



GOVERNANCE



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**EQUITABLE GROWTH, FINANCE & INSTITUTIONS INSIGHT**

# Greening Public Administration with GovTech

Embracing a Green Digital Transition  
Guidance Note - Volume 1

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1818 H Street NW  
Washington DC 20433  
Telephone: 202-473-1000  
Internet: [www.worldbank.org](http://www.worldbank.org)

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# Abbreviations and Acronyms

ADB	Asian Development Bank
AI	Artificial Intelligence
CAF	Development Bank of Latin America
CCIA	Climate Change Institute Assessment (World Bank)
CIO	Chief Information Officer
CO2	Carbon Dioxide
CODES	The Coalition for Digital Environmental Sustainability
CPB	Central Procurement Body
DESI	European Digital Economy and Society Index
DIGIT	Directorate-General for Informatics (European Commission)
DINSIC	French Digital Directorate
EC	European Commission
EIA	Environmental Impact Assessment
eLAC2020	Digital Agenda for Latin America and the Caribbean
EU	European Union
GDP	Gross Domestic Product
GHG	Greenhouse Gas
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
GPP	Green Public Procurement
GTMI	GovTech Maturity Index
GWh	Gigawatt Hour
ICT	Information and Communications Technology
IEA	International Energy Agency
IPPC	Intergovernmental Panel on Climate Change
IT	Information Technology
ITU	International Telecommunications Union
LCC	Life-Cycle Costing
M&E	Monitoring & Evaluation



Mt	Metric Ton
NGO	Nongovernmental Organization
NDC	Nationally Determined Contribution
OECD	Organisation for Economic Co-operation and Development
PFM	Public Financial Management
R&D	Research and Development
SDG	Sustainable Development Goal
SPP	Sustainable Public Procurement
TCO	Total Cost of Ownership
TRE	Transport, Resources, and Energy
TTL	Task Team Leader (World Bank)
TWh	Terawatt Hour
UN	United Nations
VfM	Value for Money
WEF	World Economic Forum



## Executive Summary

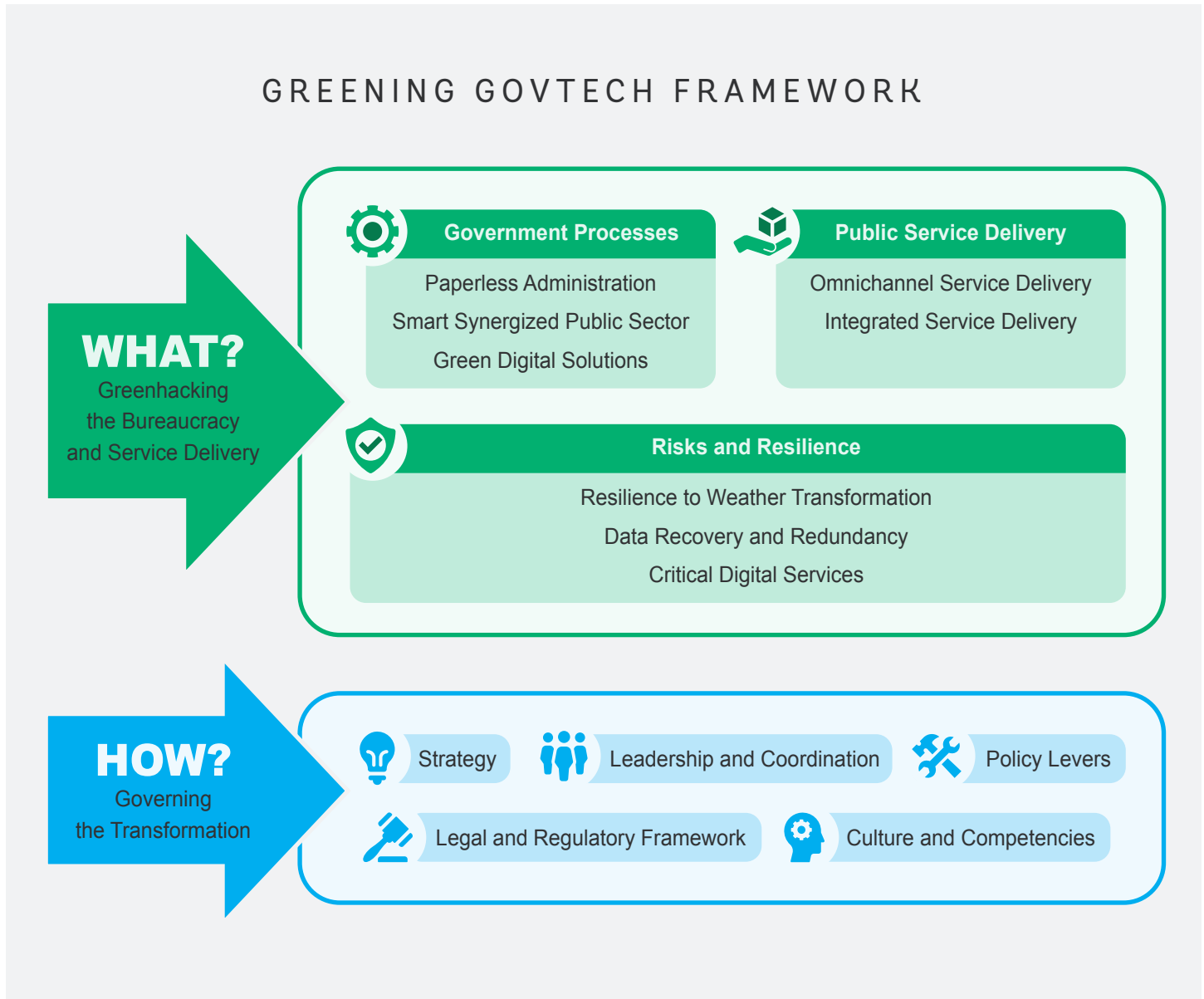
**Governments are increasingly seeking opportunities to leverage digital technologies to build a greener future.** This guidance note provides useful advice to policy makers underlining adequate leadership and commitment are crucial to implement coordinated GovTech and Green policies. The climate change impacts of digitalization can provide the benefits of green digital service delivery, paperless administration, and the efficiency of integrated services for a reduction of the carbon footprint.

**The guidance note will focus on “greening Public Administration through GovTech” defined as GovTech policies, initiatives, and/or solutions that embrace environmental considerations by design, maximizing the green benefits and considering the potential negative impacts, for example through digitalization of government processes.** This guidance note is centered around three main topics: (i) the green government process through digital solutions (e.g., greening through GovTech), (ii) greening digital service delivery (making GovTech greener and more environmentally sustainable through the adoption of new technologies) and (iii) identifying policy mechanisms to mainstream green digital approaches throughout government systems.

**The paper makes use of country and project examples to show how GovTech policies can positively address climate change without contributing to the issue as result of the inherent rise of GHG emissions that comes from increased digitalization and the transformation of the public sector.** This note does not cover the broader subject of GovTech for the green agenda (e.g., how digital technologies and data used by government can be embraced to support the broader economy and society to mitigate and adapt to climate change). Additionally, this note does not cover data analytics for informed decision making, open government, and CivicTech.

**The guidance note proposes a framework to support government efforts to go green and digital.** Both of these agendas have garnered political support but have usually done so separately, and now the focus needs to be on both concurrently, hence the “greening GovTech” policy objective. The greening GovTech framework builds on previous efforts from different entities and stakeholders, focusing on the “what” and the “how” (see figure below). The framework provides a conceptual alignment in support of policy design, implementation, development, and monitoring in these areas, mapping and making sense of the relations between the various policy subjects.

FIGURE ES.1 - Greening of GovTech: Framework of Analysis



Source: Authors.

In line with the proposed framework, the environmental impact of digitalized government processes based on paperless, connected, automated, and data-driven systems can be significant. Three dimensions should be considered: a) the benefits brought by paperless processes because of digitalization, b) efficiency, productivity, and “green” gains through an increasingly interconnected, interoperable, and data-driven public sector, and c) the available green digital solutions and management levers focusing on key IT

components, such as data centers, cloud solutions, and hard and software. Successful approaches require a combination of digital innovations linked to change management prioritization to improve the efficiency and effectiveness of public sector operations across the board. They also offer green benefits, such as reductions in paper use as well as in transport needs for both public officials (due to home and remote work) and individuals (who require fewer personal visits to public entities).



**Green digital service delivery is another dimension to be considered, focusing on how advanced features of digitalization, including automation, data-driven decision making, proactive functions, ubiquity, citizen centricity and inclusiveness, can contribute to a more environmentally friendly public sector.** These are sustained by the expected efficiency gains from digitalization in terms of reduced transport, resource, and energy consumption in the provision of services, thus avoiding waste and diminishing the carbon footprint. Sound solutions include an omnichannel service delivery that can improve efficiency and also address the climate emergency. Moreover, a green GovTech policy for public services brings significant inclusion benefits, contributing to the “leave no one behind” objective through plain, personalized, and proactive services. At the same time, respect for citizens’ digital rights, such as privacy and security, must be a fundamental requisite to sound green digital service delivery that assumes data exchange and reuse as the cornerstone of public sector transformation.

**The resilience of GovTech solutions can also contribute significantly to climate change mitigation and adaptation policies.** In order to address the current climate emergency, GovTech solutions should be able to resist extreme weather events and other emergencies, prevent data loss namely through redundancy and guarantee that critical digital services support the population’s resilience to climate catastrophes and emergencies. To this end, governments need to take measures to, for example, protect financial transactions in the aftermath of a disaster. Governments can also develop a risk management strategy for GovTech solutions to programs that identify risks, reduce vulnerability, and strengthen emergency services.

These GovTech solutions, such as digitalized early warning systems, financial transactions, wage systems, identification methods, contracts, and supply chain management, can boost government resilience and help public agencies to maintain links with the population during natural and other disasters. By proactively addressing these issues prior to an emergency, governments can improve their response.

**To disseminate the identified green digital approaches throughout the different government sectors and levels, an adequate whole-of-government institutional setting is critical for coherent and sustained implementation.** Institutional leadership, a dedicated organization, and specific coordination mechanisms are necessary to ensure a coordinated cross-government approach to both the GovTech and the green agendas. The existence of a public sector organization to lead GovTech policy is one of the first steps in facilitating the sector’s digital transformation. But to ensure the greening component, the government agency in charge of GovTech should embrace a green mindset. When there is a different ministry or department responsible for GovTech and for climate change, which is often the case, establishing strong collaboration mechanisms between the two entities is critical. Governments thus need to consider assigning a position in the organization handling GovTech to oversee internal and external communication and coordination on the country’s greening objectives.

**Legal and regulatory frameworks need to be robust, forward looking, and inclusive to promote a whole-of-government approach to the coordinated green and digital transitions.** Existing laws, policies, and standards,

including green public procurement (GPP) purchasing requirements and digital strategies, should set up a strong foundation while simultaneously enhancing resilience to climate change and promoting the achievement of Nationally Determined Contributions. Embedding interoperability into legal and regulatory frameworks also leads to more efficient digitalized service delivery that includes the green benefits of less paper use and fewer of the greenhouse gas emissions associated with travel. Moreover, recognizing that e-waste from electronic equipment will rise as countries digitalize the public sector, it is important that policy makers put in place e-waste management regulations. Incorporating all of these considerations into existing legal and regulatory frameworks helps to create an enabling environment that promotes an effective green digital transformation.

**In order to support effective greening GovTech implementation, policy levers are also important institutional mechanisms to ensure that the digital transformation of the public sector threads a green path by default.** The budgeting process should play a critical role in coordinating resources and identifying synergies for the green and digital transitions. The pre-evaluation of investments should explicitly consider the environmental impact of ICT/digital government projects to ensure their alignment with the green digital agenda. Government Public Procurement should also be another important tool to promote the use of greener products and services, including ICT. An effective monitoring and evaluation system should also be strategic way to systematically combine GovTech with climate change considerations and further highlight how GovTech can contribute to the green agenda.

**Although skills and competences are a fundamental building block for sound change management, there is no one pathway that governments can use to start the uptake of green digital talent.** Countries can choose their own pathway by examining their culture's disposition to change, their level of education and awareness on the topic, and their market's readiness for change. Enabling public sector leadership to develop a value-driven culture and to create responsive and adaptive public service systems. An emphasis should be placed on innovation (incorporating green digital competencies into awareness-raising efforts), data-driven decision making, and strategic leadership to design a future public sector workforce that is environmentally conscious. Green digital literacy should be a policy priority considering that green digital competencies will act as fundamental enablers for the successful implementation of green digital transformation policies.

**Building on the framework presented above, the ultimate goal of the current guidance note is to support policy makers and implementers leveraging digital technologies to build a greener public sector, providing useful advice on the importance of leadership and commitment to implement coordinated GovTech and Green policies.** As the digital transformation accelerates and the climate emergency poses severe threats to countries across the globe, the importance of greening GovTech policies increases. Considering the climate emergency already underway, the increasingly omnipresent nature of digital technologies, and government's fundamental role in the economy and society, greening GovTech is a critical priority that needs to be embraced across all sectors and levels of government.



# >>> Introduction

**As the world goes digital and the planet faces a climate emergency, the potential of technology to solve the climate change problem is gaining currency.** Efforts to reduce carbon emissions and improve resiliency to climate change are underway, but they require substantial economic, social, and technological transformations. The digital transition has the capacity to be part of the solution—but also part of the problem if not implemented sustainably. Digital technologies are on the front line of strategies to reduce the carbon footprint, given their capacity to improve efficiency and optimize resource consumption. According to the World Economic Forum (WEF), digital solutions can reduce greenhouse gas (GHG) emissions by 15–20 percent,<sup>1</sup> thereby limiting the impacts of climate change. The 2015 Paris Agreement on Climate Change highlights “...the importance of fully realizing technology development and transfer in order to improve resilience to climate change and to reduce greenhouse gas emissions.”<sup>2</sup> The World Bank’s Climate Change Action Plan emphasizes that “...digital technologies offer significant opportunities to improve efficiency; reduce congestion, air pollution, and GHG emissions; and transform how people and goods move around the world.” Nevertheless, the increased demand for digital infrastructure and devices is also generating concerns about energy consumption and e-waste.

**Grasping the enormity of this moment, governments worldwide are prioritizing and mobilizing resources to support both green and digital transitions in the public sector and to spur innovations in the private sector to help countries meet their climate change targets and commitments.** Digitalization allows for more paperless and interconnected public administration, in which complex and agile administrative procedures can be developed with rationalized resource consumption. The digital transformation also enables public services to be provided remotely, seamlessly, and around the clock, thereby reducing the carbon footprint from transport, resources, and energy. In fact, a higher digital adoption by government is correlated with lower CO<sub>2</sub> emissions and lower energy intensity (World Bank, forthcoming(b)). For example, the Estonian government estimates that its e-Estonia systems save the equivalent of one working week for the working population,<sup>3</sup> and its digital identity system saves 2 percent of Gross Domestic Product (GDP) per year, with a discernable carbon footprint reduction (Burke 2018). The Serbian government estimates that by going digital, the country has saved 180 million sheets of paper (almost 18,000 trees, a whole forest) and 76 million liters of water, over the past four years.<sup>4</sup> In fact, digital adoption within government builds socioeconomic resilience and is associated with lower costs for firms and households stemming from climate change, suggesting that the public sector has a positive role in reducing societal vulnerability by adopting GovTech (World Bank, forthcoming(b)). These are clear examples of how green and digital transitions in the public sector can reinforce each other.

**However, GovTech reforms can also contribute to increased carbon emissions if the potential environmental impact is not assessed and adequately addressed at the planning and design stages.** For instance, the increase in digital infrastructure can easily lead to increases in energy consumption or ICT waste, generating adverse environmental impacts and indicating that the green and digital transitions can undermine each other if not implemented coherently. The UK's Government Digital Service, for example, the public sector organization responsible for digital government policy, estimates that the electricity consumption of its hosting providers required to operate its digital services is equivalent to the CO<sub>2</sub> produced by the energy use of 400 homes every year or the fuel burned by 770 cars on average in a year.<sup>5</sup> Additionally, digitalization can generate a significant rebound effect. For instance, although the efficiency gains from digital public services seem to be clear, they can be outweighed by the increased availability and consequent rising consumption of those services (Santarius 2017). Adopting a green and system-thinking approach and

supporting whole-of-government<sup>6</sup> mechanisms are therefore critical to ensuring that digitally enabled public sectors can contribute to long-term strategies that promote individual well-being and a healthy business environment and are also environmentally sustainable.

**The public sector plays a strategic role in embracing and enhancing a green digital transition in the way it provides services, creates economic opportunities, and runs the bureaucracy.** Digital technologies have a critical role in fostering efficiency and responsiveness in public services. Given the substantial weight of public sectors in national and local economies, their green digitalization can contribute to reducing the carbon footprint. Public sectors also have an important role in influencing nongovernment stakeholders and spheres by shaping attitudes and behaviors and demonstrating how to embrace a green and digital transformation. Public sector reforms in these areas thus have an outreach beyond the government. However, since digitalization can sometimes exacerbate existing socioeconomic inequalities (World Bank 2016b), public sectors have a strong responsibility to address the resulting digital divide by facilitating social inclusion and equitable access and development. A green digital transition in the public sector is required to be just and inclusive by default, guaranteeing that no one is left behind and that benefits are shared equitably.

