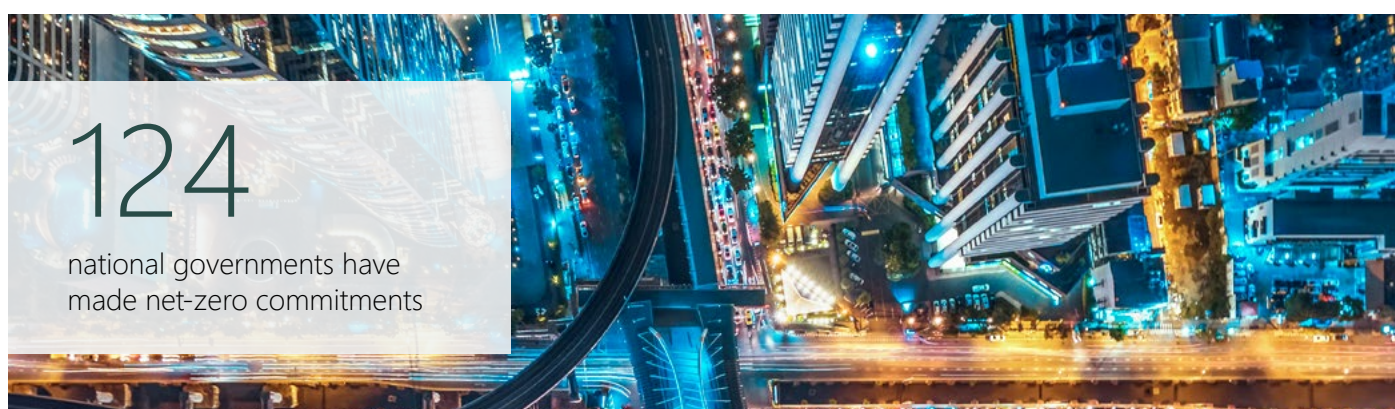
¹ https://library.wmo.int/index.php?lvl=notice_display&id=21880#.YJCySsCSk2y

² https://media.ifrc.org/ifrc/wp-content/uploads/2020/11/20201116_WorldDisasters_Full.pdf

³ <https://www.ipcc.ch/2018/10/08/summary-for-policymakers-of-ipcc-special-report-on-global-warming-of-1-5c-approved-by-governments/>

⁴ <https://eciu.net/analysis/reports/2021/taking-stock-assessment-net-zero-targets>

⁵ https://ec.europa.eu/growth/single-market/public-procurement_en



The twin transition will reinforce sustainability with technology, and enable sustainable digital transformation

Governments can harness the power of digital technologies and data to enable their sustainability journeys. For example, digital simulation tools are helping Australian public authorities better predict bushfires and inform disaster mitigation plans.⁶ Smart sensors in water pipes and meters are aiding cities worldwide better manage water usage by tracking daily consumption patterns and optimizing maintenance schedules.⁷ And advances in cloud analytics and the Internet of Things (IoT) now allow local government staff to visualize severe weather in real-time and predict their impact on demand for public services.⁸

Digital technologies can also help governments take responsibility for managing the environmental and climate impacts of public sector operations. For instance, sustainability impact assessments and dashboards, such as Microsoft's Sustainability Calculator, allow public entities to better understand the carbon footprints associated with cloud services and related technologies.⁹

Despite these advances, public sector digital transformation strategies have been decoupled from sustainability initiatives. While this increases the ability of governments to address discrete environmental problems through better analytics, it prevents many leaders from viewing sustainability and technology transformations as an integrated solution.

How does a digital government become a more sustainable one?

In the public sector, digital transformation can help drive progress on environmental sustainability through:

- Intelligent and proactive sustainable decision-making
- Measurable goals and forward thinking
- Greater transparency in supply chains and procurement decisions
- More channels for citizen engagement and policy co-creation
- Open data sharing between public agencies, academic partners, and private sector to find innovative solutions
- Improved energy efficiencies from existing technologies, better resource consumption and waste management
- Deeper understanding of climate impacts across the entire ecosystem

As governments seek to develop more sustainable and digital policies and operations, they need a greater understanding of the opportunities and risks facing the public sector.

⁶. <https://www.csiro.au/en/news/news-releases/2021/bushfire-prediction-tech-to-bolster-emergency-response-efforts>

⁷. <https://datasmart.ash.harvard.edu/news/article/come-drought-or-high-water-728>

⁸. <https://cloudblogs.microsoft.com/industry-blog/government/2020/08/25/how-cloud-analytics-can-drive-digital-transformation-in-government/>

⁹. https://www.microsoft.com/en-us/sustainability/sustainability-guide/sustainability-calculator?activetab=pivot_1:primaryr2

Governments face multiple challenges in realizing a twin transition

While digital technologies offer tremendous potential for accelerating environmental goals, governments must first overcome several challenges in their sustainability journeys:

1 Meeting rising public expectations to tackle climate change. Government leaders face growing public recognition that climate change and sustainability are urgent priorities. According to a UNDP-Oxford 2020 Survey, 64% of people across 50 countries characterized climate change as an emergency for governments to address.¹⁰ More than half called for more public sector action to conserve forests and land, accelerate renewable energy sources, enhance climate-friendly agriculture techniques, and invest more in green businesses and jobs.

64%

of people across 50 countries characterized climate change as an emergency

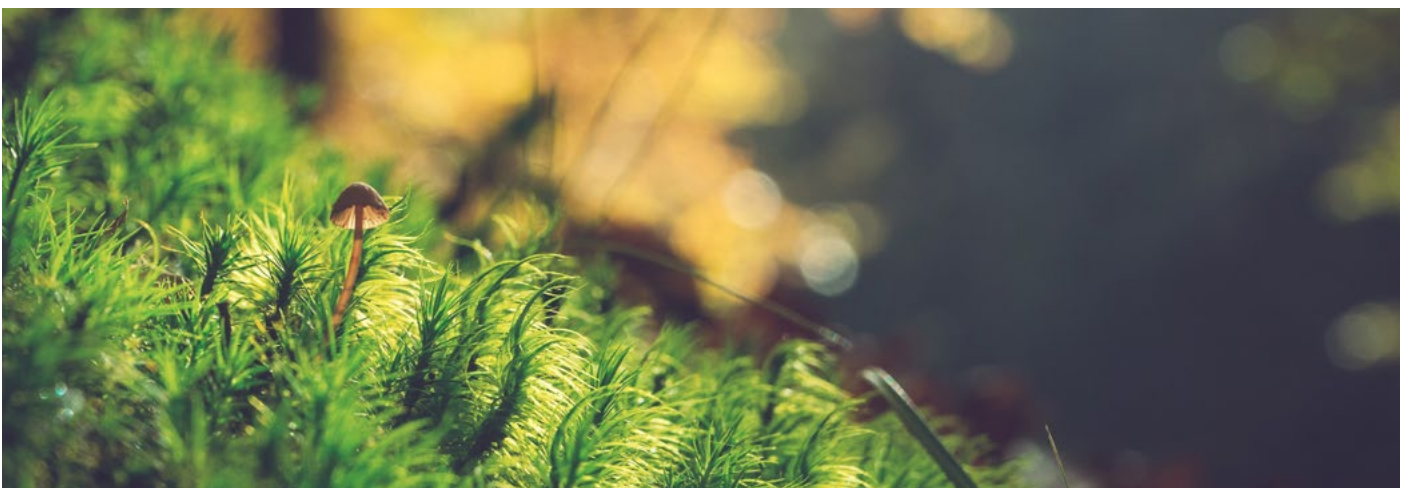
2 Realizing digital aspirations while addressing skills gaps and mistrust. A recent EY study¹¹ found broad appeal among citizens across 12 countries for greater digitalization of public services, but linking sustainability and digital agendas will require public sector leaders doing more to address public concerns over skills gaps and privacy of personal data.

3 Elevating senior leaders as digital and sustainability change agents. According to a recent Microsoft and EY study on the role of artificial intelligence (AI) in the public sector, the most transformative public entities had strong commitment from leadership across all levels of the organization, who were able to identify the right skills and structures needed to scale the use of AI.¹² Given the complexity of a twin transition, leadership is key to breakdown organizational siloes and elevate the role of sustainability with government departments.

¹⁰. <https://www.undp.org/content/undp/en/home/librarypage/climate-and-disaster-resilience-/The-Peoples-Climate-Vote-Results.html>

¹¹. https://www.ey.com/en_gl/government-public-sector/how-can-digital-government-connect-citizens-without-leaving-the-disconnect-ed-behind

¹². https://info.microsoft.com/WE-DTGOV-CNTNT-FY21-09Sep-22-ArtificialIntelligenceinthePublicSector-SRGCM3835_01Registration-ForminBody.html



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Increasing the capacity of public sector entities to share environmental data and expertise.

Establishing common standards and integrated platforms to enable data sharing can help enable governments to understand current challenges and develop potential solutions. As of October 2019, only 23% of environmentally-related targets in the UN Sustainable Development Goals (SDGs) had sufficient data to assess progress according to the United Nations Environment Programme (UNEP).¹³ And more than 30% of climate-related indicators lacked consensus for a consistent methodology and set of data sources for tracking.

23%

of environmentally related
UN SDG targets have enough
data to assess progress

5

Matching green and digital ambitions with appropriate investment.

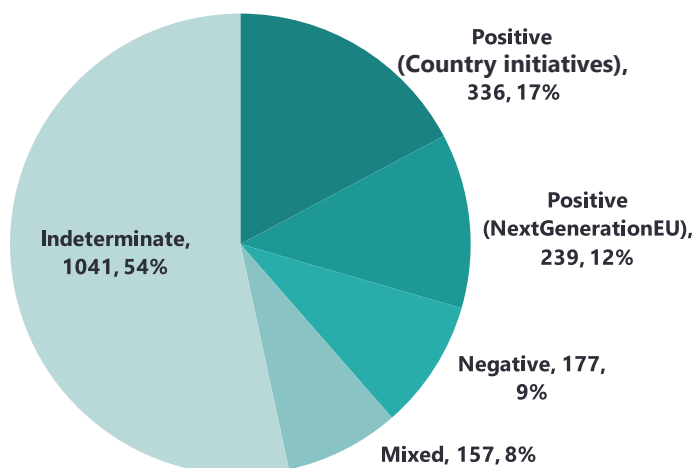
The public sector can only make an environmentally sustainable and digital transition by aligning recovery spending with initiatives that will have positive impact on the environment. If positive action on climate change is cancelled out by investments in carbon-intensive industries and technologies, this can derail the overall twin transition.

¹³. <https://wedocs.unep.org/handle/20.500.11822/27627>



Seizing the opportunity for a green and digital recovery

Funding allocated to recovery measures by environmental impact (US\$ billion)



Note: NextGenerationEU refers to the climate mandate of the European Commission's recovery fund where a minimum of 37% of funds is allocated to support the green transition. The amount is shown separately to other environmentally positive measures because individual plans by member states were still being formulated at the time of data collection.

Source: OECD Green Recovery Database (2021)

As governments formulate long-term planning following the pandemic, we find a growing number of countries dismantling siloed thinking in favor of an integrated green and digital recovery. According to the OECD's Green Recovery Database, 29% of the nearly US\$2 trillion in long-term recovery spending has been allocated to green measures as of February 2021.¹⁴ So far, the amount of spending that will likely have a positive impact on the environment closely matches spending with a negative or mixed effect.

However, taking in account recent announcements of green recovery spending by individual European Union Member States and the United States will likely tip the scale in favour of environmentally sustainable spending.

37%

of the European Union's recovery funding mandated to support the green transition

At the forefront is the European Union's €750 billion recovery plan, NextGenerationEU (NGEU), which mandates that 37% of funds is allocated to support the green transition and 20% of spending be earmarked for digital initiatives. This aims to accelerate progress toward a zero-carbon, zero-waste economy in line with the twin transition of Europe's Green Deal. This includes increased investments in promoting technologies such as artificial intelligence to better manage waste and accelerate a circular economy through programs like ReCirCE and K-Project.¹⁵

Supporting these investments are new agreements to strengthen cooperation such as the "A Green and Digital Transformation in the EU" around digital technological development across the region.¹⁶

As individual EU Member States formulate their own recovery plans, increased funding has been allocated for climate- and digitally-relevant initiatives. Italy, for example, aims to spend more than 40% of more than €222 billion in recovery spending on a "green revolution and ecological transition" and infrastructure investments for sustainable mobility. Digital initiatives will constitute 25% of the plan. Its plan includes funding to digitalize logistics and accelerate a circular economy by recycling 65% of plastic waste and 100% in textiles. These complement investments in dozens of other projects ranging from building charging stations for electric vehicles to smart grid improvements.¹⁷

¹⁴. <https://www.oecd.org/coronavirus/en/themes/green-recovery>

¹⁵. https://ec.europa.eu/environment/ecoap/about-eco-innovation/policies-matters/green-and-digital-twin-transition-also-spurs-inclusive-eco_en

¹⁶. <https://digital-strategy.ec.europa.eu/en/news/eu-countries-commit-leading-green-digital-transformation>

¹⁷. https://www.governo.it/sites/governo.it/files/PNRR_RiformeInvestimentiMissioni.pdf