**Green and digital transitions are often implemented in a siloed way, missing the opportunity to coordinate the two efforts.** The experience of a small number of countries indicates that connecting both policy agendas is an increasing priority. For instance, Denmark's recently approved digital strategy embraces different green objectives as a priority (Denmark 2022). Korea also has different initiatives underway to green its GovTech (Khoury and Lee 2022), and the European Commission's (EC) new Digital Strategy assigns substantial relevance to sustaining a green infrastructure (EC 2022a). However, looking at the experience of digital government/GovTech agendas worldwide, the link with green goals is clearly still a secondary priority, rarely or even never mentioned. Since the green and digital transitions are globally recognized as high priorities, governments should ensure that the two agendas are not implemented separately. Successfully managing the alignment of these two transitions is critical to a sustainable, cohesive, and just future.

**However, adopting green GovTech approaches generates challenges that depend on a country's level of digital maturity.** More digitally mature public sectors might struggle to update existing and well-entrenched digital systems and require substantial technical effort and sunk costs. Less

digitally mature public sectors might benefit by leapfrogging over outdated technology and avoiding the legacy challenges faced by their more mature peers, though the challenges in terms of change management, behavioral change, and personnel capacity are often considerable. At an infrastructure level, countries with more mature electricity grids are better positioned to reap the benefits of digitalization, while many developing countries with chronic grid unreliability and poor-performing electricity utilities face additional obstacles.

## 1.1 Scope, Objective and Method of the Guidance Note

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**Several questions have emerged on the desirable synergies between the green and digital agendas:** (i) How can the digitalization of governments contribute to mitigation and adaptation goals? (ii) What is the role of digital solutions in public sector adaptation and resilience? (iii) How can the adoption of digital approaches that do not increase the carbon footprint be secured? Although digital technologies have a fundamental role in tackling climate change, there is limited experience or shared strategic orientation on how GovTech can embrace this goal and on the building blocks needed to achieve it, such as: (1) What are the costs and opportunities of embracing these transitions? (2) How can a shift from declining to emerging jobs in the public sector be managed? Although new questions continually arise, a consensus has nevertheless emerged on the need for a proactive and integrated management of the twin transitions that are already underway.<sup>7</sup>

**Against the backdrop of a global climate emergency, the objective of this Greening Public Administration with GovTech Guidance Note is to provide useful advice to policy makers and practitioners underlining adequate leadership and commitment are crucial to implement coordinated GovTech and Green policies.** It responds to the demand from government officials in client countries on how to green GovTech projects and unlock the potential of technology to green the public sector. The note analyzes how governments can address the environmental emergency by considering climate concerns in the design of GovTech approaches to public sector modernization and service delivery. It discusses the importance of a stronger link between GovTech reforms and climate change strategies/commitments and simultaneously explores how GovTech policies and initiatives can themselves be reformed to be more responsive to climate change. The note underlines that some aspects of GovTech have connections with the Paris

Agreement, such as the benefits of digital communication and data exchange in terms of efficiency and reduced paper and transport use. It also highlights other aspects of GovTech with clear similarities, such as data center efficiency and green digital procurement. Combining both of these angles is one of the features of the greening GovTech framework outlined below (see section 1.2).

**For conceptual clarity, “green GovTech” can be defined as GovTech policies, initiatives, and/or solutions that embrace environmental considerations by design, maximizing the green benefits and considering the potential negative impacts.** This concept is naturally linked to the World Bank definition of GovTech that “emphasizes three aspects of public sector modernization: citizen-centric public services that are universally accessible, a whole-of-government approach to digital government transformation, and simple, efficient and transparent government systems” (World Bank 2020a). The green GovTech definition should also be understood in relation to other important concepts, such as decarbonization, adaptation, mitigation, and resilience (see Annex 1).

**The note’s overall objective is to map and articulate how the digital transformation of government can contribute to the cross-cutting policy effort toward net-zero carbon emissions.** The note should also serve as an important knowledge piece for other GovTech stakeholders, including the private sector, academia, and civil society. The target audience is senior GovTech officials of both developed and developing countries, as well as managers of public governance projects in different geographic areas. The note will focus on greening GovTech in line with the conceptual definition presented above. The note will not cover the broader subject of GovTech for the green agenda, that is, how digital technologies and data used by government can be embraced to support the broader economy and society to mitigate and adapt to climate change. Given the Bank’s considerable work on data analytics for informed decision making, open government, and CivicTech, this note does not cover those topics.

**The project team combined different research methods to properly identify the trends and practices in connecting the green and digital transitions of the public sector.** An extensive literature review was done, dedicating particular attention to the relevant work already developed or forthcoming at the World Bank, namely from the Digital Development Practice and the Climate Change Group. The work of other international organizations, as well as academia, IT consultancy firms, and think tanks, was also considered, and an analysis of the World Bank’s Climate Change Institutional



Assessments (CCIAs) and the GovTech project database was carried out. Interviews with TTLs were conducted to further understand the dynamics and complexity of including climate change mitigation and adaptation in GovTech project design and implementation, and with senior government officials and IT providers to ascertain the existing supply of and demand for carbon-reduced/free GovTech solutions and the challenge of reconciling development and environmental policy concerns. Data analysis based on GovTech international measurement instruments, such as the World Bank GovTech Maturity Index (GTMI), the UN e-Government Survey, and the OECD Digital Government Index, was carried out to identify the maturity of governments' green digital transitions. This note also considers additional primary data on the green costs and benefits of different types of administrative procedures and a wider range of qualitative information beyond World Bank projects.

## 1.2 A Framework of Analysis for Greening GovTech

Connecting the digital and green transformations of the public sector requires a framework that can support policy makers in navigating the different dimensions. A framework able to connect different pieces of the policy puzzle to determine which green and digital efforts are managed in parallel and which result in lost synergies is required. The framework should support strategic and coordinated efforts, enabling governments to secure the public interest while navigating the fast pace of green and digital innovation. A greening GovTech framework should also focus on a coherent

and sustainable application by national and subnational governments in both digitally mature and digitally less-developed countries.

**Different entities and stakeholders have been increasingly working to bridge the gap between digital and green.** Within the World Bank, the Digital Development Global Practice is working to operationalize and support digital development opportunities for climate change. Priority is being directed to (i) climate-resilient digital infrastructure; (ii) the reduction of GHG emissions from digital technologies; and (iii) the leveraging of digital technologies for climate change adaptation and mitigation. However, the focus there is on digital economy and digital society issues, not specifically GovTech. The same is true for the work of several other international organizations, such as the UN, ITU, and OECD. Digital and green are the two main priorities of the European Union's (EU) Recovery and Resilience Facility, which is committed to mitigating the negative economic and social impact of COVID-19 and will also contribute to the EU's green and digital transition.<sup>8</sup> Still, the topic of greening GovTech is not generally covered.

**The greening GovTech framework illustrated in Figure 1 builds on previous efforts and focuses on the various dimensions, particularly on the “what” and the “how.”** It reflects the difference between what can be considered policies, initiatives, or solutions that have a relevant impact on greening GovTech (the “what”), and how to implement them by supporting a whole-of-government approach (the “how”). The framework provides a conceptual alignment for policy design, implementation, development, and monitoring in these areas, mapping and making sense of the relations between the various policy subjects.

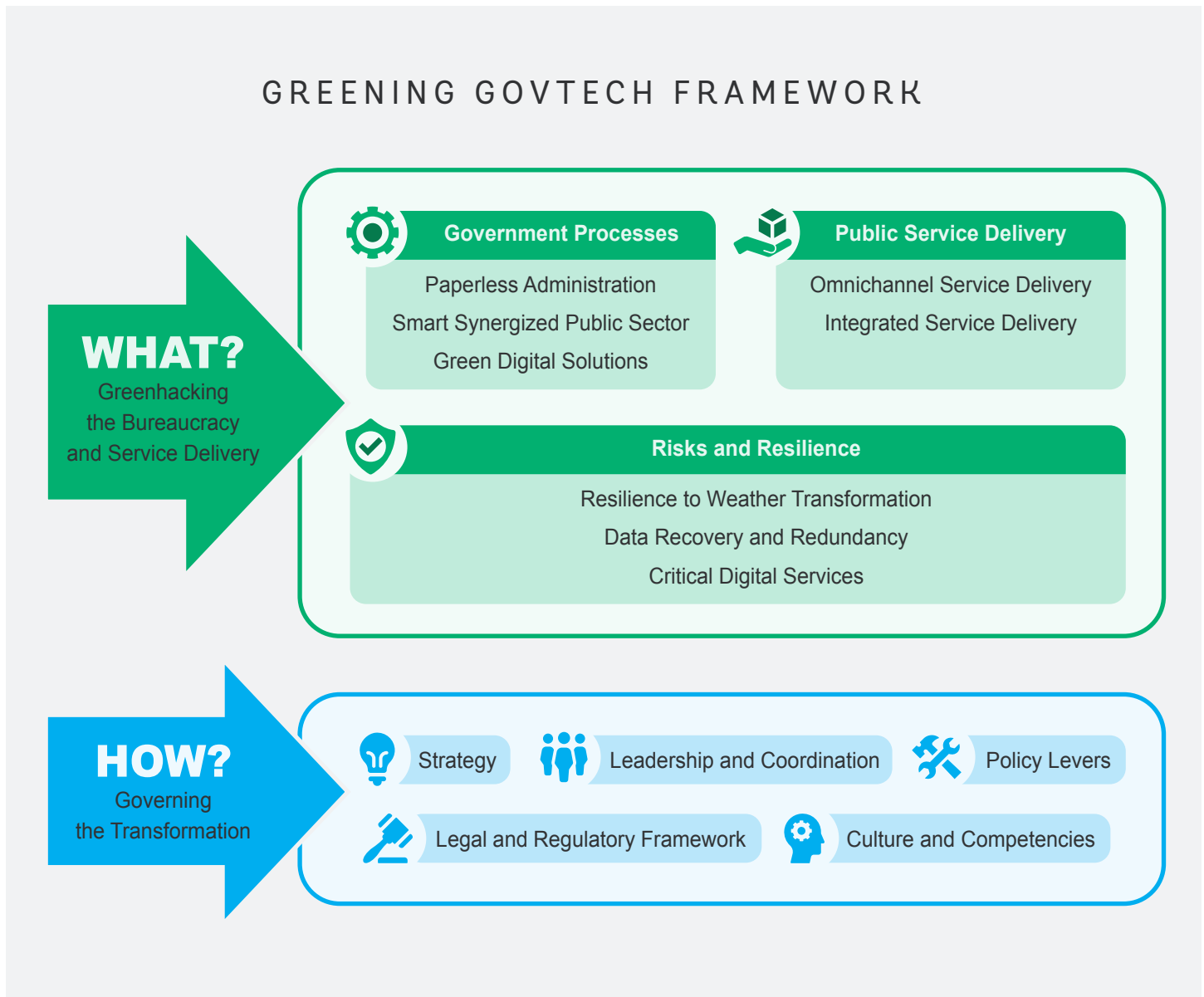


The first dimension of the framework starts by demonstrating the need to increasingly greenhack the bureaucracy to guarantee that government processes (back-office) properly link the green and digital transitions (see section 2.2). One subdimension is dedicated to the benefits of paperless procedures due to the progressive digitalization of most back-office activities, and another is devoted to the

improved administrative efficiency and productivity from more interconnected, interoperable, and data-driven systems. This latter subdimension also includes the effects of working from home. The third topic covered in this back-office dimension is the role of acquiring and using green GovTech solutions, such as the adoption of cloud computing or the reduction of e-waste.

> > >

FIGURE 1 - Greening of GovTech: Framework of Analysis



Source: Authors.

**The second dimension concentrates on the front-office part of policy action: service design and delivery** (see section 2.3). It focuses on the impact of digital service delivery, which enables citizens and companies to access services remotely and around the clock, thus avoiding the transportation involved in physical visits to public service entities and promoting efficiency through the resulting energy and resource savings. It will also cover the benefits of integrated digital services, bringing efficient and proactive service delivery through automated and data-driven systems. A refined alignment between supply and demand can be achieved, avoiding the waste of effort and resources when several public sector organizations run service life cycles in parallel.

**The third dimension is dedicated to the important contribution digital technologies can make to managing risks and improving resilience to climate change** (see section 2.4). Digital infrastructures should be resilient to weather transformation (e.g., higher temperatures, floods, storms), hence the need for climate change adaptation.<sup>9</sup> This dimension also underlines the relevance of data recovery and redundancy mechanisms that can enable public administrations to safeguard their information, documentation, and data in the event of natural catastrophes (e.g., cloud computing is particularly relevant in these scenarios). Finally, this third dimension will also identify and reinforce the critical services that should be kept operational in case of natural or other catastrophes.

**In addition to identifying the key factors involved in designing and mapping GovTech, it is prudent to consider the institutional mechanisms enabling effective implementation (“the how”).** Five subdimensions are outlined for governing the green digital transformation in the public sector and securing a whole-of-government approach in line with the World Bank’s “Tech Savvy” report (World Bank 2022d) and the OECD’s “E-Leaders Handbook on the Governance of Digital Government” (OECD 2021b). It starts by underlining the importance of a strategy that connects the vision, goals, and initiatives of digital government with the objectives and requirements of a green transition, overcoming possible siloed scenarios where these two policy priorities are managed in parallel (see section 3.2). It then emphasizes the relevance of institutional leadership and coordination to ensure that these objectives can be carried out by national public sector institutions and by the committees/councils of senior government officials that typically coordinate an effective whole-of-government process (see section 3.3).

**An updated legal and regulatory framework is another critical policy requirement for the green digital transition,**

**as it provides the required formal pillars of policies to be implemented.** Its materialization can differ substantially depending on contextual factors that are country specific, and the existence of a more legalistic or consensus-based culture in a country can determine the regulatory range or depth. At the same time, the legal and regulatory framework must be continuously adapted and improved (see section 3.4).

**A particularly relevant subdimension in the framework focuses on policy levers, the concrete institutional mechanisms necessary to enforce green and digital policy implementation across different sectors and levels of government.** Whether through budgeting coordination, strategic procurement frameworks, centralized pre-evaluations of investments, or sound monitoring and evaluation (M&E) mechanisms, governments use policy levers to guarantee that the standards and guidelines in place lead to transversely coherent and sustainable policy implementation. Although these policy levers are not exclusively used to push for a green digital transformation, their applicability in these specific areas can be a strong asset for public sectors in tackling the fast-paced transformations underway (see section 3.5).

**Last but not least, a green digital culture and competencies in the public sector are foundational pillars of any green digital transformation.** This subdimension underlines that consistent efforts are required to guarantee that green GovTech is not viewed as a technically specialized issue, but as a priority that needs to be embedded in all processes, services, and operations. This cultural shift needs to be recognized and supported across the civil service. Additionally, since competencies are the backbone of the ongoing reforms, public sectors should prioritize the development of professional digital skills with a green angle to proactively manage any observed and expected skill gaps (see section 3.6).

**The framework represented in Figure 1 should be responsive to the fast-paced innovations and changes in these areas.** It is not meant to be a definitive approach to greening GovTech, but first and foremost a conceptual effort to support policy development and analysis. Its application will determine future iterations in order to capture the evolving needs of policy makers and practitioners and the emerging green digital trends. Following the methodological choices mentioned in this Introduction, the framework does not, as noted, individually highlight such topics as open government, data analytics, and CivicTech, which have been well detailed in other Bank reports. Nevertheless, as these are cross-cutting elements in a whole-of-government approach, they are mentioned in various sections of Chapter 3.



# Greenhacking the Bureaucracy and Service Delivery Using GovTech Solutions

## 2.1 Introduction

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**This chapter helps to identify green friendly GovTech policy approaches through the development of a framework of analysis.** The green impacts of the integration of digital technologies into the economy and society have been highlighted in recent decades, and the public sector has been a part of this focus. The green benefits brought by digital and data have been persistently emphasized by both policy makers and IT producers and practitioners. However, in the absence of explicitly measured outcomes, this positive link between GovTech and decarbonization is not always clear. Although specific examples can be easily flagged—less paper consumption, lower energy and transportation costs, fewer resources mobilized per public service delivered—there is still a considerable need to substantiate the connections and causality between digitalization and the added benefits of climate action.<sup>10</sup> Additionally, the negative impacts of digitalization in terms of energy consumption or increased production of IT waste due to the limited life cycle and constant innovation that surrounds IT products raise legitimate concerns about the carbonization effects of the digital revolution underway.

This guidance note understands *greenhacking the bureaucracy* as the development of innovative and disruptive GovTech prototypes to address climate change challenges, as well as finding new ways in bureaucracy to develop environmentally responsible GovTech solutions envisaging large impact with modest investments and changes in behavior.

In this sense, the current chapter is structured around three areas of analysis:

- 1. Modernization of Government Processes.** The digitalization of internal government processes and operations might reduce the consumption of paper, energy, and transport. A paperless and interconnected public sector should respond more efficiently and with fewer resources to citizen and business demands. Automation, interoperability, and data-driven approaches in public sector management should also determine increasing rates of efficiency and effectiveness, allowing the public sector to do more with less. The adoption of remote working and cloud computing can also help reduce the public sector's carbon footprint. However, digitalization can lead to the need for more IT equipment and higher energy consumption, pointing to its environmental impacts. Which GovTech approaches most favor a green friendly government bureaucracy?
- 2. Citizen-Centered Service Delivery.** Digitalization allows for the remote delivery of services, which can generate substantial efficiency gains for government, businesses, and individuals. Public services provided remotely through the internet can be available around the clock and in every geographic location, minimizing the need for physical service centers and transportation. Digital technologies and data can also enable customized service. However, poorly designed citizen services can lead to wasted resources that contribute to increased carbon emissions. Which service designs and delivery approaches properly adapt to climate change and decarbonization and effectively meet citizen needs?
- 3. GovTech Resilience to Climate Change Risks.** GovTech solutions should be able to resist extreme weather events, and recovery functions should prevent data loss and prepare information systems for redundancy to climate change. Digital services also increase individual and community resilience to natural catastrophes and other weather-related emergencies. How can sound GovTech adaptation approaches to vulnerability contexts increasingly driven by climate change be secured?