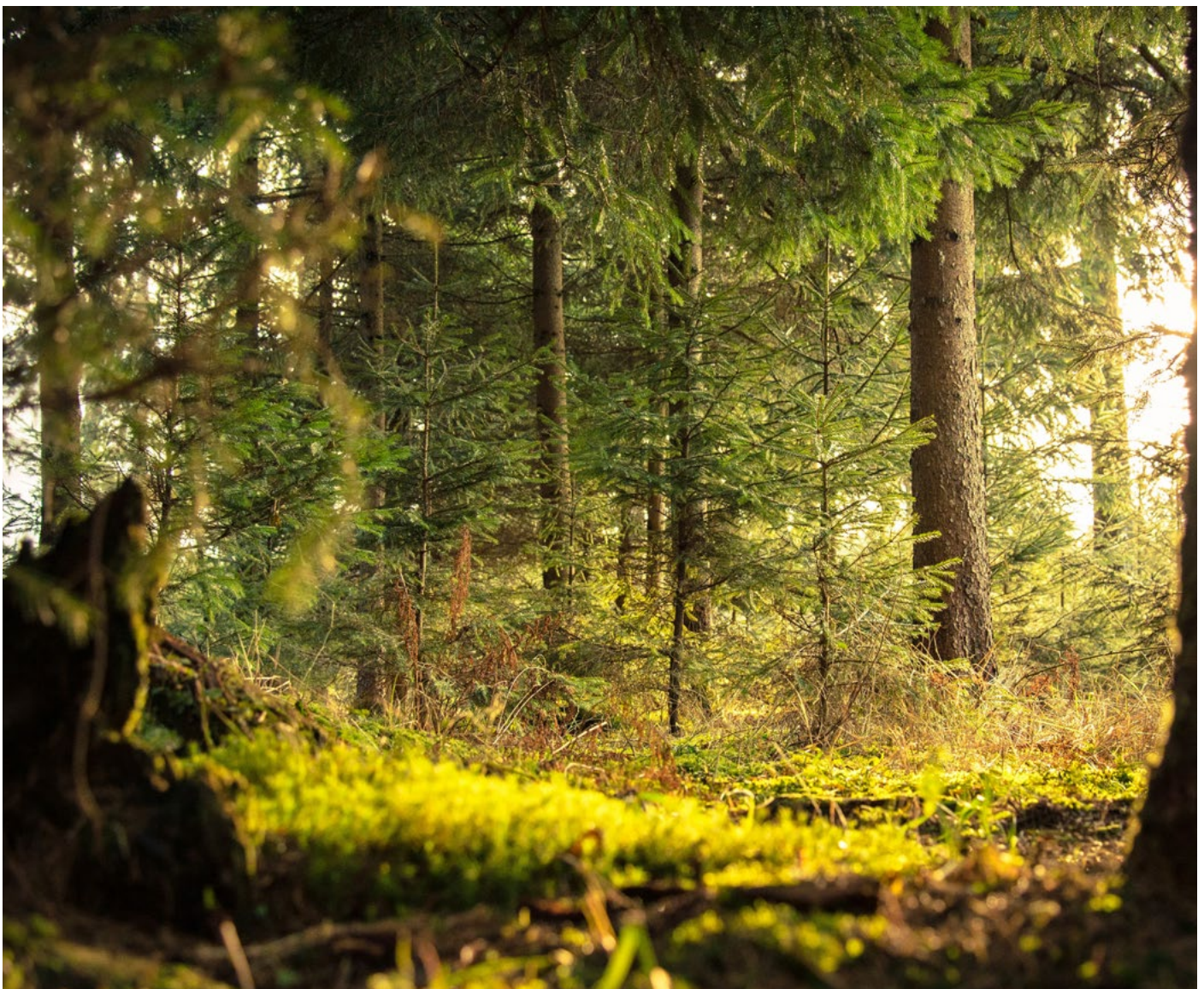
Beyond Europe, South Korea has formulated an ambitious set of nearly US\$200 billion in recovery plans. They include US\$63 billion in green funding for smart grids and infrastructure for electric vehicles. Also included are circular economy initiatives, such as reducing and re-using energy in factories, carbon capture and storage, and re-using industrial materials.¹⁸ Supporting new green digital solutions is also a key part of Singapore's Green Plan 2030 and the S\$1 billion investment fund to accelerate the adoption of digital solutions and new technologies.¹⁹

Finally, with a US\$2.3 trillion proposed infrastructure and jobs plan, the United States aims to accelerate progress on environmental sustainability through clean infrastructure investments, research and technology innovations, and green skills development.²⁰ Among other initiatives, the plan calls for US\$35 billion to be channeled into research for climate technology innovations and an additional US\$15 billion to fuel development around energy storage and hydrogen.

By channeling public investments effectively toward a twin transition, the public sector can accelerate progress on their sustainability journeys.

¹⁹. <https://www.greenplan.gov.sg/>

²⁰. <https://www.whitehouse.gov/briefing-room/statements-releases/2021/03/31/fact-sheet-the-american-jobs-plan/>



Leading environmental initiatives in existing recovery packages

Americas	Europe	Asia
<p>Canada</p> <ul style="list-style-type: none"> Canada launched "A Healthy Environment and a Healthy Economy" recovery plan worth more than US\$11.7 billion in funding for incentives for zero-emissions vehicles, renewables and green communities as well as US\$4.7 billion to invest in clean infrastructure. <p>Brazil</p> <ul style="list-style-type: none"> Brazil's recovery package includes US\$203 million in green bonds, a new National Energy Plan with a renewable energy target of 45% by 2030 and funding for wind energy infrastructure. <p>Colombia</p> <ul style="list-style-type: none"> Colombia's "Compromiso por el futuro" provides US\$26 million for sustainable initiatives, including renewables, afforestation and biodiversity conservation. <p>Mexico</p> <ul style="list-style-type: none"> Mexico has enacted US\$28 billion in economic relief and recovery spending, including a proportion devoted to expanding Mexico City's bicycling infrastructure. 	<p>The EU Green Deal and NextGenerationEU</p> <ul style="list-style-type: none"> The most ambitious environmental recovery project to date, "NextGeneration EU" commits 37% of the US\$830 billion funding to measures supporting the "EU Green Deal". These include sustainable agriculture, renewables, and support for electric vehicles and EV infrastructure. It also commits financial support for member states to the "do no harm" principle of no negative environmental effects from spending. <p>France</p> <ul style="list-style-type: none"> France enacted a US\$33 billion "Ecological Plan", including energy efficient building renovations, decarbonization policies, sustainable agriculture and clean mobility. <p>United Kingdom</p> <ul style="list-style-type: none"> The UK's "Ten Point Plan for a Green Industrial Revolution" provides almost US\$12 billion in investment for hydrogen, clean mobility, EV infrastructure, carbon capture, flood protection and nature-based solutions. <p>Italy</p> <ul style="list-style-type: none"> In its National Plan of Recovery and Resilience, Italy announced US\$120 billion across the two pillars - Green revolution and ecological transition and Infrastructure for sustainable mobility. 	<p>Japan</p> <ul style="list-style-type: none"> The government has set forward US\$3 billion for solar and battery development as well as US\$780m funding for afforestation policies. <p>South Korea</p> <ul style="list-style-type: none"> South Korea "New Deal" designates US\$63 billion for green projects, including renewables, electric vehicles, and energy efficiency renovations. It also prioritizes green and digital infrastructure investments. <p>Singapore</p> <ul style="list-style-type: none"> Singapore's recovery spending includes US\$409 million to support the digital transformation of businesses and the arts. <p>Australia</p> <ul style="list-style-type: none"> Australia has committed more than US\$233 million for hydrogen and renewables, while territorial governments have implemented measures for energy efficiency. <p>New Zealand</p> <ul style="list-style-type: none"> New Zealand's "Wellbeing Budget" commits to creating 11,000 green jobs and initiatives for improving energy efficiency in homes.

A photograph of a cornfield with green stalks and tassels in the foreground, set against a bright blue sky filled with fluffy white clouds. A semi-transparent white rectangular box is positioned on the left side of the image, containing the title text.

A new digital and sustainability framework

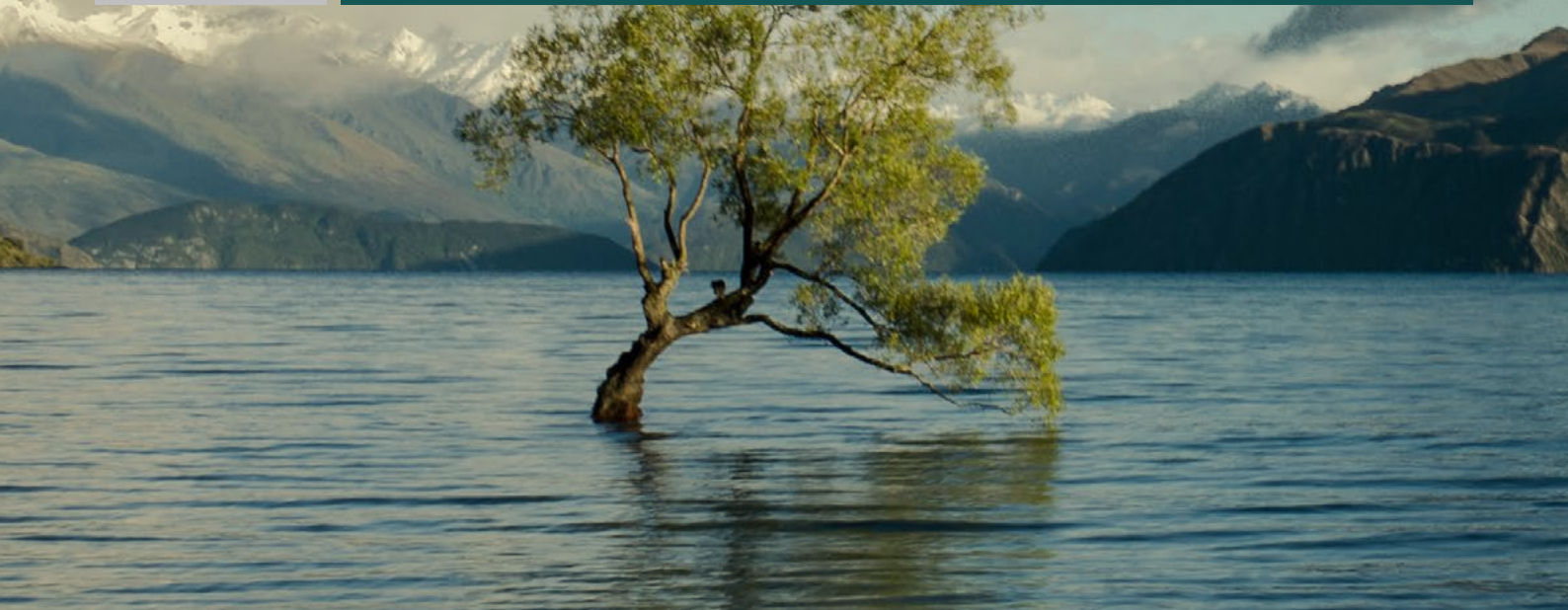
By integrating digital and green initiatives, the public sector can enable a twin sustainability transition

Achieving progress on environmental sustainability is an evolutionary journey through investments in technology and data, leadership, inter-governmental collaboration, and stakeholder buy-in. Based on consultations with public sector stakeholders, and sustainability and technology experts across 12 countries, we identified four stages of digital sustainability. These stages act as a diagnostic framework to describe the progress from a fragmented approach among different government departments to an intelligent, digital government where sustainability has been internalized as part of its organizational culture.

SUSTAINABILITY OUTCOMES					
		Fragmented	Limited	Realized	Transformed
Enablers	Technology and Data	<ul style="list-style-type: none"> Global goals established but few actionable policies Fragmented organizational approaches prevent the pooling of information Sustainability strategies are reactive to address regulatory failures 	<ul style="list-style-type: none"> Climate action plans based on limited data and aimed at improving efficiencies Limited synchronization across government agencies or jurisdictions Environmental expertise and skills unevenly distributed Compliance-driven policies 	<ul style="list-style-type: none"> Joined-up approach across departments and jurisdictions Digital technologies seen as essential to the sustainability agenda Harmonization of local targets with global goals around clear measures and a standardized methodology Governments start to enact plans to reduce their own environmental footprint 	<ul style="list-style-type: none"> Sustainability practices become part of the public sector culture, which result in inclusive and climate-first policies and strategies Sustainability awareness starts with transformed education curriculum Real-time data inform planning and communication Green procurement practices embed circular principles into government operations
	Leadership and governance	<p>Analog Government</p> <ul style="list-style-type: none"> Lack of data standards and insufficient reporting methods to measure progress Complex, manual processes fragmented across multiple organizations Paper-based record keeping Information is siloed and data usage restricted to premises 	<p>Transactional Government</p> <ul style="list-style-type: none"> Diagnostic and descriptive data informs environmental policies and discussions Data not shared between and across teams Technology use limited to answering discrete questions Policies predicated on limited data sets 	<p>Service-centered Government</p> <ul style="list-style-type: none"> Large datasets, centralized platforms and geospatial analysis enable prediction and individualized assessments Open data frameworks create stronger ecosystems Citizen-facing employees have access to all data they need Services can be proactively targeted to groups 	<p>Intelligent government</p> <ul style="list-style-type: none"> Cloud-based tech and innovative digital tools can help drive sustainable decision-making Multiple sources of data used to model impacts and formulate positions, policy and interventions Proactive responses to crisis situations Citizens control their data and trust uses of AI
	Strategy and policies	<p>Leaders unaware of tech's benefits for sustainability; Departments working in silos, with little or no governance around sustainability</p>	<p>Leaders understand the benefits of a twin digital and sustainable transition, but they have limited capacity to implement or innovate</p>	<p>Leaders champion the integration of digital and sustainability. Governments work across jurisdictions on an ad hoc basis.</p>	<p>Digital and sustainability are embedded throughout senior leadership and individual government departments</p>
	Stakeholder cooperation	<p>Sustainability concepts emerge in strategic planning but little implementation is disjointed</p>	<p>Environmental targets are used in strategic guidelines but not yet standardized across jurisdictions</p>	<p>Use of performance measures to track the progress and outcomes</p>	<p>Policies are co-created and regularly updated to align with current and anticipated citizen expectations</p>
		<p>Stakeholders identified but little understanding of how they are connected and communication is one-way</p>	<p>Basic consultation with the stakeholders on potential sustainability initiatives</p>	<p>Regular communication with the stakeholders on the climate activities and environmental progress</p>	<p>Two-way communication flows and iterative learning; stakeholders co-create sustainability policies</p>

A connected approach between sustainability and digital transformation can enable cross-government synergies

TOPIC	DIGITAL AND SUSTAINABILITY FRAMEWORK	
Overview	Fragmented	<p>With the establishment of global sustainability goals and the Paris climate agreement, governments in this phase have started to set ambitious targets. However, many governments still struggle with developing detailed action plans.</p> <p>There is a lack of standardization for incorporating climate and environmental risks into strategic planning, and governmental action is tied to addressing regulatory failures and disaster response rather than proactive resilience and adaption planning. Many policies are still in inception phases and there is a failure to find the best pathways forward to implement policies.</p>
	Limited	<p>Governments are making inroads in their sustainability journeys, but innovation is piecemeal and there are pockets of excellence rather than comprehensive planning. For example, governments are starting to think about common sustainability definitions and resource needs. To this end, we see some governments developing climate and sustainability coordination units to address these gaps.</p>
	Realized	<p>In the wake of the COVID-19 pandemic, many governments are aiming to reach this phase by putting sustainability and digital transformation at the center of an inclusive economic recovery. In this stage, governments have established a joined-up approach around sustainability linking across government agencies and between central and local governments.</p>
	Transformed	<p>Sustainability concepts are embedded within government departments and a culture of sustainability emerges across its core services and across stakeholders. This results in inclusive and climate-first policymaking.</p>



Digital approaches have the potential to generate progress on global sustainability goals

TOPIC	DIGITAL AND SUSTAINABILITY FRAMEWORK	
Technology and data	Fragmented	Analog Government. Insufficient data and reporting standards hamper abilities to leverage technological innovations. There are few channels toward sharing usable data across departments or jurisdictions. There is a lack of awareness for a joined-up approach for addressing sustainability challenges, and talent strategies do not yet prioritize the need for scientific and technical skills in recruitment and retention drives.
	Limited	Transactional Government. Increasing use of data and evidence in making sustainability decisions, but governments primarily use data for diagnostic and descriptive purposes. Reports are increasing digitized, but the information remains siloed and restricted as it must be used on premises. There is limited ability to pull the data together to make forecasts and predictions.
	Realized	Service-centered Government. National and local sustainability targets are harmonized with global standards. Data and governance move from diagnostic analysis to prediction and forecasting, involving the use of large datasets, centralized platforms and geospatial analysis.
	Transformed	Intelligent Government. Digital technologies allow governments to better understand behaviors associated with environmental degradation and offer interventions to drive more sustainable choices. Technology and local knowledge act as one in helping drive more sustainable consumption patterns. Smart technologies meet smart controls for monitoring emissions and impacts allowing governments to predict and make intelligent decisions. Cloud-based technologies enable secure data storage and seamless interactions to drive sustainable decisions across governments, the private sector, civil society and ordinary citizens. Real-time data and sophisticated analytical tools inform sustainable development planning.