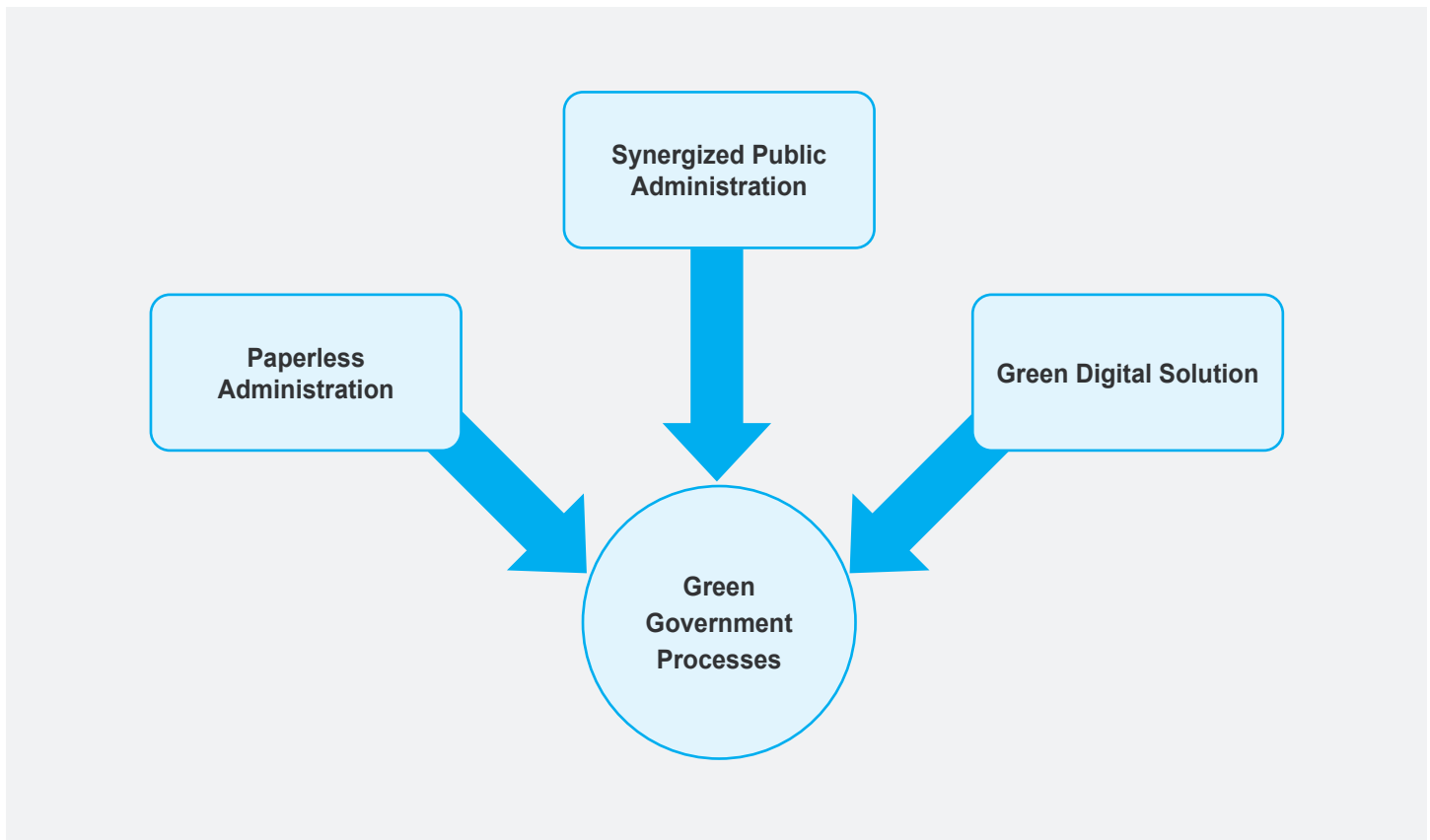
## 2.2 Modernization of Government Processes

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**The twin goals of increasing both the efficiency and effectiveness of the public sector have been at the center of modernization efforts over time.** The sector's digital transformation, which began in most countries more than 25 years ago, is part of this process. There is a wide consensus on and overwhelming evidence of the fact that a digital transformation can be pivotal in modernizing the public sector, both its front-end services and back-office operations,<sup>11</sup> which include public financial management (PFM), human resource management, tax administration, public procurement, and public investment management. Nevertheless, government modernization efforts have not always given adequate attention to environmental goals in their public sector reform strategies. Political and administrative pressures often overemphasize efficiency and cost-effectiveness, in part because of the difficulties in formally assessing and monitoring the environmental and climate impacts.

**This section will look at three trends of current modernization efforts and highlight where there is potential to improve and accelerate the greening of ongoing public sector digital transformations.** The first trend emphasizes the benefits of less paper consumption and the move toward a paperless public sector. The second describes the potential to increase the overall efficiency and effectiveness of public operations through an increasingly interoperable and whole-of-government modernization approach that has positive spillover effects on key green evaluation variables, such as the reduced need for transportation. The third trend involves the latest innovations in green digitalization that are often developed through a collaboration between the private and public sectors with the primary goal of reducing the government's energy consumption, particularly in its ICT services.

FIGURE 2 - Highlighted Trends that Support Greening Government Processes



Source: Authors.

### 2.2.1 Paperless Public Administration

Although paper consumption during the first phase of the automatization process often remains constant—and in some cases might even increase due to excessive printing—it is safe to assume that paper use will decrease significantly with increased digitalization.<sup>12</sup>

In the transition’s early phase, paper use is often still driven by legacy paper-based business procedures, while digital solutions tend to support the administrative functions. These legacy procedures might rely, for example, on traditional paper-based application forms, receipts, signatures, approval certifications, filing, record keeping, and audit standards. More advanced forms of digitalization, on the other hand, can be based on redesigned or newly designed interoperable digital business procedures that require no or only minimal paper consumption.

**Paperless operations are an environmental goal because paper has a considerable carbon footprint.** First, carbon-absorbing trees are eliminated from the ecosystem, and second, the paper manufacturing process requires large amounts of water and energy. Moving from a paper-based analog bureaucracy to a modern digital one would thus have a significant environmental impact. The example from Serbia was cited above: by going digital, the country has saved 180 million sheets of paper (almost 18,000 trees), over the past four years.<sup>13</sup> Box 1 describes the approach taken to assess reductions in paper consumption in a World Bank–funded project in Bangladesh. The digitalization interventions have already contributed to a savings of 1.1 billion pieces of paper. The total number of pages to be saved under the original project with additional financing is 10.3 billion.<sup>14</sup>

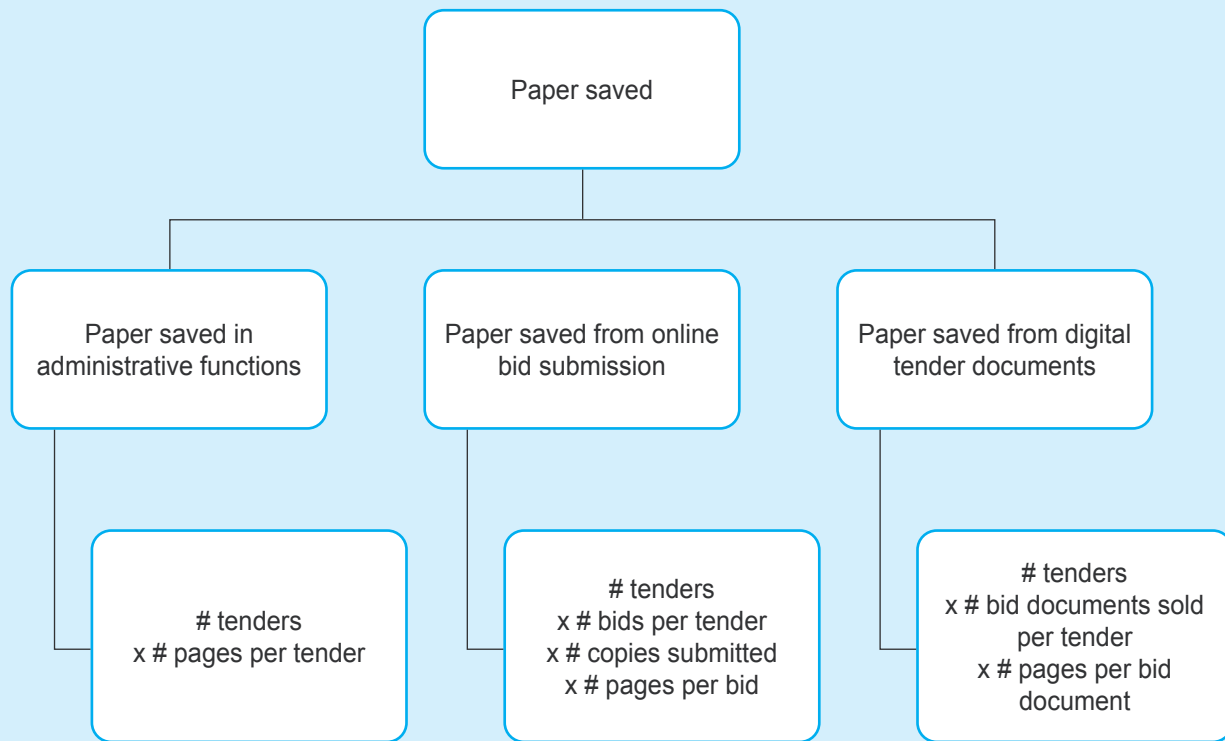
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### BOX 1 - Assessing the Reduced Paper Consumption of Digital Public Financial Management in Bangladesh

To assess the reduced paper consumption through digital procurement in a World Bank project in Bangladesh, the Task Teams used transaction data and procurement indicators. The image below briefly illustrates the key steps and data inputs for the calculations made.

> > >

FIGURE 3 - Key Steps and Data Inputs for the Calculations



Source: Inputs shared by the World Bank Procurement team in Bangladesh.

At the same time, the transformation from paper-based analog to e-government systems also entails offsetting environmental and climate effects, as ICT-enabled administrative procedures use increasingly higher amounts of energy and ICT hardware.<sup>15</sup> ICT hardware production also uses a successively growing quantity of natural resources, like rare minerals. However, obtaining robust data that can help quantify the overall effects is very challenging, especially on the country and global levels. A forthcoming volume of this guidance note will discuss in detail the envisioned approach to measuring the net GovTech contributions to climate change.

### 2.2.2 A Synergized Public Sector

The ongoing digital transformation does not stop at the deployment of silo-based e-government solutions

but continually moves toward whole-of-government and integrated systems. Interoperability frameworks are a key enabler of GovTech as they reduce system boundaries between government agencies by setting standards and guidelines across government for the seamless exchange of information and communication. Instead of each government entity working in isolation, departments across government levels and sectors can work together to achieve their joint goals. Interoperable systems enable data sharing at a much larger scale and in a much faster and easier way, leading to significant efficiency gains. Estonia's interoperable e-Estonia systems, as noted above, have saved the equivalent of one work week and 2 percent of GDP per year (Burke 2018). Reduced back-office processing and handling times, in combination with fewer errors, lead to greater cost efficiency

and potentially reduced carbon emissions with each bureaucratic operation or service case.<sup>16</sup>

**Mobile government (M-Government) solutions, which are often closely linked to interoperability frameworks, also contain a significant potential for greening GovTech.**<sup>17</sup>

Especially in the rural areas of less-developed countries, government entities can face challenges in accessing fixed and reliable IT networks to conduct government-to-government but also government-to-citizen business procedures. M-Government solutions offer a cost-effective and efficient

way to overcome these challenges by utilizing existing mobile networks and mobile devices, such as mobile phones and tablets. Through interoperable mobile applications with fixed centralized ICT operations, back-office government-to-government operations, as well as service delivery and citizen engagement, can be improved. As demonstrated through a project supported by the German government in Tanzania, these M-Government solutions can also help diminish the carbon footprint by reducing road travel while at the same time improving taxpayer compliance and local government revenues (see Box 2).

> > >

## **BOX 2 - Transportation Reduction through Inter-Operable M-Government Solutions**

Digital tax payments have eliminated the need for tiresome journeys and given Tanzanian municipalities greater revenue for education, health, and infrastructure.

A day trip to the tax office? Until recently, this was a reality for people living in rural areas in Tanzania, as they had to travel to a local government office to pay their taxes. Depending on where they lived, this meant traveling up to 100 kilometers, a full day's journey. In the Longido and Ngorongoro districts, this is now a thing of the past. A mobile payment system—similar to electronic payment by card—has been introduced that has significantly reduced the effort and costs involved in paying taxes. Citizens can now conveniently pay their taxes close to home—and to people they trust, as local employees are responsible for collecting the payments. This makes people more willing to pay taxes, and the tax revenue of the municipalities has increased as a result.

### **Digital Administration: More Money for Education, Water, and Health**

On behalf of the German Federal Ministry for Economic Cooperation and Development (BMZ), the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH worked closely with nine local governments to implement the system. GIZ provided them with 103 mobile devices and trained staff on how to use the technology.

Revenues from local taxes and market and license fees now give the municipalities an important financial basis from which to invest in education, water supply, and health care. Around 40 percent of the revenues are used for these purposes.

“Our infrastructure and safety have improved,” says local shop owner Tyson Huho from the Ngorongoro district. The concept has caught on and is now being expanded. In 2019, the Tanzanian government procured more than 7,000 mobile devices. A total of 185 local government authorities in Tanzania are now using these devices with the help of an accompanying guide developed by GIZ.

Source: GIZ website: <https://www.giz.de/en/mediacenter/98255.html>



**Remote work is another important feature.** More home and remote work, in combination with more videoconferencing, should translate into reduced transport needs and thus reduced fossil fuel consumption and GHG emissions by cars, trains, busses, and planes. These benefits became very visible during the COVID-19 pandemic when, for example, in the United Kingdom, almost 47 percent of people with a job reported that they had done at least some work from home. Most UK residents (70 percent) think that workers will never go back to the office at rates before the pandemic, and 60 percent continue to prefer working from home at least some of the time.<sup>18</sup> This trend can lead to significant reductions in the carbon footprint through reduced transport emissions. A study by the International Energy Agency (IEA) highlights that 80 million tons of carbon emissions (an amount comparable to the entire annual CO<sub>2</sub> emissions of Chile) could be saved if a fifth of all jobs globally could be done from home for three days a week.<sup>19</sup> Governments can develop their own home, remote, or hybrid work policies, allowing for their respective digitalization status and specific needs for an office presence. The EC, which plans to retain remote working as a standard practice, is one example.<sup>20</sup> Another is Malta, which launched a new remote working policy for public servants in 2021.<sup>21</sup>

## 2.2.3 Green Digital Solutions

### 2.2.3.1 ELECTRICITY CONSUMPTION AND GHG EMISSIONS

**Various studies show increased electricity consumption and GHG emissions by the world's ICT sectors and underline the possibility of an ever more dramatic increase globally, indicating that adequate mitigation measures are required.**<sup>22</sup> The share of ICT in global electricity consumption currently stands at about 10 percent. Even if there is a

significant reduction in the energy consumption of individual devices, projections suggest a growing consumption of increasingly resource-intensive hardware production, clouds (data centers), and data transfer systems.<sup>23</sup> It is expected that newer and fast accelerating digitalization trends, such as blockchain and artificial intelligence (AI), coupled with increasing numbers of digitalized business processes and data centers, will push the demand for energy up even further.

**GHG emissions from the ITC sector are also expected to increase in the coming years if effective mitigation actions are not taken.** Currently, roughly 1.5–4 percent of global emissions are related to digital infrastructure and applications, a level on par with the airline industry.<sup>24</sup> Some studies have forecasted that the ICT sector's share in overall GHG emissions could double to up to 8 percent in 2025, though others predict a more moderate increase of about 6–7 percent by 2040.<sup>25</sup> In absolute terms, some studies suggest an increase in GHG emissions from ICT from 730 MtCO<sub>2</sub> equivalent in 2020 to 800 MtCO<sub>2</sub> equivalent in 2030.<sup>26</sup> Although there is no consensus on estimates, it is evident that government and private sector initiatives are needed to change this emissions trend to reduce ICT's carbon footprint.<sup>27</sup> Actions are therefore needed to a) expand the use of renewable energy to generate electricity and b) promote the utilization of more energy-efficient green digital solutions (data centers, ICT hard and software, etc.). Although policies to expand the use of renewable energy sources should be a centerpiece of any green public energy strategy, this note focuses on what public sectors can do to reduce the electricity consumption of their ICT operations by greening their GovTech.<sup>28</sup> In some cases, governments are a key driving force behind the digitalization drive and consequently its accelerating consumption of energy and natural resources.



**Several governments and private sector actors decided early on to mitigate against adverse environmental and climate impacts by launching green IT initiatives.**

Examples of early public sector green IT initiatives can be found in Germany in 2008 and the United Kingdom in 2011.<sup>29</sup> These programs were somewhat limited in scope and reach

but paved the way for experimentation and innovation. In cooperation with private sector green IT initiatives, these public sector systems developed promising ways to optimize the energy performance of data centers, devices, architectures, applications, and digital services in general.



> > >

**BOX 3 - Reducing Energy Consumption and GHG Emissions: The Green IT Initiative of the German Federal Government**

The German federal government's *Green IT Initiative* started in 2008 and has just been extended to the end of 2027. The main aim of the initiative is to reduce energy consumption and GHG emissions in the German federal administration. Some states in Germany run similar initiatives, like Baden-Wuerttemberg.

The annual energy consumption of the entire ICT sector in Germany reached 58.4 TWh (terawatt hours) in 2019, which is equivalent to the annual electricity consumption of the whole of Switzerland. The German government estimates that the use of new technologies, such as blockchain, cloud computing, and 5G, will lead to a continued rise in electricity consumption and emissions if not mitigated early on. For this reason, the federal administration is trying to design and operate its own IT infrastructure so that it contributes to climate protection as much as possible. The federal government is convinced that if used correctly, digitization can help to reduce the consumption of energy and natural resources.

The *Green IT Initiative* at the federal level has the following three objectives:

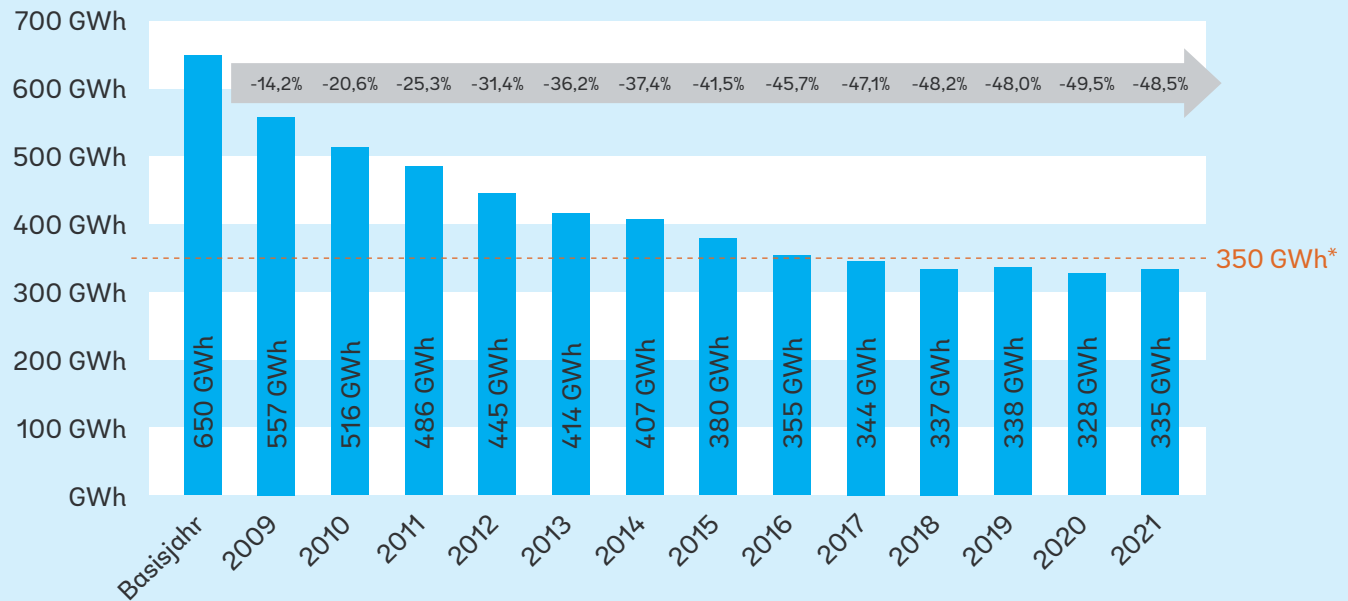
- Despite further performance improvements, energy consumption of IT operations should not exceed the target value of 350 GWh/year.
- Sustainable procurement (meaning also green) of IT hardware and services is to be implemented.
- For all major new IT investments, including data centers, the inclusion of energy consumption over the entire life cycle is to be included in the procurement criteria.

As part of its operations, the Green IT Initiative set up a system of regular monitoring and reporting and the results are very convincing:

- Since the initiative was founded, energy consumption has fallen by around 49 percent, from 649.65 GWh in 2008 to 334.54 GWh in 2021.
- Based on its monitoring system, the German government estimates a reduction in energy consumption between 2008 and 2020 of 3.6 TWh of energy and 1.8 Mt of GHG emissions. An additional benefit is an estimated budgetary saving of €546 million.

> > >

**FIGURE 4 - Total Energy Consumption of Federal IT 2008–21**



Source: Germany, Government of, "[Green-IT-Initiative des Bundes](#)," Federal Ministry for the Environment, Nature Conservation, Nuclear Safety and Consumer Protection (BMUV); German Federal IT Rat, "Beschluss 5/22 Green-IT-Initiative des Bundes," 2022; BMUV, "[Green-IT-Initiative des Bundes: Green-IT in Zeiten des digitalen Wandels](#)," 2020 ([bmu.de](#)); and Ministry of the Environment, Climate and Energy Baden-Württemberg website: [Startseite Green IT \(baden-wuerttemberg.de\)](#).

### **2.2.3.2 THE GOVTECH APPROACH PROMOTES GREEN DIGITAL SOLUTIONS**

Although Green IT initiatives often differ in reach, focus, and organizational approach, several solutions and instruments have already been developed and tested and are available for integration and application as part a green GovTech strategy. A selection of possible green digital solutions and instruments is discussed below: green data center, cloud solutions and IT architecture, hardware, green software solutions and dark data management.

#### **2.2.3.2.1 Green Data Centers**

Data centers are becoming an increasingly important part of government modernization efforts. Data centers host all the elements of ICT, including server and data storage. Given their increasing importance in the digitalization process, they also represent an already high and fast-growing share of IT's overall energy consumption and carbon footprint. The good news is that increasingly greener data centers have recently been developed and put into use.<sup>30</sup> Critical and proven levers

to improve the energy efficiency and reduce the environmental impact of data centers are:

- Location of the data centers (outside temperature, proximity to networks)
- Energy source for the operation (green/renewable energy)
- Degree of use of certified green hardware (green labels Korea/Germany)
- Server virtualization and server load
- Utilization of heat given off by servers (waste heat), and so on
- Material Recycling Rule
- Cooling system optimization through AI

In line with political priorities, some countries, for example Germany, Malaysia, and Denmark, have already focused on the carbon emissions and electricity savings potential of the green data center used by the public sector<sup>31</sup> and have issued mandatory standards or specifications for their use. Hong Kong has issued a comprehensive Green Data Centres Practice Guide.<sup>32</sup>

#### BOX 4 - Example: Cold Aisle Design of Data Center Reduces Energy Consumption

As part of the Green IT Initiative of the state of Baden-Wuerttemberg in Germany, the central IT service provider for the state administration, BITBW, improved the energy efficiency of its data centers by introducing a cold aisle design in its server rooms in 2018. The impact was substantial, as an estimated 10 percent less energy is required for cooling. With a consumption of 1,120 megawatt hours in 2017, the energy savings amount to 100 megawatt hours per year.

Source: State of Baden-Wuerttemberg - [BITBW spart Energie durch Kaltgangeinhausung](#) - [BITBW spart Energie durch Kaltgangeinhausung](#) - [Green IT \(baden-wuerttemberg.de\)](#).

#### 2.2.3.2.2 Cloud Solutions and IT Architecture

**Cloud solutions offer great potential for the increased energy efficiency of IT systems as they can bundle IT services and operations away from less efficient on-site or smaller data centers to more efficiently designed and managed larger data centers.**<sup>33</sup> Cloud solutions can significantly reduce energy consumption, waste, and GHG emissions. According to Microsoft Corporation and WSP Global Inc., cloud computing on the Microsoft cloud services can be 93 percent more energy efficient and can result in up to 98 percent lower GHG emissions than on-premises data centers.<sup>34</sup>

**Microsoft and WSP attribute those savings to four key factors:**

- **IT operational efficiency:** Larger cloud services can operate with greater efficiency than smaller, on-premise deployments thanks to large-scale dynamic provisioning and multi-tenancy, which allow for more efficient use of IT resources.
- **IT equipment efficiency:** Large-scale hardware components can be tailored to find the most efficient ways to power the specific needs of its services.
- **Data center infrastructure efficiency:** Advanced technologies significantly reduce electricity requirements for lighting, cooling, and power conditioning.
- **Renewable electricity:** Consolidated electricity demand creates the potential for large-scale purchases of green power that would not be otherwise viable.

Depending on market conditions, governments have the choice of a spectrum of commercially available cloud solutions or they can develop their own. The forthcoming World Bank

publication, “Institutional and Procurement Practice Note on Cloud Computing,” offers deep guidance on the issue.

#### 2.2.3.2.3 Hardware: Energy Efficiency, Longevity, Repairability, Environmental Impact

**The policy and strategic commitment to procure, use, and recycle certified green IT hardware is another way to greater decarbonization and better resource utilization.** Depending on the manufacturer and specifications, devices, such as personal computers, laptops, tablets, smartphones, servers, and other hardware, can have very different production inputs, from energy to rare metals to transportation needs and social production conditions. Comparable products can also vary significantly in energy consumption while in use, as well as in longevity, repairability, and recyclability.

**Time comparisons of key IT hardware devices such as smart phones (an important part of all M-Government initiatives) demonstrate the importance of hardware’s longevity, repairability, and recyclability.** The carbon footprint of key hardware has changed over time and continues to do so. For example, the share of carbon emissions during the production process of iPhones keeps rising dramatically (from 45 percent with the iPhone 3 to 78 percent with the iPhone 7), while the share of emissions during the use phase of the product’s life cycle declines (from 49 to just 18 percent). For hardware in general, the equipment production phase occupies a very significant share, around 45 percent in 2020, of the total energy consumption of digital technologies and the resulting GHG emissions (Monnin 2019). Hence, the longer the hardware is used, the more the potential to reduce the carbon footprint.

**Policy notes and updated guidelines on green public procurement(GPP)offeropportunitiesto help governments to purchase greener IT hardware.**<sup>35</sup> Specifically designed procurement systems can make it mandatory to take energy

and environmental hardware differences into account and also provide grounds for preferential selection that can help reduce energy consumption and improve resource use.<sup>36</sup> Levers that can help in these processes are:

- Life-cycle analysis and comparisons during or before the procurement
- Introduction or use of green labeling/certifications in the IT sector
- Capacity development of key personnel on green IT in procurement and drafting of technical specifications
- Creation and involvement of green IT expertise in the procurement process
- Capacity for internal and external audit for green IT hardware
- Extension of the standard lifetimes of hardware (i.e., laptop from three to five years, smart phone from two to three years)
- Recycling of hardware (laptops and smartphones)

#### 2.2.3.2.4 Energy Efficient or Green Software

**Energy-efficient software is a relatively new focus area in the search for greener IT solutions, but it could have a potentially substantial impact.**<sup>37</sup> Experience and research show that the energy consumption of IT systems (i.e., processor utilization) and even the lifetime expectation of IT hardware (keyword: hardware preconditions/specifications of the utilized software) are significantly dependent on the

software. Although there are no robust studies yet on how much operational energy can be saved, energy efficient or green software will become an important element of green IT solutions. Key software developers are currently driving the progress in this area. Accenture, GitHub, Microsoft, and ThoughtWorks launched the Green Software Foundation in 2021 with the aim of developing standards and best practices.<sup>38</sup>

**Governments can develop criteria and certification standards for software products that save energy and natural resources.** As with hardware efficiency standards, updated software standards and specifications can inform and be utilized in the public procurement system.

#### 2.2.3.2.5 Dark Data Management

**Data that have been generated, acquired, and stored but not utilized and analyzed to draw conclusions or insights for decision making are classified as dark data.**<sup>39</sup> Organizations, including governments, retain dark data for a variety of reasons, such as initially limited analytical capacity, regulatory compliance, record keeping, and so on. Storage of dark data is simple and cheap, which is driving its high growth rate. Veritas, a major international data management company, estimates that 52 percent all data stored by organizations globally is dark data and that the absolute amount is growing rapidly from 33 zettabytes in 2018 to an estimated 175 zettabytes in 2025. Veritas' research also indicates that dark data contributed significantly to the global carbon emissions of the ICT sector (5.8 million tons) in 2019.<sup>40</sup> Dark data management should therefore become an important element of any green IT solution and of any greening GovTech approach. Dark data should be managed through clear guidelines and practices, including data filters, data deletion, and improved data utilization.

#### Key Takeaways

- GovTech solutions have the significant potential to reduce **resource consumption**, in particular paper use, in the public sector. Successful approaches require a combination of digital innovations, the utilization of digital solutions, and significant management and cultural changes.
- E-Governance, interoperability, and M-Governance approaches can improve efficiency and effectiveness in public sector operations at large, including in the delivery of public services. They offer additional green benefits, such as **reductions in transport needs** for public officials (due to remote work), the private sector, and citizens (due to fewer personal visits to public entities).
- Taking advantage of innovative green digital solutions (green data center, procurement of energy-efficient hard and software as well as green energy sources, etc.) within an overall green GovTech approach can successfully **mitigate against the potentially increasing energy/electricity demand** from a digitalized public sector.

## 2.3 Greening Digital Service Delivery

**How services are designed and delivered determines citizens' experience of government and influences trust in public sector institutions.** Government agencies increasingly prioritize efficiency, transparency, and inclusiveness, as well as the user experience, and the digitalization of service delivery reflects these objectives. The shift from an analog, siloed, and administration-based service delivery to a GovTech system involves redesigning processes and automating decision making—but always with the user in mind (World Bank 2021g). Since climate change mitigation and adaptation is today also a cross-cutting priority, it is critical to determine the digital service design and delivery approaches that can also properly respond to the decarbonization emergency.

**This section explores how well-designed public services can both diminish the carbon footprint and improve the quality of public service delivery to citizens.** Securing effective green digital services would help countries to meet several of the UN's Sustainable Development Goals (SDGs), namely, SDG 13, focused on “taking urgent action to combat climate change and its impacts,”<sup>41</sup> and SDG 16 on the need to “promote just, peaceful and inclusive societies.”<sup>42</sup> The section builds on the work of the World Bank report, “Service Upgrade: The GovTech Approach to Citizen Centered Services” (World Bank 2021g), namely, the four stages of public service modernization.<sup>43</sup> It assumes that greening GovTech for service delivery should be mainstreamed in the public service modernization life cycle. The following two dimensions will be considered:

- **From unichannel to omnichannel service design and delivery:** Focused on the green impact brought by omnichannel service delivery, as well as on the importance of digital inclusion and the requisite of leaving no one behind
- **From siloed to integrated service design and delivery:** Centered on the green impact of personalized and proactive service delivery, provided that data rights and privacy are fundamental requisites

### 2.3.1 From Unichannel to Omnichannel Service Design and Delivery

**To better understand the green impact of service digitalization, the three cross-cutting variables described above will be analyzed: transport, resources, and energy**

(TRE). Although the benefits of remote delivery are clear, concrete models of analysis are necessary to synthesize these different variables. The reduction in emissions associated with avoided transportation is evident, but other variables should also be examined. Should the user's energy consumption be considered as well as the provider's? Moreover, although the potential for carbon footprint savings appears to be substantial, any arguments that digital service delivery is good for the environment also needs to confront the “greenwashing”<sup>44</sup> critique that might emerge if the assertion here is not sufficiently grounded in evidence.