But this requires commitment by senior leadership and resources to back up their ambition

TOPIC	DIGITAL AND SUSTAINABILITY FRAMEWORK	
Leadership and governance	Fragmented	Senior leaders are largely unaware of their organization's own environmental footprint and have little information on leveraging digital technologies to address their sustainability challenges.
	Limited	Some communication by leadership of the benefits of digital approaches but tactical plans to get there are unclear. Limited awareness of the climate impacts of the government's own operations.
	Realized	Senior leaders begin to champion digital technologies' role in enabling sustainable development. Plans emerge to determine government's own environmental footprint.
	Transformed	Senior leaders are engaged in the overall planning and implementation of green technologies. They play a key role in communicating the benefits and a vision for government's sustainability journey . Governments are able to "walk-the-talk" by adopting proactive policies to counter the environmental impacts of their own operations.
Green budget, finance and procurement	Fragmented	There is limited public financing for long-term sustainability strategies and budgets are skewed toward disaster response rather addressing climate change and improving environmental protection.
	Limited	Standardized concepts and reporting around sustainability have yet to be brought into budgetary decisions, with each department developing different measures. Growing use of monitoring tools and impact assessments in climate-related policies, but there remains a lack of a standardized framework and tools.
	Realized	Green public procurement practices leverage digital approaches to increase transparency and sustainable production and consumption of goods and services.. Open data and integrated systems allow governments across different jurisdictions to share data through two-way flows locally, regionally, and internationally.
	Transformed	Green public procurement practices embed circular principles with digital and sustainability tools working as one. Open data and integrated systems allow governments across different jurisdictions .

Leveraging stakeholders throughout the entire ecosystem can help build a culture of sustainability across the public sector

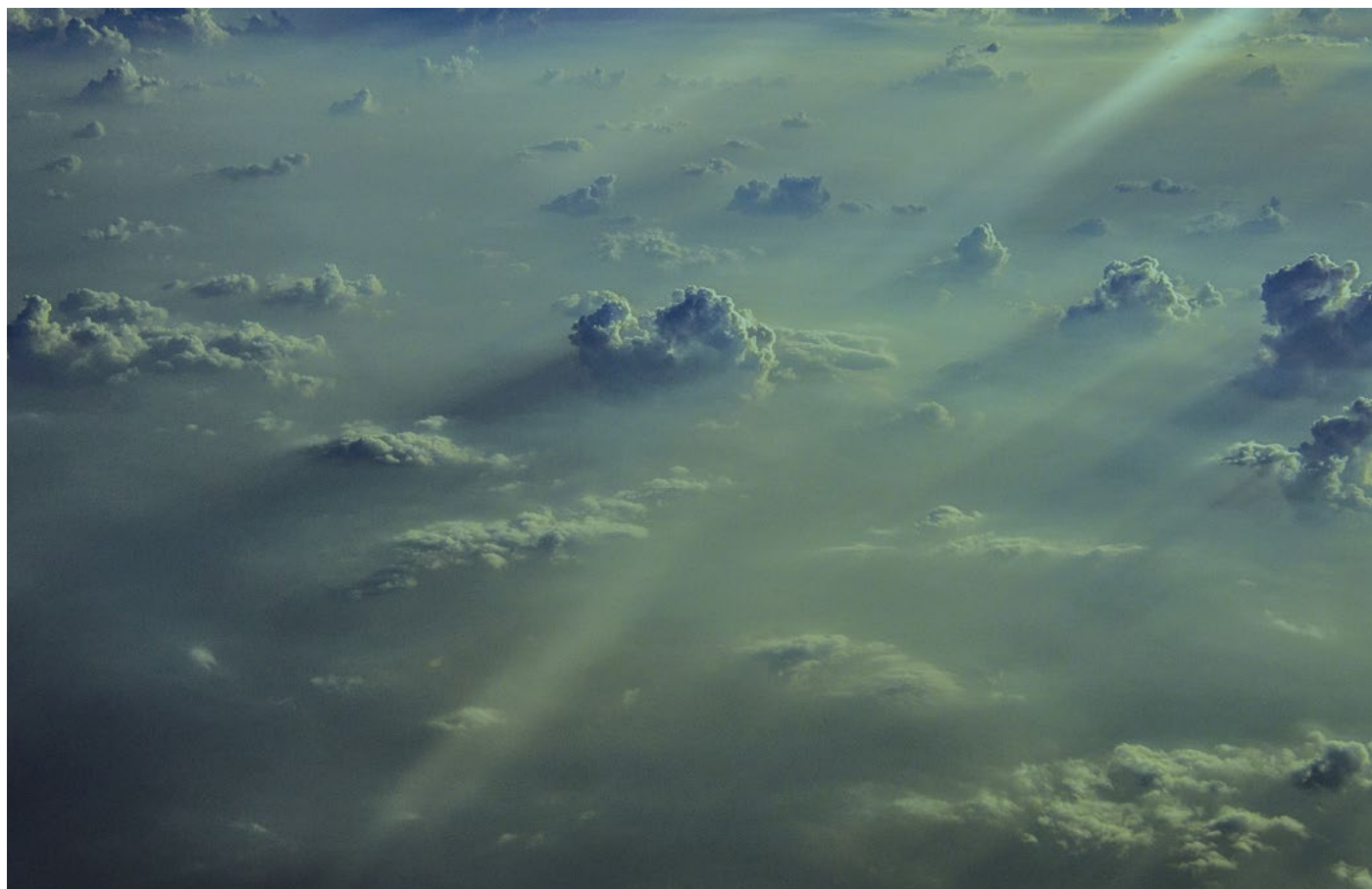
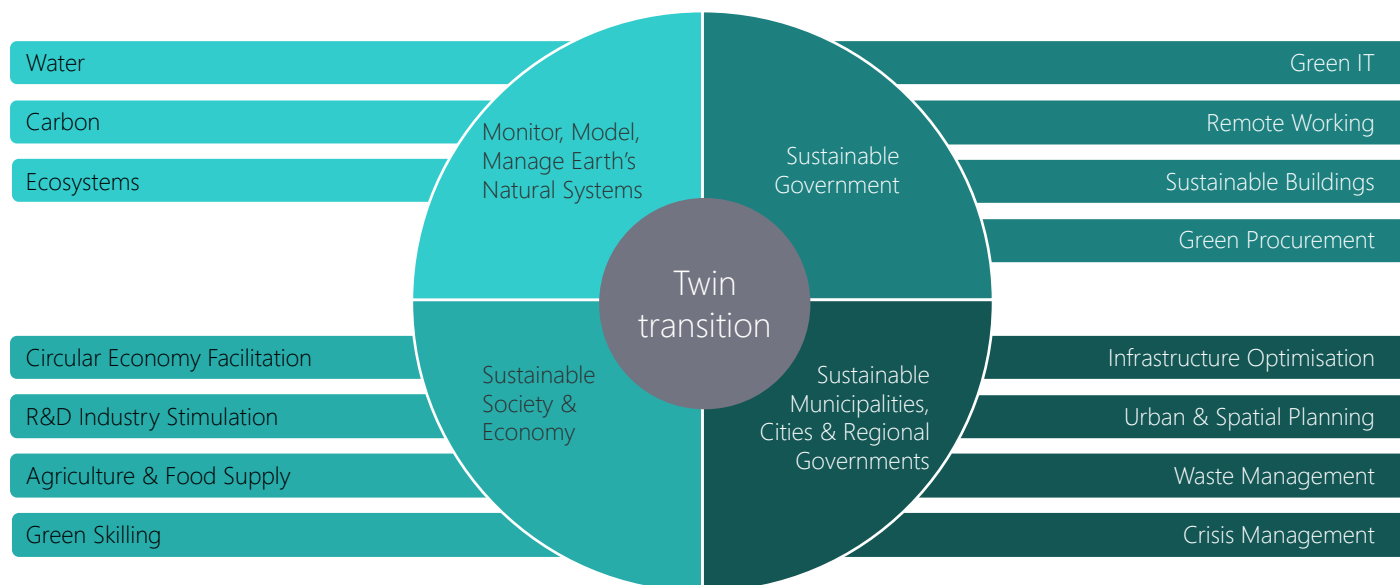
TOPIC	DIGITAL AND SUSTAINABILITY FRAMEWORK	
Stakeholder collaboration	Fragmented	There is a lack of coordination between governments, private sector, and civil society organizations around sustainability issues. Communication is limited and hierarchical structures prevent the synergies and co-creation of policies.
	Limited	Governments start to partner with private sector around sustainability and digital projects, but public-private partnerships are limited. Communication with civil society organizations are largely one-way and top-down.
	Realized	Nascent open data frameworks help enlarge the sustainability ecosystem, with citizen scientists, academic research institutions and NGOs. Consultation with a wider set of stakeholders, which becomes more personalized including everyday citizens through listening sessions, private sector industry, and academic researchers.
	Transformed	Climate action is integrated within school curriculum and the use of digital tools (e.g., gamification) helps encourage sustainability awareness at a young age. Policies are co-created and monitored across the entire ecosystem with agile methods for communication and reporting.