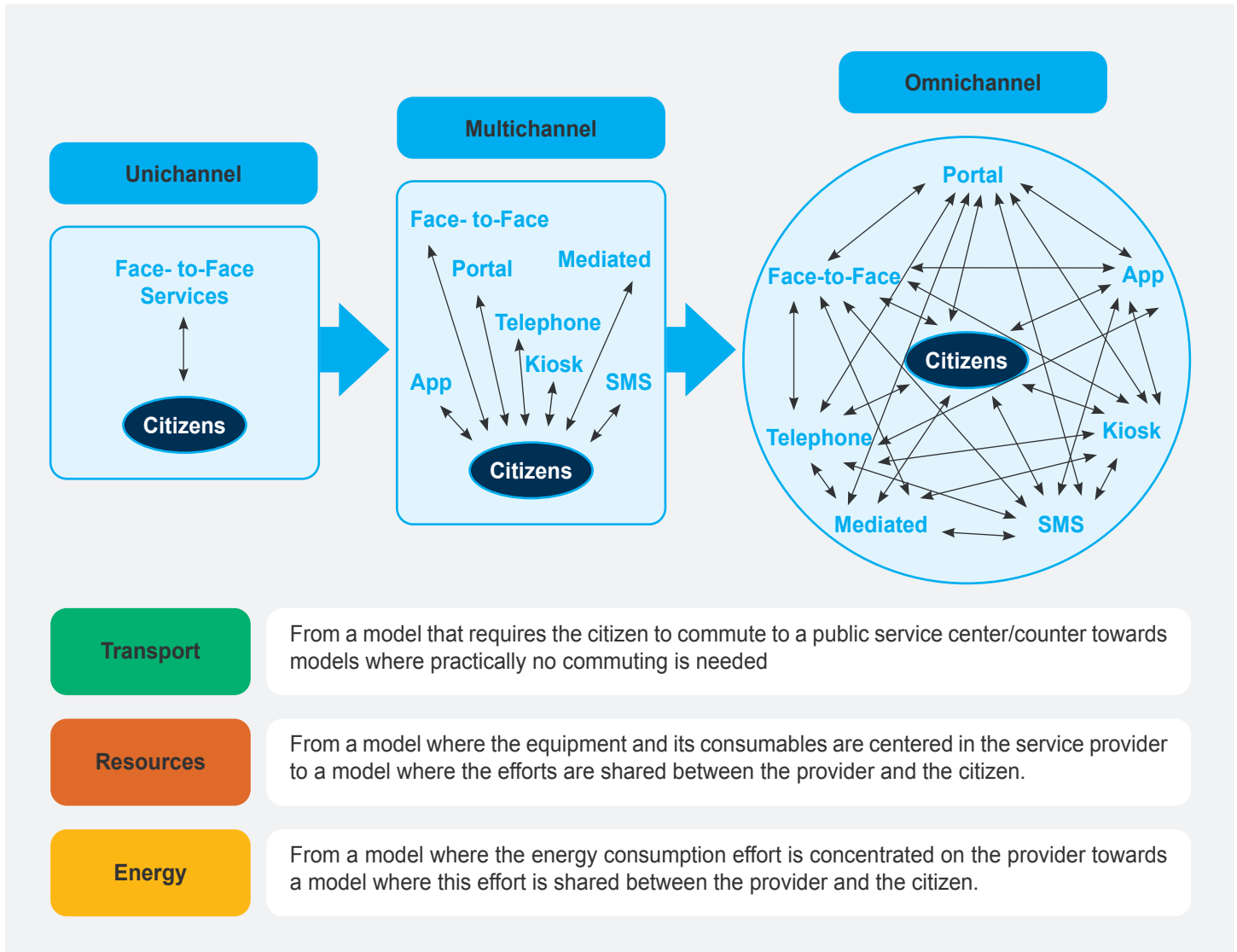
**Omnichannel service delivery ensures that the digital transition is people centered.** There has been an evolution in recent decades from a unichannel experience of public service delivery, where citizens had to go physically to a public office to request a (typically paper-based) service, to a multichannel service delivery paradigm, where citizens can opt for different channels (e.g., portal, app, phone) to manage or experience their service (see Figure 5). Nevertheless, despite the improvements involved, the procedures involved in, and the user experience of, the multichannel system are typically isolated, as they were developed in an incremental way, following various steps toward digitalization, and not integrated from the start. An omnichannel service design and delivery approach, on the other hand, allows citizens to take the full benefit of digital-by-design practices, where processes and services are embedded from the start with all the benefits of efficiency and interchangeability brought by digital technologies and data (see Figure 5). Under this approach, citizens can navigate seamlessly across different channels, benefiting from advanced data exchange that generates full responsiveness, customization, and proactiveness in the delivery of services by the public sector (for more information on the different channels, see Annex 1) (World Bank 2021g).

**An omnichannel service delivery policy is also an important inclusion tool that brings the digital transition to different segments of society.** Citizens with more mature digital skills can manage their service needs through a portal or app, while more vulnerable segments of the population, such as seniors or other sometimes less digitally literate groups, might feel more comfortable using face-to-face, telephone, or mediated service delivery.<sup>45</sup> Omnichannel service delivery can also help to reduce the typical gap between urban and rural

regions since the latter can more easily benefit from remote access to services (e.g., portal, kiosk, mediated service delivery). Additionally, omnichannel service delivery can allow people with different life conditions, such as immigrants, citizens with special needs, or caregivers of small children, to choose the most convenient channel through which to access services.

> > >

**FIGURE 5 - Exploring the Green Impact – From Unichannel to Omnichannel Service Design and Delivery**



Source: World Bank (2021g).

**In addition to the focus on the user, an omnichannel service delivery policy can also help to reduce the carbon footprint.** Although it is challenging to demonstrate the benefits explicitly, and there is a lack of published work on the positive green effects of digital service delivery, as noted above, the previously mentioned TRE variables can be used to explore the possible shift from unichannel to omnichannel service design and delivery. The transport savings have

already been described. Whether through an online services website, an app, or a telephone contact center, remote service delivery has the potential to substantially reduce carbon emissions originating from transport needs. As an example of the positive impact of digitalization with regard to the transport variable, Box 5 describes the approach taken to reduce carbon emission through a World Bank-funded project in Bangladesh.<sup>46</sup>

> > >

### BOX 5 - Green Impact of Digital Public Financial Management in Bangladesh

To demonstrate the green impact of implementing digital procurement in a World Bank project in Bangladesh, TTLs used transaction data and indicators from the procurement system to estimate the reduction in distance traveled due to the implementation of the digital system. In other words, using transaction data, the following were estimated: 1) average number of participants per tender and 2) the average distance in kilometers between bidder and tender location. TTLs were able to estimate the average number of kilometers saved per tender thanks to the electronic government procurement (eGP) system, aggregated over the total number of tenders per year. The same approach was taken to demonstrate the benefits of the introduction of a contract management process. The image below briefly illustrates the calculations made.

> > >

TABLE 1 - GHG Accounting for the Procurement and Contract Management Processes

#### GHG Accounting for Procurement Process

Year	Number of tenders	Distance less travelled due to e-GP (in million km)	Total CO <sub>2</sub> emission avoided due to less travel because of e-GP procurement process (in tonnes of CO <sub>2</sub> )
2017-2018	86816	345	49147
2018-2019	110130	615	86728
2019-2020	99779	725	102022
2020-2021	122144	768	108477
2021-2022	168558	1060	149698
2022-2023	215380	1355	191281

#### GHG Accounting for Contract Management Process

Year	Number of tenders	Distance less travelled during contract management phase (in million km)	Total CO <sub>2</sub> emissions due to travel during contract implementation (in tonnes of CO <sub>2</sub> )
2019-2020	99779	307	50420
2020-2021	122144	376	61722
2021-2022	168558	518	85176
2022-2023	215380	662	108836

Source: Estimates shared by the World Bank Procurement team in Bangladesh.



**The impact of omnichannel service delivery on resource and energy consumption also promises to be substantial.**

The digitalization of government requires significant changes to the public sector's back-office resources, including sizable investment in new equipment and consumables. The energy consumption in the public sector that results from this digital shift is also likely to increase, although paperless procedures and services can bring positive green impacts. This effort on resource and energy consumption becomes shared since the citizen also needs to have the right equipment and electric power to properly access digital services (see Figure 5 above).

**In order to accurately calculate the impact of digitalization, an empirical model of carbon emissions per service provided needs to be developed to analyze the shift from a unichannel to an omnichannel service delivery.**

For example, in obtaining a civil certificate, the model should calculate the carbon emissions of this service in a face-to-face approach using the average number of kilometers a citizen must travel to obtain the service and the average CO<sub>2</sub> emitted based on the transport used (see the example provided in Box 5). It should also consider the resources used and the energy consumption of the service and how that is reflected in terms of carbon emissions. A similar calculation should be made for the same service provided through an omnichannel approach. The comparison should indicate the climate benefits for the public sectors that embrace this shift.<sup>47</sup>

### 2.3.2 From Siloed to Integrated Service Design and Delivery

**The provision of integrated service delivery is a lengthy process, requiring coordination across different sectors and administrative levels to overcome siloed approaches and to provide an end-to-end cohesive user experience.**

Services have traditionally been delivered in a siloed way, usually provided independently by each ministry or agency in their service delivery office. With the initial implementation of digital technologies in government operations, this siloed approach has been reproduced in the digital space, giving rise to different portals from the various policy streams (e.g., separate portals from each ministry or agency) (see Figure 6).

**To overcome this siloed structure, governments began to concentrate services in one single portal, physical one-stop shops, or even contact centers, but with**

**limited levels of integration and sophistication.** In this concentration phase, the citizen could access various services from different ministries in a single office or portal organized in a relatively intuitive way by policy area or even by life event, but the effective service development and provision would be made in a sectoral portal or specific physical counter to which the citizen was directed.

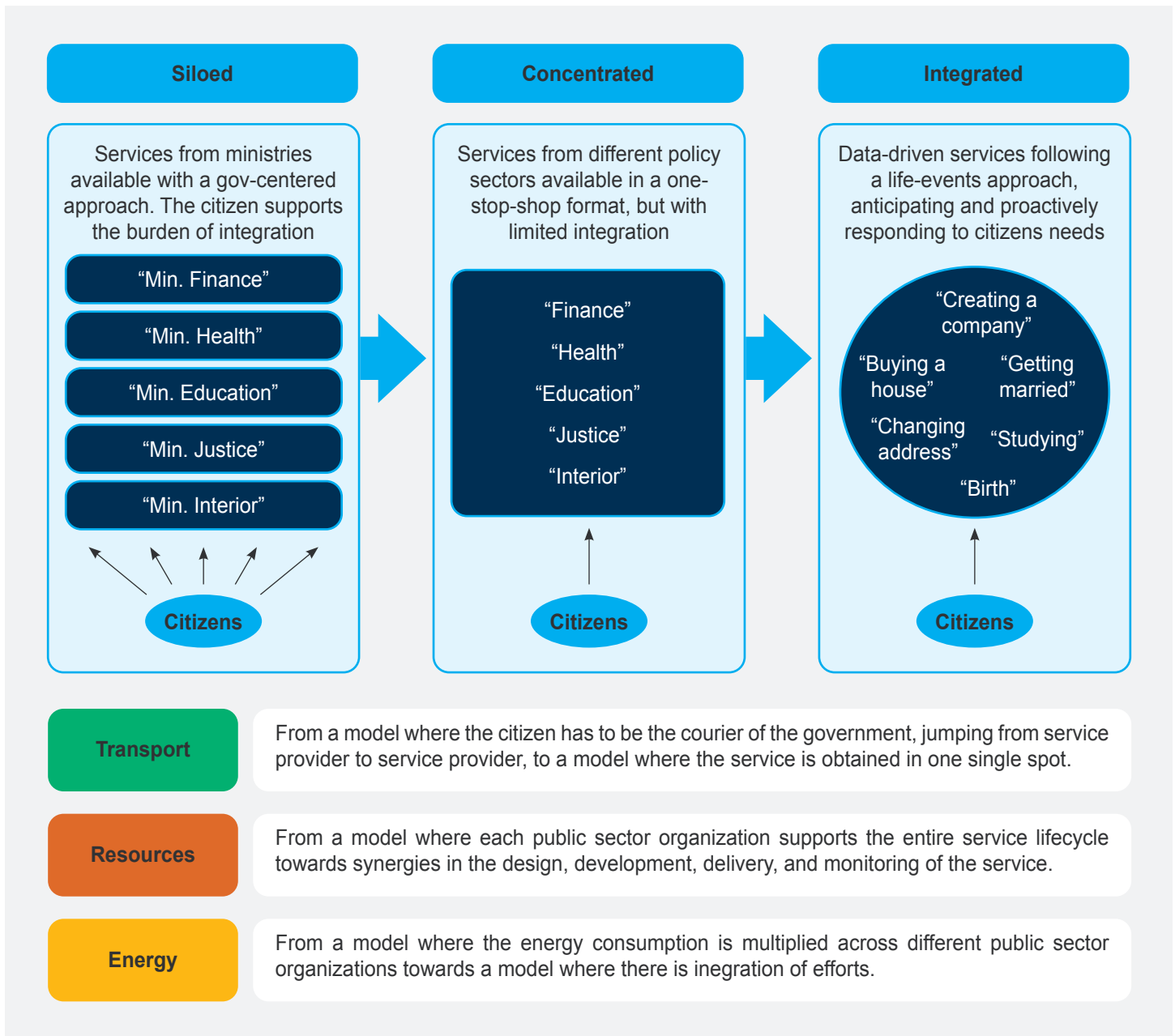
**An integrated stage of service delivery makes services available in different channels in a totally citizen-driven way.**

As illustrated in Figure 6, through data integration across ministries based on common standards, the public sector acts as a unique service provider, making its different sectors and ministries transparent to citizens. Services, such as banking, energy, or telecommunications, can also be perfectly integrated, reflecting multistakeholder collaboration on service delivery. Citizens can navigate seamlessly across services based on life event approaches or through quick queries and intuitive searches. More than informative services, transactional fully integrated services are able to anticipate and respond to citizens' needs based on interoperable information available in different administrative sectors.

**An integrated service delivery approach is also likely to contribute to tackling the climate emergency through the reduction of carbon emissions.**

Demonstrating this hypothesis is challenging, as noted above, and there is a lack of studies that disclose the green impact of efficiency gains brought by data-driven, life event-based, and proactive services. Figure 6 reflects how the TRE variables are impacted by this advanced stage of service delivery. From a transport perspective, the citizen is no longer required to travel for different services to different entities, as the services are delivered in one spot and in an integrated way. As for the resource and energy consumption involved, the reengineering and integration efforts in the provision of public services typically lead to the optimization of processes, avoiding overlaps and enhancing synergies. In this sense, instead of siloed, duplicated, and/or parallel efforts for service delivery across different public sector entities, the collaboration necessary for a unified delivery of services favors simplification and rationalization. This typically leads to carbon efficiency per service delivered, although the rebound effect should not be minimized.<sup>48</sup>

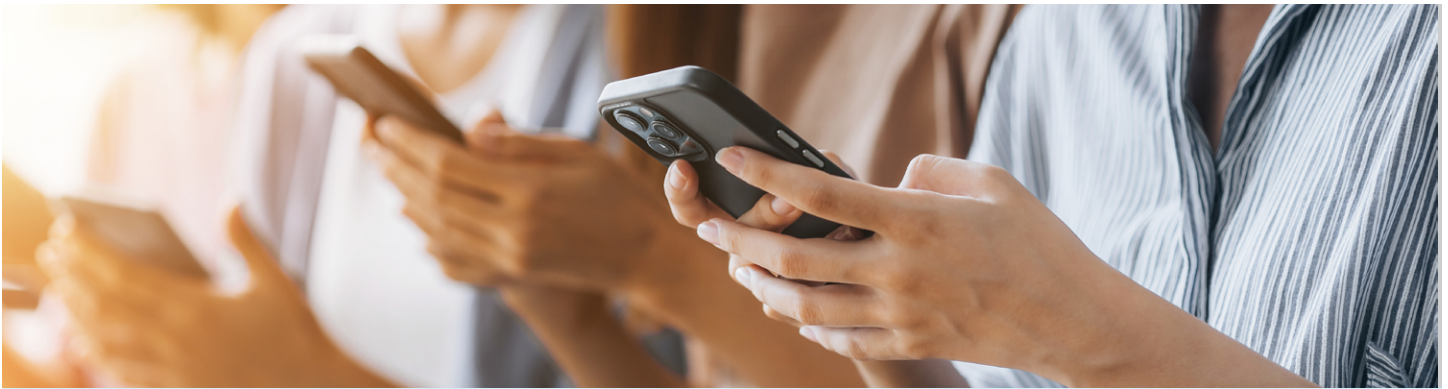
**FIGURE 6 - Exploring the Green Impact: From Siloed to Integrated Service Delivery**



Source: Authors.

**Taking as an example a life event such as a birth, the benefits of integrated service delivery can be easily demonstrated.** In the siloed scenario, the parents of a newborn need to register their child with different government agencies. For instance, with the Ministry of Interior or Justice for the child to be part of the civil register; the Ministry of Health to be part of the national health care system; the Ministry of Finance for fiscal purposes; the Ministry of Social Security for social benefits purposes; and the Ministry of Education or the local government for a potential vacancy in a nursery. This multiplication of interactions and procedures leads to considerable inefficiencies on the supplier side and

also to significant TRE efforts from the new parents, certainly increasing the carbon footprint. In contrast, in an integrated service delivery scenario, once a child is born, the parents need to proceed with the registration only once, and the information will be disseminated automatically across the different sectors and ministries. Based on data-driven approaches, public administration will be able to immediately reflect the existence of a newborn in the fiscal file of the household, create a new health file, proactively attribute the social benefits to the family, and register the child in a local nursery. Key enablers, such as digital identity and interoperability frameworks, are critical to support this seamless scenario of service delivery (see Box 6).



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## BOX 6 - The Green Impact Integrated Service Delivery in Portugal

In the past two decades, the Portuguese public sector has prioritized the development of a progressively omnichannel and integrated service delivery to its constituents. The national network of physical one-stop shops called Citizen Shops and Citizen Spots, as well as the ePortugal website and the telephone contact center, reflect this ambition. Life event-oriented and proactive service delivery approaches have been developed, supported by the national digital identity system called Citizen Card and the Interoperability Platform for the Public Sector (iAP).



The iAP currently connects more than 120 entities, mostly from the public sector but also from private sector utility providers. It registered more than 250 million transactions in 2021. As an accountability mechanism, the platform makes available an online dashboard with real-time data on various indicators, including estimates for spared trees, tons of neutralized carbon, and tons of CO2 emissions saved per kilometer not traveled. The platform's green accountability helps justify the benefits of an interoperable public sector and an integrated service delivery approach.

Source: Estevez et al. (2021); and AMA, "A IAP em Números," <https://www.iap.gov.pt/web/iap/iAP-em-numeros>.

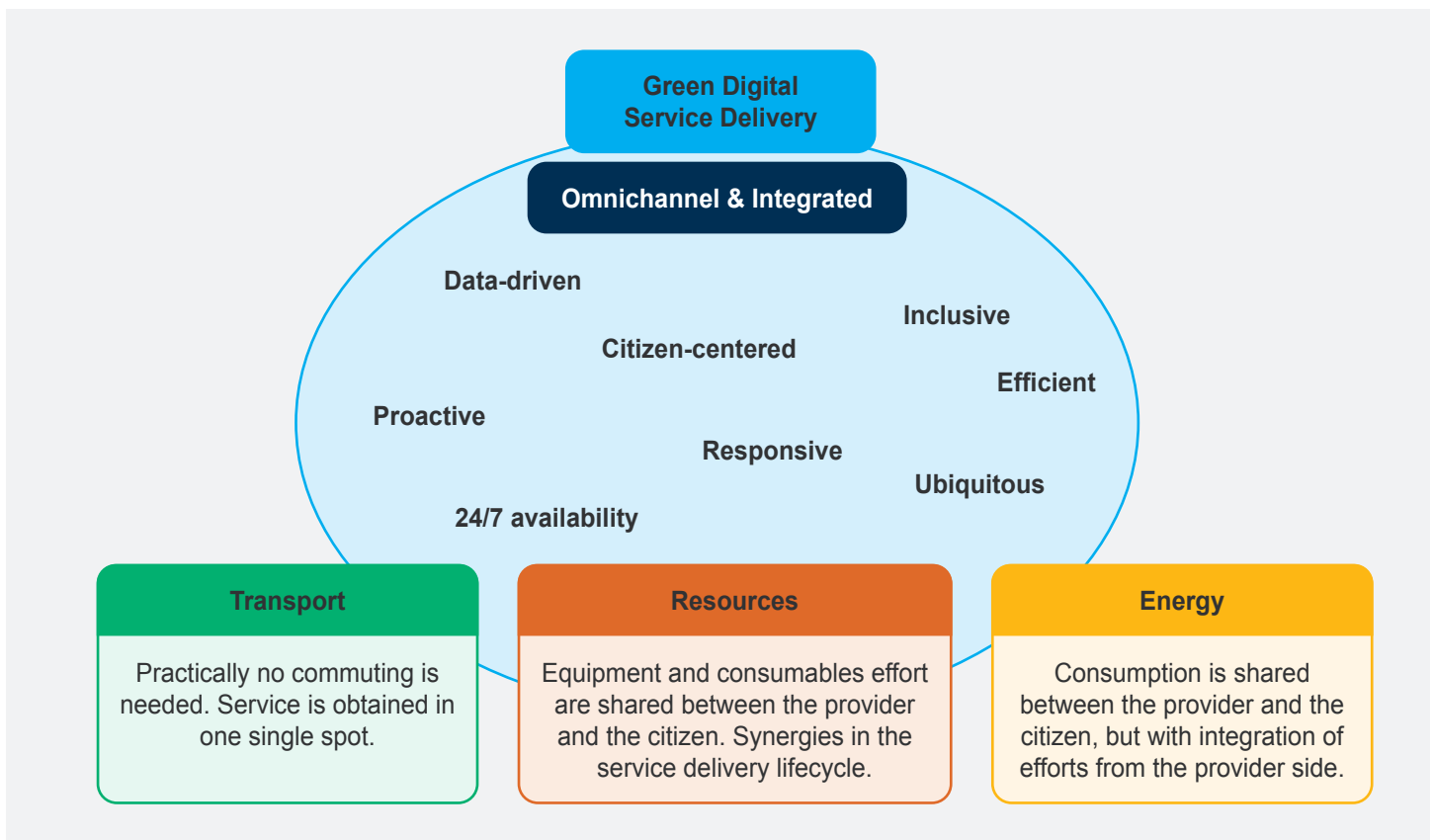
However, the benefits of integrated service delivery also bring new risks related to inclusion and privacy. Since large data exchange and reuse is the cornerstone of cohesive service delivery, governments should guarantee that citizens' data are safe, their privacy is secured, and that inclusive models will frame policy action in this area. In line with the World Bank's *World Development Report 2021* (World Bank 2021h), a social contract around data is fundamental, based on an agreement among all participants in the process of creating, reusing, and sharing the data, affirming that the data will not be harmed and that the value created will accrue equitably.<sup>49</sup> Moreover, updated legal and regulatory frameworks are fundamental to ensure that citizens' digital rights are properly respected, including the right to know how their data is being used and to authorize its reuse (or not) across different sectors and levels of government.

### 2.3.3 Towards a Green Digital Service Delivery

As demonstrated in previous sections, omnichannel and integrated service delivery can indeed contribute to a more decarbonized public sector. Green digital service delivery is able to enhance the most advanced features of digitalization, such as data-driven approaches, automation, proactive models, ubiquity, citizen centricity, and inclusiveness, to build a more environmentally friendly public sector. This is reinforced by the expected efficiency gains that digitalization brings in terms of the TRE variables. Figure 7 summarizes the different features and variables presented and discussed in the sections above.

> > >

FIGURE 7 - Green Digital Service Delivery



Source: Authors.

Nevertheless, green digital service delivery is only part of the broader effort to green GovTech. Prioritizing the public sector's digital front office—services, in other words—should be done in coordination with the green digitalization of behind-the-scenes government processes (the back-office) (see section 2.2) and should align with policies to tackle climate change risks and improve government resilience (see section 2.4). But to go beyond successful but limited policy interventions, whole-of-government approaches are necessary to engage the different sectors and levels of government.

## Key Takeaways

- Omnichannel service delivery can potentially reduce the carbon footprint of digital services by eliminating the need to travel to and from public service offices.
- An integrated service delivery approach is likely to help to tackle the climate emergency due to the efficiency gains on the part of both the administration and the user.
- A green GovTech policy for the design and delivery of public services also brings significant inclusion benefits, contributing to “leave no one behind” objectives through plain, personalized, and proactive services.
- Respect for citizen’s digital rights, such as privacy and security, is a fundamental requisite for a sound green digital service delivery that assumes data exchange and reuse to be the cornerstone of public sector transformation.

## 2.4 GovTech Resilience to Climate Change Risks

### **GovTech plays a critical role when considering climate change risks and the resilience of government operations.**

By digitalizing the business processes associated with core public service delivery, governments can eliminate the inefficiencies of paper-based systems (see section 2.2.1), which are easily exposed to natural disasters, such as floods, storms, and fires, that can quickly destroy entire paper-based archives of information. Outdated IT infrastructure, such as server rooms and data centers without business continuity plans, can also pose a grave risk if not mitigated correctly. Disasters can provide the opportunity to strengthen digital infrastructure through “build back better” initiatives and to adapt to long-term climate change and disaster risks (World Bank 2020b).

**Climate change adaptation is a shared responsibility of government ministries and agencies, and a long-term commitment will be required to ensure that GovTech solutions fight climate change effectively.** Adaptation seeks both to reduce the risks and vulnerabilities from climate change and to increase the resilience of GovTech, which in turn provides resilience to public service delivery and core government systems. For example, inland areas that are harshly affected by flooding, or small island nations that are affected by rising seas, will need to adapt to the new normal guaranteeing that day-to-day GovTech solutions are fully utilizable by users.

**Mitigation helps to reduce the severity of extreme weather events and other emergencies, such as epidemics and pandemics.** By ensuring that GovTech systems have

business continuity plans governments can mitigate the effects of crises and disasters. For example, countries that are susceptible to seasonal weather patterns, such as hurricanes or typhoons, can safeguard against them by either hosting their core government systems and associated data in a cloud offshore or, at a minimum, ensuring that the backups are readily accessible in other locations.

**GovTech resilience requires concerted planning and actions that address challenges at multiple levels and different phases of disasters.** Actions to strengthen the resilience of GovTech against climate and disaster risks can be guided by the following four-phased process: i) an understanding of the range of disaster and climate change risks that can affect critical digital services; ii) risk-informed planning of national strategies and prioritization of investments and actions to mitigate and avoid impacts; iii) disaster mitigation and preparedness actions through GovTech policy, ICT infrastructure, and finance-based approaches; and iv) response and recovery to facilitate a rapid and sustainable return to functioning government operations. A resilient GovTech framework is proposed to guide governments, ICT practitioners (including firms and government agencies), financial institutions, and development partners on mainstreaming resilience into GovTech (World Bank 2020b).

**The resilience of GovTech has a number of important dimensions to be considered.** The first is resilience to weather transformation: GovTech solutions should be able to resist extreme weather events and other emergencies. The second is data recovery and redundancy: recovery functions

should prevent data loss and prepare information systems' redundancy for climate change. And the third involves critical digital services, which increase the resilience of a beneficiary population in natural catastrophes and weather-related emergencies.

### 2.4.1 Resilience to Weather Transformation and Emergencies

**GovTech solutions need to be able to resist extreme weather events and emergencies.** GovTech solutions need to respond effectively to increasingly frequent natural disasters that are associated with climate change, such as storms, floods, and rising sea levels. These solutions must also be resilient to emergencies, such as pandemics, wars, and armed conflicts. When few strategic measures are in place, emergencies and disasters may reduce government readiness to respond and then impose extra costs. Governments therefore need to put together early warning systems to help mitigate these kinds of emergencies. Public sectors can implement strategies to expedite emergency procedures that can improve the government's response capacity by decentralizing emergency operations. Furthermore, by developing a risk management strategy for GovTech solutions, governments can create programs that identify risks, reduce vulnerability, and strengthen emergency services. By proactively addressing these issues prior to an emergency, governments can improve their response.

**Once a disaster has occurred, it is important to decide whether it warrants an emergency response.** It must be clear that the situation meets the criteria for treatment as an emergency and that a flexible approach addressing GovTech-related issues can be fully justified. Second, the immediate GovTech-related activities that can bring relief should be identified and prioritized. Third, the operating environment and conditions on the ground should be assessed and a determination made of what other regional countries, government agencies, and nongovernmental organization (NGOs) are doing to explore potential collaboration.

**To ensure resilience, it is important to plan before disasters occur.** Governments can conduct systematic data analysis of prior emergency requirements, develop and implement annual or multi-year plans that consider disaster-related needs, and ensure readiness to implement flexibility measures during a crisis. From the public sector perspective, it would be important to gather data and conduct spend analyses to extrapolate future requirements from historical disaster response purchases. This makes analyzing previous revenues and spend for future preparedness possible and

predictable. Additionally, it would be important to conduct ex ante market research and spend analyses to assess markets. Regular reviews of spending, including current and historical spending, can identify opportunities where governments can reduce transaction costs, improve strategic sourcing, and ensure continuity of supply in emergencies.

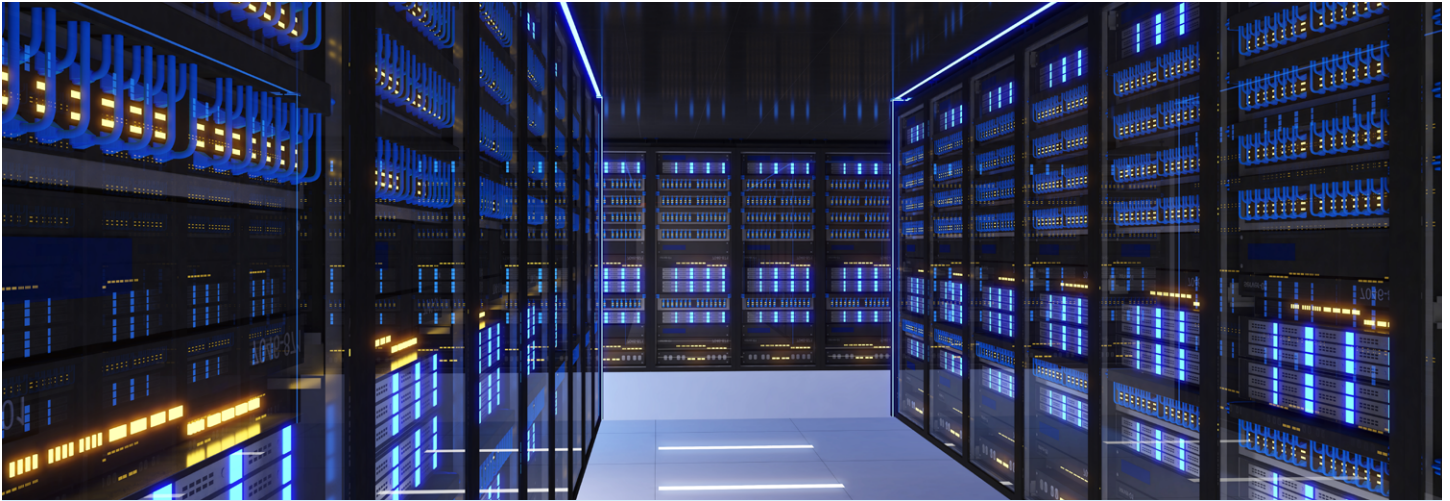
### 2.4.2 Data Recovery and Redundancy

**For many governments in less-developed countries, the impact of climate change can be severe, and data recovery and redundancy are therefore crucial.** Recovery functions should prevent data loss and prepare information systems' redundancy in case of an intense climate change event. The concentration of ICT infrastructure, complemented by distributed cloud computing approaches, can provide the best secure data recovery and redundancy in terms of resilience. Having all infrastructure co-located can increase the chance of catastrophic risk if, for example, a hurricane destroys the entire system. However, a distributed cloud system that cannot be affected by a single extreme weather event can help to ensure resilience, as there is only a marginal chance that the entire system will be compromised.

**Cloud solutions provide shared computing resources, such as servers, storage, and services.** Cloud solutions enable ever-present, convenient, and on-demand network access to a shared pool of configurable computing resources (i.e., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction (Mell and Grance 2011). The benefits include resource pooling, on-demand self-service, rapid elasticity, broad network access, and measured service (World Bank 2016a).

**The cost-efficiencies of cloud services and public cloud solutions offer numerous benefits for GovTech.** Although many countries acknowledge the benefits of cloud services for the public sector, their adoption in developing countries has been very slow due to concerns about cybersecurity, data sovereignty, and privacy (World Bank 2023a). Due to inadequate assessment frameworks to identify and assess the risks of cloud solutions, governments in developing countries typically set up a government cloud. A government cloud, or "G-Cloud," hosts a government-wide data center shared by all government ministries (World Bank 2023b), which seems logical for more sensitive or mission-critical data. Adopting a hybrid cloud model that leverages the cloud services from the private sector to work in conjunction with the G-Cloud can offer immense opportunities to save costs, improve security, enhance performance, and strengthen resilience. However,

client governments need guidance to change their policy response on cloud computing from one of risk avoidance to one of risk management. This involves developing a decision framework using a data classification methodology to determine what data is more appropriate for hosting on a private cloud (World Bank 2023b).



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### BOX 7 - Costa Rica ICT Infrastructure for Data Recovery

**Costa Rica has implemented a data center and data recovery solution.** It procured core GovTech government systems, such as an integrated financial management information system (IFMIS), tax administration, and customs administration, which are all supported by common operating systems and databases. Costa Rica decided not to procure hardware and instead procured such services as infrastructure-as-a-service (IaaS) or sharing ICT infrastructure in the cloud. They allocated US\$80 million for the systems using commercial-off-the-shelf (COTS) implementations, all of which were hosted in the cloud.

**The Constitution of Costa Rica limits the amount of government data that can be hosted outside of the country.** This is a trend in Latin American and Caribbean countries—the laws and constitution require that data be hosted inside the country. But in Costa Rica, a small country with a limited private sector, lawyers were able gain approval for the data and core government information systems to be hosted outside the country.

*Source:* World Bank, “Costa Rica : Fiscal Management Improvement Project,” <https://documents.worldbank.org/en/publication/documents-reports/documentdetail/873761583868077662/costa-rica-fiscal-management-improvement-project>

## 2.4.3 Critical Digital Services

**The strategic use of GovTech solutions, combined with digital skill sets, an institutional framework, digital capacity, and good policy and regulatory environments in ICT, can help to facilitate fast and efficient delivery of the most critical digital services** (ADB 2021). Critical digital services are a technology-based service offered by governments to their citizens. They are designed to provide a more efficient, secure, and cost-effective way for governments to deliver essential public services. They allow governments to better manage and respond to their citizens’ needs and concerns, while providing better value for money. Examples of critical digital services include digital ID verification and

authentication, digital payment processing, online forms, digital document management and storage, digital customer service and support, and online government services. By leveraging critical digital services, governments can drastically reduce the cost of providing services and significantly improve the overall quality of service delivery. Furthermore, digital services increase the resilience of the beneficiary population during and after natural catastrophes and weather-related emergencies. GovTech solutions, such as digitized early warning systems, financial transactions, wage systems, identity cards, contracts, and supply chain management, can boost government resilience, helping agencies to maintain links with the population during disasters (World Bank 2020b).

**To realize the full potential of GovTech for resilience during emergencies, governments in emerging economies still need to promote the digitalization of the most critical government services.** Gaps in digital infrastructure, capacity, and policies and procedures explain much of the lag in the adoption of core government systems and public service delivery by developing countries. These countries also have weak basic ICT infrastructure, low computer use, and low levels of digital literacy. Such issues further inhibit innovation and the uptake of critical digital services, which in turn constrains adoption, especially during disasters that disrupt the flow of resources and information (World Bank 2020b).