How digital approaches can unlock a twin transition



How digital approaches can unlock a twin transition

By having a greater understanding of the digital sustainability framework, public entities can start to determine the resources and capabilities required to succeed in their sustainability journeys. It can also be helpful in providing pathways to enable sustainable development in four key areas: sustainable society and economy; sustainable municipalities, cities and regional governments; monitoring, modelling and managing the Earth's natural system; and sustainable government.



Sustainable Municipalities, Cities & Regional Governments

Sustainable Municipalities, Cities & Regional Governments

Infrastructure Optimisation	Waste Management
Process & Services Optimisation	Waste Collection Optimization
Asset Management	Pollution detection & recycling compliance management
Predictive Maintenance	
Smart Streetlights	Crisis Management
Urban & Spatial Planning	Early Warning System
Digital twin	Coordinated Response
	Mass Communication

Key Digital Enablers

through new channels of participatory city planning; and enabling citizen-centric urban redesign and planning. For example, the City of Edinburgh connected the city's 64,000 streetlights under a centralized system, which is projected to reduce energy consumption by upwards of 60% and expenditure by £54 million in the next 20 years.²²

And as resilience gains importance for cities during the recovery, digital twins – or digital representations of real-world urban environments through sensors and data²³ – have been a powerful tool to better manage urban grids, transportation networks, water and flood management, carbon emissions, and entire city ecosystems. For instance, Singapore has launched a US\$73 million Virtual Singapore project to strengthen the city-state's resilience by optimizing energy networks and improving disaster management planning from rising sea levels.²⁴

Finally, cities are leading the way in encouraging an equitable, sustainable and digital recovery with prominent initiatives such as the "C40 Mayors Agenda for a Green and Just Recovery" focusing on green jobs, resilience, equity and well-being. These initiatives can help accelerate progress by providing common frameworks and digital learnings from one another.

Data Management Framework Enables City Climate Action

The C40 recognized that many cities lacked high-quality climate data to develop comprehensive climate action plans. The C40 and EY developed a [Data Management Framework](#) focusing on strategy, quality, leadership, technology, and data-usage. The result was a detailed guide to advance their climate plans with better and consistent use of climate-related data.

Source: C40/EY

²¹. <https://www.un.org/en/climatechange/climate-solutions/cities-pollution#:~:text=Cities%20are%20major%20contributors%20to,cent%20of%20the%20Earth's%20surface> ; <https://www.c40.org/ending-climate-change-begins-in-the-city>

²². <https://link.springer.com/article/10.1007/s12652-021-02970-y>

²³. <https://techcommunity.microsoft.com/t5/internet-of-things/smart-cities-ontology-for-digital-twins/ba-p/2166585>

²⁴. <https://www.govtech.com/smart-cities/digital-twin-technology-can-make-smart-cities-even-smarter.html>

Sustainable Government

Sustainable Government	
Green IT	Sustainable Buildings
Sustainability Calculator	Energy Management
Remote Working	Water Efficiency
Collaboration & Productivity Tools	Air Quality
Virtual Desktop	Green Procurement
	Impact Analysis
	Supply Chain Transparency

Key Digital Enablers

In the US, nearly a third of all public sector employees continue to work from home full-time compared to less than 4% prior to the pandemic.²⁷ The sudden shift toward remote work translates into less commuting and a considerable reduction in vehicle emissions, but its long-term viability is only possible when technologies strengthen productivity and teaming throughout government agencies. For instance, Microsoft teams were able to enable remote work for the City of Corona, California in 72 hours by migrating its existing infrastructure to Microsoft Azure Government. The move saved 5,952 hours in lost productivity and more than US\$712,500 in new computing equipment.²⁸

Digitalization can also help enable more sustainable IT and procurement decisions. This is important because the IT industry is expected to account for 20% of the world’s electricity by 2025.²⁹ As a foundational step, governments need to know the impact of IT purchases and can leverage carbon footprint calculators such as Microsoft’s Sustainability Calculator. Digital solutions can also better track green procurement decisions by unlocking the value of data and gaining real-time visibility into government supply chains. Germany has introduced a “Digital Product Passport” to help standardize data on the individual components of specific products to help enable better procurement decisions.³⁰

A successful transformation for governments requires the public sector to embrace sustainability by reducing their own carbon footprints. This can be achieved through new ways of working, energy-efficient buildings, sustainable IT standards, and green public procurement policies. Governments as large holders of real estate contribute to significant share of global greenhouse gases when considering the entire building sector accounts for more than a third of global energy consumption and more than half of global electricity demand.²⁵ For example, advances in real-time monitoring of energy usage in public buildings have helped the City of Boston save an estimated US\$1 million in energy costs annually.²⁶

Sensors and predictive analytics help reduce energy use in government buildings in Singapore

Singapore’s government agency JTC has played a critical role in developing industrial landscape in the country. Inspired by Microsoft’s campus in Redmond, US, JTC decided to become more sustainable by using data sensors and predictive analytics to reduce energy use across all its 39 buildings and increase productivity by decreasing down time.

²⁵. <https://www.iea.org/reports/digitalisation-and-energy>

²⁶. <https://www.smartcitiesworld.net/news/news/boston-ranked-top-for-energy-efficiency-4418>

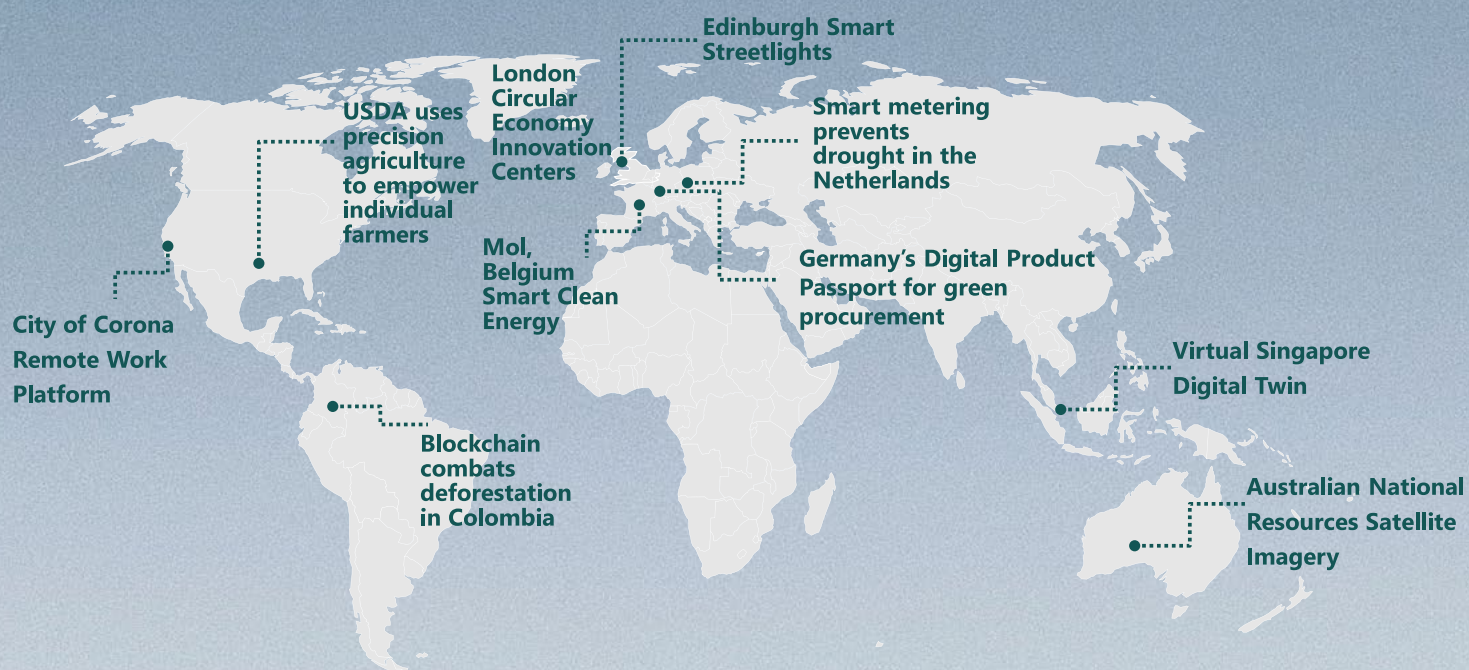
²⁷. <https://www.bls.gov/cps/effects-of-the-coronavirus-covid-19-pandemic.htm>

²⁸. <https://customers.microsoft.com/en-US/story/850777-city-of-corona-government-windows-virtual-desktop>

²⁹. <https://www.unclearn.org/wp-content/uploads/library/19-00405e-turning-digital-technology-innovation.pdf>

³⁰. <https://www.bmu.de/en/service/haeufige-fragen-faq/details-cluster/bmu-digital-policy-agenda-for-the-environment-digital-product-passport/>

Initiatives accelerating the twin transition across the world



Monitor, Model, and Manage Earth's Natural System

Monitor, Model, Manage (MMM) Earth's Natural Systems

Water	Ecosystems	Climate
Interactive Demand Management	Biodiversity hotspots MMM	Carbon Footprint tracking & reporting
Customer Engagement	Climate & human behaviour impact analysis	Weather & Climate MMM
E-invoicing	Species MMM	Climate disaster impact predictions & assessments
Water Usage MMM	Camera and satellite image analytics	Clean Energy
Water Quality	Sound analytics	Customer Engagement
Realtime remote monitoring	Habitat MMM	E-invoicing
Water Supply	Land cover mapping & optimisation	Energy distribution optimisation
Leakage detection	Forest MMM	Renewable Energy Credits
Infrastructure Optimisation	Situational Awareness & Impact Analysis	Demand & supply Forecast
Flood Protection	IoT, Data Collaboration, AI & ML, Planetary Computer, Super Computing, geospatial analytics	Hydrogen Energy MMM
Flood & Impact Predictions		Intermodal Mobility
Infrastructure Optimisation		Incentivising sustainable MaaS
		Traffic Optimisation
		Machine-to-Machine exchange
		EV Charging
		Air Quality MMM

Key Digital Enablers

Digital innovations have the potential to transform how governments will deliver upon global goals to protect the planet and enable a transition toward net-zero carbon emissions. This potential is beginning to be shown through better management of waterways and oceans, better protection of natural ecosystems, and better investments in technologies to permanently remove greenhouse gases.

Technology is also demonstrating opportunities to better manage the supply and demand of water resources. E-invoicing and two-way communication platforms have helped tailor services to the specific

needs of customers and change behaviors toward greater conservation. Smart water metering has improved the performance of water infrastructure and helping to alleviate droughts and water shortages. Natural Resource Access Regulator (NRAR), Australia, is using satellite imagery to monitor water flows and water extraction in detail enabling it to investigate on-farm storages and floodplain harvesting.³¹

There are many other digital applications to identify and prevent biodiversity and habitat loss, from identifying illegal fishing through underwater camera technologies and sensors to leveraging blockchain to ensure that milk is not sourced from farms using deforested land in Colombia.

Some of the boldest decarbonization efforts come from clean energy and transport initiatives enabled by technology. For example, Microsoft's FLEX harvester helped the city of Mol in Belgium maximize renewable heating from sustainable sources by using wireless indoor environmental sensors throughout 40 buildings.³² The integration of renewable energy with mobility transformations also promises to galvanize climate progress with the acceleration of electric, connected and autonomous vehicles.

Smart metering and IoT help counter a drought in the Netherlands

The Netherlands has encountered a persistent water shortage from climate change. The Dutch utility PWN leveraged IoT technology to fight the problem and helped connect usage demand to individual customer data. They then moved the system to the cloud for better optimization of water usage. The result was more sustainable high-quality water and drought alleviation for more than 1.5 million residents.

³¹. <https://www.abc.net.au/news/rural/2021-02-05/watchdog-watching-for-illegal-water-take-using-satellites/13099060>

³². <https://flexharvester.vito.be/en>

Sustainable Society and Economy

Sustainable Society & Economy

Circular Economy Facilitation

Peer-to-peer industry platforms

Lifecycle Transparency

R&D and market investments stimulation

Grants Management

Impact & Risk Assessments

Scientific Literature Review

Agriculture & Food supply

Supply Chain Transparency

Food Waste & Shortage MMM

Crop & precision
agri recommendations

Green Skilling

Digital Skills 4 Green

Skills Gap Analysis

Learning Management System

Key Digital Enablers

A public sector green transformation is only possible by connecting environmental sustainability with sustainable socioeconomic transformations. For example, improving access to education can help drive a wide array sustainable development outcomes. The Malala Fund estimates that improving access to education for young women to 70% could reduce disaster-related deaths by 60% by 2050.³³

Another key pathway toward a sustainable and inclusive economy is the improvement of sustainable consumption and production practices. Digitally-enabled circular economies involves comprehensive monitoring of climate-related impacts by governments using sensors, predictive analytics, and big data that go beyond recycling analytics. For instance, the UK government allocated £22.5 million in funding for new circular economy innovation centers to help design technology solutions to tackle waste.³⁴

Precision agriculture and predictive analytics is another channel for promoting a sustainable economy by enabling sustainable farming and securing the food supply. These technologies combine diverse data sources including weather, soil information and historical crop yields to help prepare farmers and governments a better sustainable of how climate change will impact agriculture.³⁵

Finally, a sustainable economy will ensure that no one is left behind in a green transition. In 2019, the ILO estimated that more than 70% of the jobs lost from a renewable energy transition would need some form of reskilling to meet future ways of working.³⁶ For example, the UK energy company, Drax, announced an initiative to improve the skills of one million people by 2025 in order to enable a workforce with the skills to manage the digital technologies necessary for decarbonization.³⁷

Precision agriculture helps the USDA empower individual farmers with more sustainable practices

Small farmers often lack data and analytics to understand changes in crop and soil conditions. Microsoft partnered with the US Department of Agriculture (USDA) to leverage AI and better data for the prevention of soil erosion, better management of water and pest control.