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#### **BOX 8 - Critical Digital Services are Moving to the Cloud in the Caribbean**

**In the Caribbean countries, critical digital services are moving to the cloud to provide resilience.** For example, there is a strong government commitment to the digitalization agenda in Grenada, where digital services, such as the civil registry and tax administration, are moving to the cloud. The government currently struggles with change management, as many signatures are needed to move a digital initiative forward, so the country has considered hiring a consulting firm to help resolve these issues. The digital transformation office has been working for three years to strengthen critical digital services. The tax and civil registry have started to digitize all records and to move all documents to a cloud-based system. This includes the scanning and uploading of probates, land, and other related documents using a cloud-based archiving system.

**Crucial to the resilience of digital services in GovTech are the core government systems that run the day-to-day functions of government.** How resilient are PFM information systems and vital records to threats from natural disasters? Governments need to institute safeguard measures to protect and ensure the continuation of financial transactions in the aftermath of a disaster. The following recommendations are suggested for PFM adaption and mitigation (World Bank 2019a):

a. Finance agencies need to be prepared to handle disasters, including by defining mission-critical functions

and systems, establishing a hierarchy of operational importance, pre-identifying a list of critical applications, and carrying out impact assessments of system failure.

- b. A disaster recovery plan needs to be in place that includes a comprehensive and up-to-date IT disaster recovery plan covering the computer room environment, hardware, connectivity, software applications, and data protection and restoration, including for hardcopy files.
- c. A recovery point and time objectives for all priority PFM applications should be created.



- d. Known vulnerabilities in critical PFM systems should be identified to prevent their collapse.
- e. Data backup routines, technology, and locations should be identified and in place.
- f. Data center resiliency should be ensured, including through fire and flood barriers and robust building architecture; multiple connections; uninterruptible power supply with battery backup and generators; redundant and physically

secured servers and storage; multiple high-speed network links entering and exiting at different points; and smoke, fire, humidity, and flood detection.

**When considering the criticality of digital services, the adoption of common frameworks is important.**

Governments need to ensure common interoperability frameworks, shared ICT infrastructure, base registry frameworks, shared services, common data architecture, and the use of open-source software (OECD 2019a).

### Key Takeaways

- Governments need to safeguard measures that protect and maintain financial transactions in the aftermath of a disaster.
- GovTech resilience requires concerted planning and actions that address the challenges of disasters and other emergencies. Efforts to strengthen the resilience of GovTech against climate and disaster risks can be guided by a resilient GovTech framework.
- Governments can develop a risk management strategy for GovTech solutions, involving programs that identify risks, reduce vulnerability, and strengthen emergency services. By proactively addressing these issues prior to an emergency, governments can improve their response.
- GovTech solutions, such as digitalized early warning systems, financial transactions, wage schemes, identity cards, contracts, and supply chain management, can boost government resilience, helping government entities to maintain links with the population during disasters.



# 3

## Governing a Green and Digital Transformation of the Public Sector

### 3.1 Introduction

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**This chapter examines how to govern the digital and green transitions of the public sector.** Implementing any kind of policy change in a coherent way across different sectors and levels of government over the long term is a central challenge faced by bureaucracies, and green GovTech is no exception. The capacity of the public sector to shift from numerous siloed approaches to one integrated systems thinking is critical to this process. Following Chapter 2 on the “what,” or what practices to focus on, this third chapter is centered on the “how”: how to disseminate the identified policy mechanisms to mainstream green digital approaches throughout government systems. Building on country examples, the following five whole-of-government areas of analysis will be prioritized:

1. **Strategy.** Considering the priority attributed to the green and digital transitions, most countries have policy strategies and action plans, frequently running in parallel. Synergies for delivering both of these transformations concurrently are commonly missed.

**Key question:** How can an improved green and digital policy alignment be secured?

2. **Institutional Leadership and Coordination.** Since 2015, dedicated central government GovTech units have been established in 80 countries.<sup>50</sup> SDG 13 and the Paris Agreement have laid out more explicit goals for governments in coordinating cross-cutting public efforts in decarbonization and adaptation.

**Key question:** How can the institutional coordination needed to implement digital and green priorities be improved?

3. **Legal and Regulatory Framework.** Adapting the legal and regulatory frameworks to the public sector's priorities is a common challenge. Both digitalization and decarbonization plans typically require substantial legal foundations.

**Key question:** What synergies between digital and green policies can be further explored in the legal and regulatory fields?

4. **Policy Levers.** Budgeting, pre-evaluation of public expenses, public procurement, and M&E systems are some of the policy levers frequently used by governments to guarantee coherent policy implementation across the public sector.

**Key question:** What is the best way to mobilize and calibrate these policy mechanisms to promote a green digital transition?

5. **Green Digital Competencies.** Skills and talent are a central pillar of the twin transitions underway. The lack of and gaps in digital competencies is a significant hindrance to the coherent and sustainable transformation of government administrations.

**Key question:** How can a green digital culture be mainstreamed in the public sector? Which key policies would best help the public sector to embrace green digital talent?

**Each country's level of GovTech maturity determines the differentiated approaches to sound policy implementation.** There is no one-size-fits-all approach to a whole-of-government digital transformation. As noted above, although more digitally developed countries will face the challenge of adapting existing information systems to more green standards, potentially dealing with sunk costs, less digitally developed countries can benefit from some

technology leapfrogging, though they will still need to focus on change management and institutional cultural shifts to secure the progressive digital transformation desired.

## 3.2 Strategy

**An increasing number of countries have formulated GovTech and digital government strategies, but only a few have included green objectives in these plans.** According to the latest iteration of the World Bank's GTMI, almost 90 percent of countries (176 out of 198) have or will soon have a GovTech or digital transformation strategy.<sup>51</sup> At the same time, governments are stepping up efforts to promote the green agenda. However, the two agendas are seldom aligned. Given the potential for reducing carbon emissions both by using GovTech for green and by greening GovTech, a strategy that synergizes digital and green objectives would more effectively advance both digital and sustainable development.

**A whole-of-government orientation in green digital strategies fosters government-wide reform buy-in and policy coherence.** Advancing the digital and green transitions requires broad reform ownership involving all parts of government and all seniority levels (World Bank 2022d, 16). As an example, the Scottish government adopted a whole-of-government approach in its 2021 Digital Strategy and incorporated green thinking into the digital solutions planned.<sup>52</sup> The strategy proposes establishing Scotland as an attractive location for green data centers and links this action to the country's National Environment Outcome of the National Performance Framework. In fact, the OECD recommends linking digital government strategies to broader agendas, such as sustainability, as it is beneficial for coherence and collaboration within the public sector (OECD 2021b, 77).

**Embedding interoperability in GovTech and digital government strategies will enhance the efficiency and sustainability of public administration and service delivery.** As highlighted previously (section 2.3.2), GovTech and digital government strategies should aim to overcome public sector silos that result in isolated and often inefficient solutions that are not user friendly. Therefore, strategic documents should emphasize interoperability to ensure that digital government can share and reuse data efficiently and sustainably. Interoperability objectives may focus on the technical, organizational, cultural, or legal aspects and prioritize the adoption of common data exchange standards

and the use of an interoperability hub or platform (World Bank 2022f, 19). For example, data gathered on GHG emissions or mobility in readable formats may help to track goals related to the green transition.

**Several countries have adopted strategies that explicitly seek to green GovTech or to leverage GovTech for green goals.** These countries are aligning their policies on the digital and green agendas to ensure that progress on one does not come at the expense of the other. Oftentimes, combining digital with green objectives can help secure the political backing necessary for delivery. For example, in Ireland, the reform of a data center received ministerial approval after its contributions to the green agenda were highlighted.<sup>53</sup> The cases of Denmark, South Korea, and the EC are discussed below as examples of strategies that combine both digital and green objectives.

### 3.2.1 Example: Denmark

**Denmark has recently released a new digital strategy that envisions the acceleration of the green transition through digital solutions (Denmark 2022).** In addition to highlighting the green benefits of digitalization, the strategy also acknowledges the need to reduce the impact of digitalization itself on the environment and proposes concrete actions to this end through the introduction of climate-efficient technologies.

**Denmark has already achieved significant efficiency gains by digitizing administrative processes and data sharing through interoperability.** Holistic back-office and administrative reforms have rendered high-level decision-making processes, as well as citizens' interactions with the state, more efficient. For example, ministers can sign important documents on their tablets and citizens have around-the-clock access to a wide range of digital services.

**Denmark also has a national strategy for GPP to ensure that its climate goals are factored into public procurement decisions.**<sup>54</sup> Denmark has committed to reducing its GHG emissions by 70 percent by 2030 compared to the level in 1990, and to reaching climate neutrality by no later than 2050. The strategy includes a comprehensive assessment of the climate footprint of public procurement in the country and plans to set a specific reduction target. Denmark is also actively incorporating the EU's GPP criteria for public procurement of data processing and storage.

### 3.2.2 Example: Korea

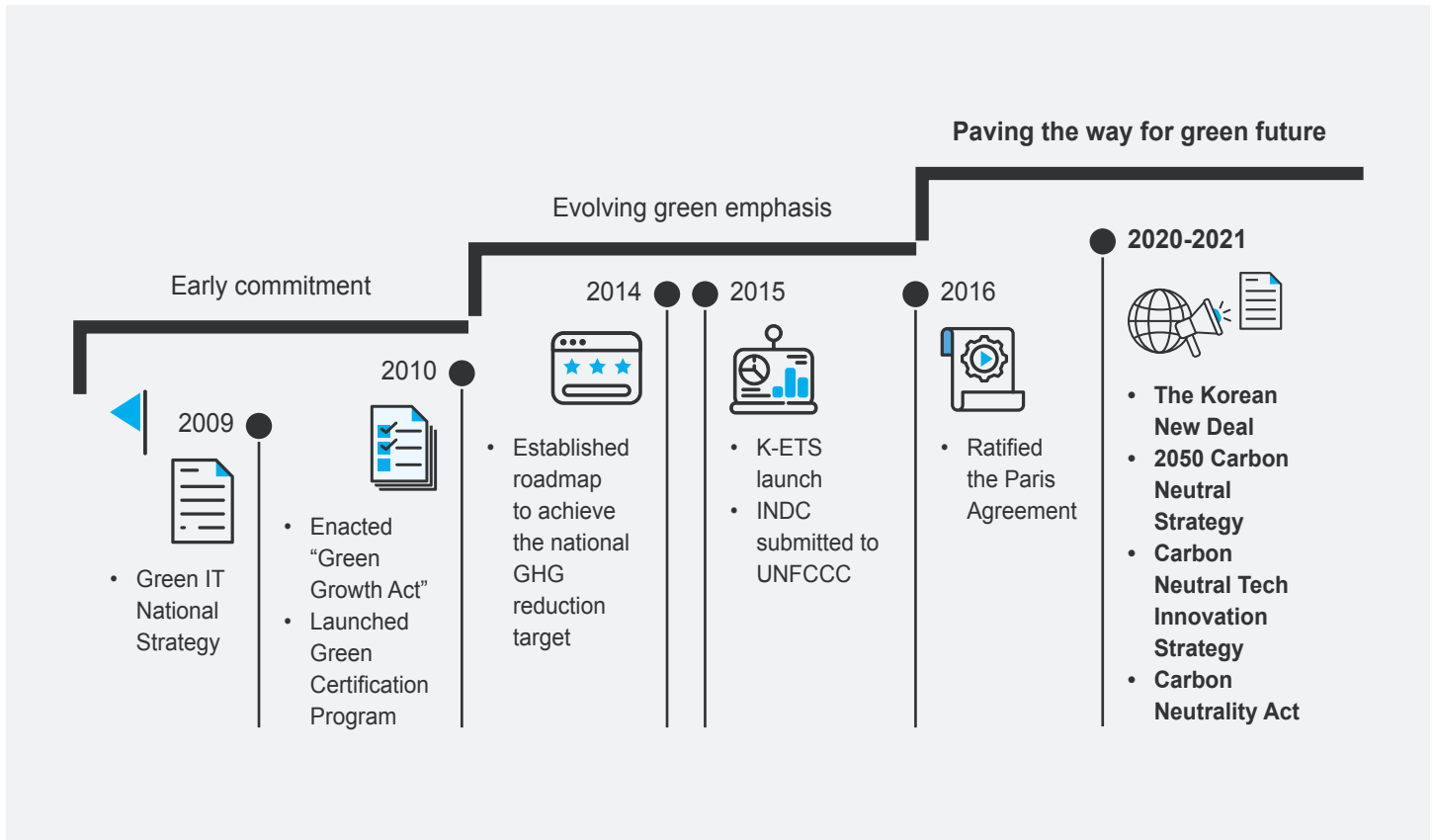
**Korea was among the first adopters of a strategy aimed at mitigating and reducing the environmental impact of its digital transition.** In 2009, Korea announced a Green IT National Strategy to address the ICT sector's carbon footprint. Since then, the government has introduced several initiatives to support a sustainable digital transition, including a green certification program (2010), the standardization of green data center guidelines (2012), and the Carbon Neutral Technology Innovation Strategy (2021).

**The Carbon Neutral Technology Innovation Strategy seeks to promote innovation in energy efficiency in the ICT sector through digitalization.** Six months after the Strategy was released, the government complemented it with 10 Core Technology Development Directions that it regards as fundamental to achieving carbon neutrality by 2050. Digitalization is listed as a core area, and concrete actions are being proposed related to (i) greening of ICT infrastructure and devices, (ii) energy data utilization, (3) management of distributed energy resources, and (iv) smart grid technologies (World Bank 2022b, 23).

**Korea leverages GPP as a key policy tool to promote decarbonization of the ICT sector.** In 2011, the government expanded the Act on the Encouragement of Purchase of Environment-Friendly Products, which required public entities to procure green products, including electronic and ICT devices. The previously released Green Growth Act had defined green products as those that have received eco-label, low-carbon product, and recycled content certification (World Bank 2022b, 25).

**Korea offers valuable lessons for other countries seeking to green their digital transition and foster innovation for climate action.** Leadership and early government commitment to a green digital transition have led to strategies with clear goals and time frames as well as an enabling legislative framework. Korea has adopted a whole-of-government approach, with all 18 ministries and local governments involved in leveraging digital to advance the green agenda. Moreover, public awareness building led to broad citizen support for environmental policies, and clear incentive structures for the private sector fostered technology innovation for increased sustainability (Khoury and Lee 2022).

FIGURE 8 - Korea's Green IT Policy Milestones



Source: World Bank (2022b).

### 3.2.3 Example: European Commission

The EC assigns a central role to digital technologies in its efforts to reach corporate climate neutrality by 2030. The recently published European Commission Digital Strategy (June 2022) (EC 2022a) and Communication to the Commission: Greening the Commission (April 2022) (EC 2022c) set out the way that the EC will meet its climate-neutral objective. The strategic documents promote a vision in which embracing digital solutions and operating in a green manner become part of the institution's work culture going forward.

**Upgrading digital technologies may help to significantly reduce emissions related to commuting.** Staff business travel accounted for 28 percent of the EC's GHG emissions in 2019. The upgrading of web and videoconferencing tools should allow staff to shift all non-essential missions to an online format and help reduce travel-related emissions. The Commission expects that increased telecommuting and the use of greener methods of transport will reduce emissions by at least 50 percent between 2019 and 2024 (EC 2022c, 10).

In addition to highlighting the potential of adopting digital technologies to reduce emissions, the Commission has also addressed the negative externalities of digitalization. Emissions related to IT equipment represented around 5 percent of the EC's carbon footprint in 2019. Despite the envisioned expansion of digital technologies in the coming years, the EC plans to reduce the GHG emissions emanating from its digital operations by at least 30 percent between 2019 and 2030 (EC 2022c, 14).

The EC has proposed several measures to mitigate the environmental impact of its increasing use of digital technologies. Concrete measures include (i) consolidating digital infrastructure into a smaller number of green data centers, (ii) accelerating the shift to more energy-efficient IT devices, (iii) strengthening green procurement, (iv) decommissioning obsolete systems, (v) maximizing paperless workflows and the digitalization of archives, and (iv) promoting green digital behavior among staff (EC 2022c, 14f). Although the EC is a unique institution in many ways, its digital transformation journey does provide relevant lessons to other institutions and countries on how to engineer a principles-driven digital transformation.

## Key Takeaways

- Although most countries have announced a digital government strategy, only a few have included green objectives in it. Synergizing digital and green objectives in GovTech strategies has significant potential both to leverage digital technology for green purposes and to green the use of that technology.
- Embedding a whole-of-government approach in green digital strategies broadens reform ownership and increases policy coherence, augmenting the likelihood of achieving strategic objectives.
- GovTech and digital government strategies that promote interoperability are more likely to achieve efficiency and sustainability gains.