³³. <https://www.project-syndicate.org/commentary/climate-change-forcing-children-out-of-school-by-yasmine-sherif-2021-04>

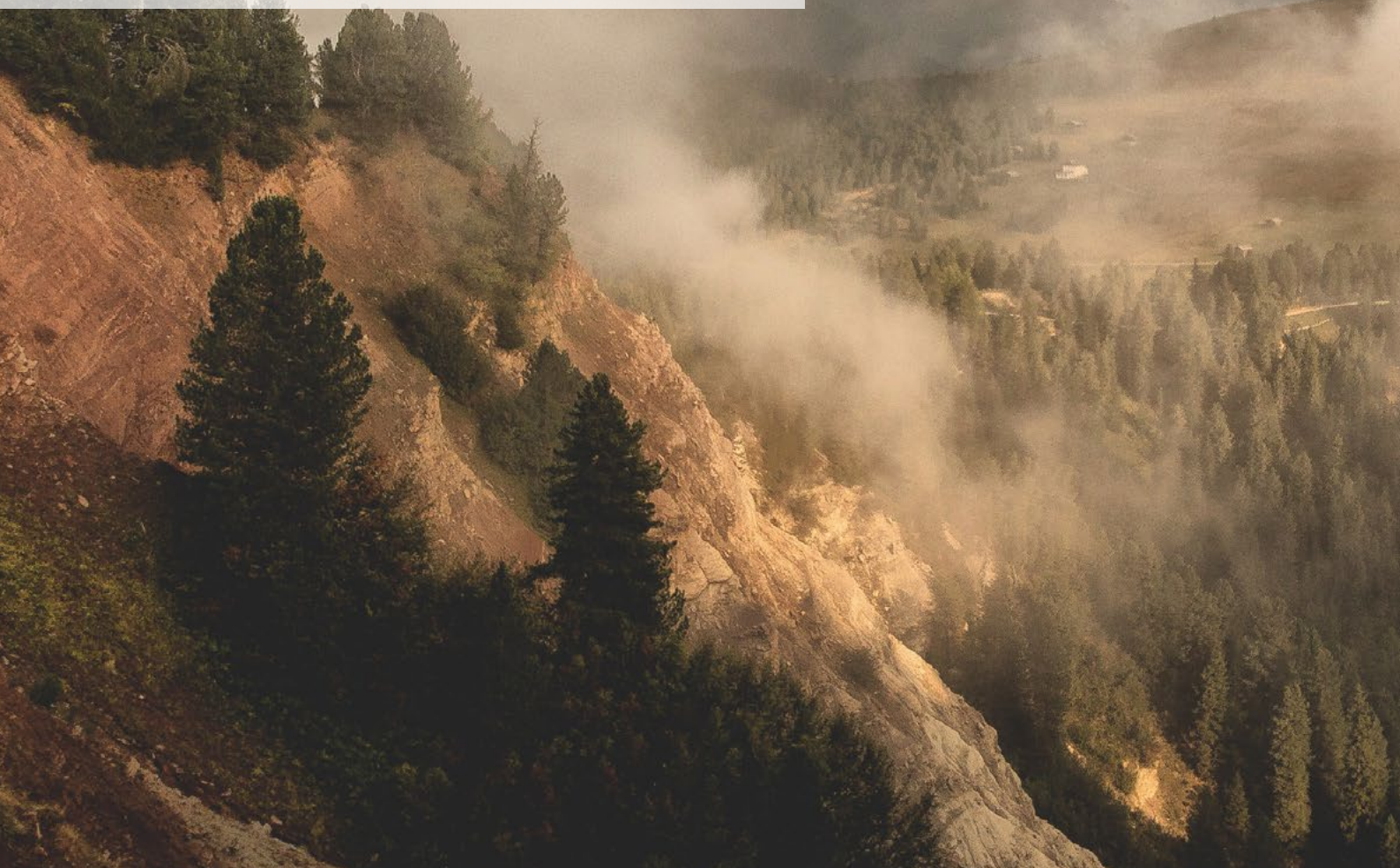
³⁴. <https://www.gov.uk/government/news/225-million-funding-to-turn-industry-waste-into-environmental-wins>

³⁵. <https://blogs.microsoft.com/on-the-issues/2019/07/23/ag-analytics-helps-farmers-and-researchers-use-ai-to-prepare-for-climate-change/>

³⁶. https://www.ilo.org/wcmsp5/groups/public/---ed_emp/documents/publication/wcms_732214.pdf

³⁷. <https://www.climateaction.org/news/drax-launches-initiative-to-improve-green-skills-for-a-million-people>

Key factors for using digital approaches in public sector sustainability



Key factors for using digital approaches in public sector sustainability

As the world faces a “make-or-break year” to confront the global environmental emergency, technology and data are critical enablers for limiting global warming and accelerating progress on sustainability. To help fully realize this ambition, we find four factors for supporting governments on their sustainability journeys:

1

Emphasize common digital and sustainability standards and reporting frameworks

Sustainability is the responsibility of every public sector agency, and the need to integrate sustainability into pre-existing models is key. Digital and sustainability standards and reporting frameworks must therefore rapidly improve to progress alongside the equally rapidly developing green public policies around the world (e.g., EU Green Deal and NextGenerationEU). Common standards and frameworks can provide relevant, faithful, comparable and reliable information, such as goals and targets, enabling governments to better improve sustainability performance and dismantling organizational siloes by accelerating whole-of-government digital transformations.

2

Create digital partnerships that encourage innovation and cross-sector collaboration

Governments alone may not have the financial or resource capabilities to drive sustainable development through digitalization. To overcome these challenges, governments must leverage the learnings from the pandemic to take bold actions and be willing to partner with the private sector to realize their innovation potential. For example, Breakthrough Energy Ventures, a coalition of private investors, have helped channel financing in partnership with the public sector, including the European Commission and the Government of Canada, toward climate disruptive technologies in electricity, transport, agriculture, and buildings. Through the program, the public sector acts a crucial link to accelerate the development of promising technologies, scale innovation by bringing together investors, private sector and public sector leaders, and formulate smart policies to shape the market and development of climate solutions.

³⁸. <https://public.wmo.int/en/media/news/2021-%E2%80%9Cmake-or-break-year%E2%80%9D-climate-action#:~:text=2021%20must%20be%20the%20year,change%20indicators%20and%20worsening%20impacts>.

³⁹. <http://mission-innovation.net/2020/11/30/european-union-celebrates-mission-innovations-5-year-anniversary-successful-collaboration-remembered-through-5-major-achievements/>



3

Link socioeconomic ambitions with climate-related goals

In order to reach global climate targets, governments will need to couple environmental goals with socioeconomic considerations. Long-term sustainable growth is only possible when no one is left behind. For example, the programs behind the European Union's Just Transition aim to bring skills training and investment to regions to ensure that decarbonization does not disproportionately impact certain communities over others. Many city governments have started to include equity into their climate change and recovery initiatives. In Boston, city leaders have started to assess the environmental and green jobs impacts for residents from disadvantaged neighborhoods and communities of color.⁴⁰ Other cities have started to create equity and climate indexes to measure and map social and environmental vulnerability.

4

Integrate skills development with digital solutions

The public sector can quickly scale digital solutions, but success can fall short without developing the requisite skills set within government workforces. Green upskilling and reskilling of public (and private) sector labor force is fundamental to delivering overall sustainability success.

⁴⁰. <https://www.greenbiz.com/article/8-cities-share-how-racial-justice-embedded-their-climate-plans>