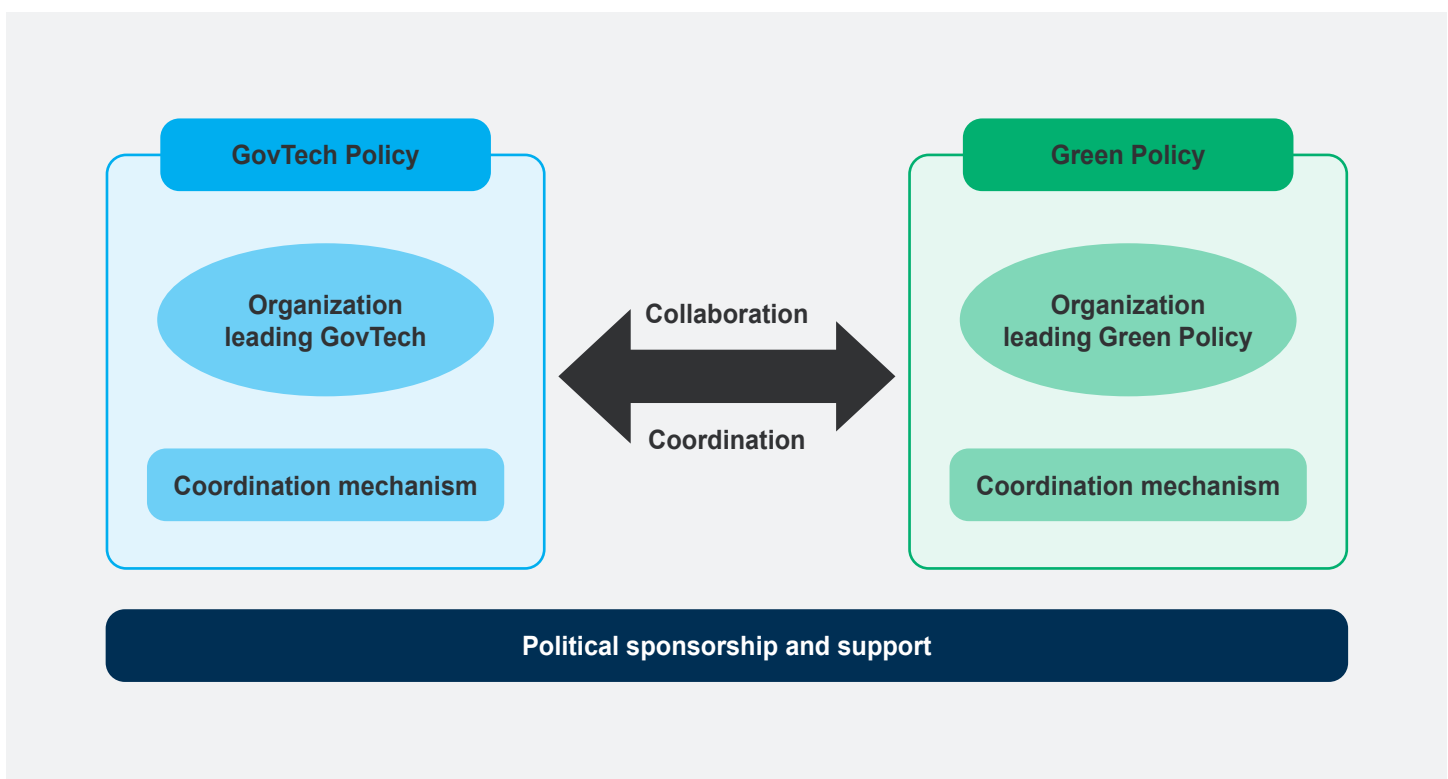
## 3.3 Institutional Leadership and Coordination

**To encourage the participation of all government ministries and agencies despite their different priorities, institutional leadership, political support, a dedicated organization, and coordination mechanisms are all necessary.** The government agencies and coordination mechanisms for GovTech are usually different than those for green policies, so it is important to establish close communication to collaborate

and coordinate these two policy areas. This section explains how political support, public sector organizations leading GovTech, and coordination mechanisms can promote a green digital transition and how institutional coordination can be improved to implement both priorities. Figure 9 shows how institutional leadership and coordination mechanisms could work internally toward these goals.

> > >

**FIGURE 9 - Institutional Leadership and Coordination for Green and Digital Government**



Source: Authors.

### 3.3.1 Political Sponsorship and Support

**The experience of several digitally advanced countries indicates that adequate leadership is a critical asset to implementing coordinated GovTech and green policies.**

In Korea, one of the GovTech leaders according to the World Bank's GTMI, former presidents adopted e-Government as a fundamental policy priority, providing continuous attention and financial and institutional support (Republic of Korea 2021). The absence of political leadership and support can lead to significant difficulties in securing the financial and human resources needed. In fact, many World Bank task teams have said that leadership is one of the main challenges to designing and implementing GovTech projects in client countries, and the Bank's "Tech Savvy" report identified leadership, management, and culture as of key importance to change management strategies (World Bank 2022d). Leadership can support successful design and implementation of the change management plan that is one of key GovTech enablers. Change management strategies help public sector organizations overcome complaints and reluctance to innovations. Leadership is also critical to raising awareness of green GovTech. In Bangladesh, lack of knowledge and

awareness among many relevant sector officials about the country's Nationally Determined Contribution (NDC) and the need for mitigation measures is mentioned as one of the main implementation barriers (Bangladesh 2021). High-level leadership could help to overcome this challenge. Many other countries also highlight the role of leadership in addressing climate change in their NDCs.<sup>55</sup>

**How can leadership awareness of the need to align the digital and green policy agendas be improved?** Government leaders could participate in international collaboration activities, providing them with opportunities to communicate with other leaders. Many international organizations, including the UN, World Bank, and OECD, have already highlighted both GovTech and green policy. Management may need to be incentivized to develop a performance-oriented bureaucracy that encourages innovation and the use of GovTech (World Bank 2022d). The presence of a government chief information officer (CIO) contributes to the co-work across government to embed digital reforms, drive the strategic planning, establish standards and frameworks, and report on progress (World Bank 2022d).

> > >

#### BOX 9 - Leadership in Nationally Determined Contributions

- In **Bangladesh**, the prime minister, as chair of the 48-nation Climate Vulnerable Forum (CVF), has launched a program to develop a "Mujib Climate Prosperity Plan" for Bangladesh with a strategic investment framework to mobilize financing, especially through international cooperation, for renewable energy and climate resilience initiatives.
- **EU** leaders agreed that: the EU budget will be the main tool for the climate action effort; EU expenditure should be consistent with the principles of the European Green Deal; and a Just Transition Mechanism, including a fund, will be created.
- In **Pakistan**, the Prime Minister's Committee on Climate Change oversees progress on implementation as well as regional and international partnerships to ensure that Pakistan continues to be an active member of the global community in the implementation of the Paris Agreement.

Source: NDC Registry, <https://unfccc.int/NDCREG>.

### 3.3.2 Public Sector Organization Leading GovTech Policy

**The first step is to identify which organization will lead the GovTech and green agendas in the public sector.** Since both agendas have been highlighted globally, many countries have already established an institutional structure assigned to promote them. According to the 2022 GTMI, among 198 economies, more than 70 percent (154) have already set up a government entity focused on GovTech, and only 33 economies have not. As can be seen in Table 2, all the economies of Group A and B except one have a committed organization.<sup>56</sup> Countries in Group C and D need to consider establishing a government entity focused on GovTech.

> > >

**TABLE 2 - The Existence of a Government Entity Focused on GovTech**

	Economies	Group A	Group B	Group C	Group D
Yes (Established)	154	69	45	33	7
Planned/In Progress	11	-	1	6	4
No	33	-	-	14	19

Source: GTMI 2022 data.

Also, of the 165 countries in Table 1 that have designated or plan to designate an organization to implement GovTech, more than half (96) have delegated the responsibility to ministries, such as the Ministry of Information and Communications Technologies, Ministry of Finance, Ministry of Interior, or Ministry of Public Service. The president’s or prime minister’s office has institutional responsibility for GovTech in 41 countries (see Table 3).<sup>57</sup> There is no one size fits all to institutional responsibility, so governments will need to consider their own country context and governance structure.

> > >

**TABLE 3 - Institutional Responsibility for GovTech**

Autonomous Entity	President’s/ PM’s Office	MoICT	MoF/MoE	Mol/MoHA	MoPS/Pub Adm	Other
11	41	76	6	2	12	17

Source: GTMI 2022 data.

Note: MoICT = Ministry of Information and Communications Technologies; MoF = Ministry of Finance; MoE = Ministry of Economy; Mol = Ministry of Interior; MoHA = Ministry of Home Affairs; MoPS = Ministry of Public Service.

Similarly, as the importance of green policy is growing, some countries have established a government entity dedicated to climate change, which is a requirement for adaptation planning and implementation (UNFCCC 2014). In Australia, the Department of Climate Change, Energy, the Environment and Water was established to address climate mitigation and adaptation holistically.<sup>58</sup> In Indonesia, the State Ministry for National Development Planning and the National Development Planning Agency (BAPPENAS) are responsible for implementation and M&E of the National Action Plan for Climate Change Adaptation (RAN-API), including dissemination to provincial governments (UNFCCC 2014).

As described above, it is not common to find a GovTech strategy that already includes green policy, so governments need to set up an institutional arrangement inside the leading GovTech entity to reflect a green perspective in its initiatives. Developing a specific guideline, providing capacity-building programs, and creating a community of

practices could be considered to improve the green mindset. In the United Kingdom, the government has developed various useful guidelines to embed a green perspective in the public sector, such as the [Green ICT Maturity Model](#), [Green ICT Workbook](#), and [Green government ICT case studies](#).

### 3.3.3 Coordination Mechanisms

**Establishing strong and effective coordination mechanisms for GovTech ensures a whole-of-government approach.** The absence of such mechanisms results in the development of siloed systems, fragmented public services, inefficient financial investment, and unnecessary competition between organizations. According to the 2022 GTMI, 105 countries out of 198 have a coordination body leading their GovTech initiatives. Less than half (97) of countries have an entity to monitor and report on GovTech spending for the entire government, and only 70 publish the GovTech institution’s annual progress report.<sup>59</sup> This indicates that many countries still have room to improve their coordination mechanisms.



**TABLE 4 - Coordination in the GovTech Maturity Index**

Index	No	Yes	
Is there a coordination body (steering committee, council) leading GovTech initiatives?	93	105	
Is there an entity to monitor and report on digital/GovTech spending for the whole government?	101	97	
	No	Yes (Internal)	Yes (Published)
Is the GovTech institution’s annual progress report published (results/spending)?	128	8	62

Source:

Since climate change impacts all sectors of the economy and society, actions to address it also require coordination among multiple government and nongovernment actors (World Bank 2021d). Many countries have developed or revised their NDCs based on a strong coordination mechanism encouraging various stakeholders’ participation. For example, Brazil’s National Adaptation Plan (NAP) includes 55 types of federal government policies, plans, and programs for different sectors, with a view to broadening the coherence, efficiency, and synergies of the adaptation strategies in light of the SDGs.<sup>60</sup> In Nigeria, the country updated its NDC through a collaborative and inclusive approach, such as close consultation with all relevant stakeholders, including the states, private sector, and civil society organizations, through validation workshops.<sup>61</sup> The revision process of Pakistan’s NDC blended bottom-up and top-down approaches that ensure active engagement by a wide range of stakeholders aimed at consensus. A National Steering Committee chaired by the Special Assistant to the Prime Minister on Climate Change, as well as technical working groups consisting of federal and provincial-level policy makers, scientists, experts, and other stakeholders, is playing a critical role in revising the NDC.<sup>62</sup> As we can see above country cases of NDCs, organizing effective coordination mechanisms for Greening Govtech is one of key elements of NDCs and well aligned with the development process of NDCs.

Even if each coordination mechanism of the GovTech and green agendas is well established, the next important step is to strengthen the collaboration between the two. Governments may consider an institutional arrangement to establish formal processes that enable both policy agendas to collaborate. A GovTech organization should have a well-organized structure of a unit or position to help green GovTech strategy and implementation. For example, in the EC, the Directorate-General for Informatics (DIGIT) has a unit for Digital Transformation and Coordination. The position of the Internal Control of Institutional Matters in this unit plays a coordinating role with related agencies and other internal units to ensure that a greening policy is part of the digital strategy.<sup>63</sup> Also, it is encouraged that each coordination mechanism has a process to communicate with the other side to discuss possible cooperation. For example, when the Steering Committee for the GovTech invites participants from green agendas to their regular meetings, it can contribute to effective coordination between two policy agendas. Both coordination mechanisms can use policy levers, such as budgeting practices, pre-evaluation of digital investments, public procurement, and monitoring and evaluation to facilitate GovTech strategies to be aligned with green perspectives.

## Key Takeaways

- When senior leaders in the GovTech domain have a deep understanding of the importance of green policy, green perspectives are more likely to be reflected in the GovTech initiatives.
- Participating in international collaboration activities, teaching the core attributes, and incentivizing better management can help ensure political support for the green digital agenda, as can the presence of a government chief information officer.
- Delegating a public sector agency to lead GovTech policy is an important way to facilitate the public sector's digital transformation. To ensure the greening of GovTech, leading government entities should have a green mindset within their organizations.
- An effective coordination mechanism between the GovTech and the green policy agencies can facilitate close cooperation between the two agendas even though they may pursue different priorities.

## 3.4 Legal and Regulatory Frameworks

Legal and regulatory frameworks play a fundamental role in establishing a whole-of-government approach to embracing the green digital transition. These frameworks encompass the “laws, codes, regulations, and practices that govern and support” the green digital agenda (World Bank 2017). They create the binding and non-binding rules that govern the process and also provide the grounds for the adoption of green digital technologies to ensure a long-term, decarbonized, inclusive, and resilient public sector modernization (OECD 2021b). The digital agenda's full alignment with climate change commitments should also be part of the legal framework.

### 3.4.1 Policy Initiatives and Legal Actions

Green policy initiatives can lay the foundation for a digital transition while also contributing to countries'

**decarbonization and adaptation goals.** As showcased in Box 10, countries can update existing climate change and digital laws and policies to keep up with the green digital transformation. Leveraging existing laws, policies, standards, and procedures enables countries to green the digital transition, enhances resilience to climate change, and accelerates the achievement of targets set in the NDCs. Digitalization, as illustrated in Korea's digital transformation journey, can drive energy efficiency gains and bring countries closer to achieving their NDCs and long-term climate targets. Increasing investments in digital access, cloud capabilities, and smart buildings with energy efficiency measures contribute to a reduction in GHG emissions and facilitate the transition to 2050 carbon neutral economies.



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## BOX 10 - Korea's Green Digital Transformation Journey

As mentioned in section 3.2, Korea was among the first countries to adopt a green policy initiative. In 2010, Korea introduced the Framework Act on Low Carbon Green Growth, or the Green Growth Act, to combine fragmented laws and provide the legal framework for implementing national green growth action plans and strategies. The Act clarified the main principles of a green economy, outlined the government's plans to create green industries while transforming traditional ones, and called for mandatory GHG emissions reporting by the government, among other requirements. The Green Growth Act was superseded by the Framework Act on Carbon Neutrality and Green Growth, also known as the Carbon Neutrality Act, in 2021. It outlined policy instruments and legal processes to achieve the country's 2050 carbon neutrality goal. It is Korea's highest legal framework for tackling climate change and enables the country's green digital transformation. More specifically, Article 3 stipulates that green growth and the transition to a carbon-neutral society will be promoted according to various criteria, including by strengthening investment and support for green technologies and industries.

To further accelerate Korea's implementation of its NDC, the country formulated the Korean New Deal, which encompasses the Digital New Deal, the Green New Deal, and the Stronger Safety Net. It highlights 10 projects, four of which are green and digital convergence projects. They include the installation of energy-efficient facilities to promote energy savings and environmentally friendly classrooms, and investments in smart and green industrial complexes.

Source: [World Bank \(2022b\)](#).

**In the EU, public entities spend approximately US\$2 trillion annually in procurement purchases.**<sup>64</sup> This creates a large opportunity for the public sector to promote a green digital transition through the purchase of specific goods and services. Mandatory GPP purchasing requirements or criteria can enable countries to set new standards to promote a green digital transition and stimulate the expansion of climate-readiness markets. GPP policies can also enable a circular economy and promote greater transparency across supply chains and procurement decisions. In 2021, France passed green laws on digital technology, outlining guidelines on eco-designs for products and requiring consumer disclosures on environmental impact (France 2021). And in Japan, digital policies continue to be updated to enhance disaster resilience and recovery. The country introduced "L-Alert," an information-sharing platform for early warning systems and evacuation instructions that enables the country to disseminate information digitally through various channels. The use of the platform, among other digital solutions, is enabled through various disaster risk management policies and procedures, allowing the country to leverage technology for climate resilience (World Bank 2019b).

### 3.4.2 Interoperability Frameworks

**The use of interoperability frameworks supports a whole-of-government approach and promotes a more efficient way for government systems to communicate and**

**exchange information, especially at critical times,** such as before, during, and after climate-induced events. For example, Argentina mandated the "Once Only Principle," making the government responsible for implementing an integrated data system for public administration that reduces the need for citizens to provide the same data to the government numerous times. It also promotes paperless administration by preventing receiving agencies from requiring citizens to present paper documents. The mandate ensures that government agencies are digitizing all paper records received by citizens, thereby protecting records in case of floods and other destructive climate-induced disasters. As part of Chile's digital transformation, the country established a law requiring the digitalization of all government procedures and eliminating paper-based communication between government institutions (World Bank 2022d).

**To fully embrace interoperability, there should be clear incentives and a collective understanding of the expected benefits.** Embedding interoperability into the legal and regulatory frameworks means that privacy and security laws should also be updated to include (i) limitations on data use; (ii) limitations on the longevity of data storage; and (iii) enhanced specificity on the lawfulness of data collection. For example, the European Data Governance Act, enacted in June 2022, aims to increase trust and facilitate data sharing and use across EU countries in important economic

sectors, including agriculture, energy, environment, finance, and health.<sup>65</sup> Interoperability frameworks will need to comply with these laws to gain buy-in from all stakeholders. A strong interoperability framework that is supported by clear and up-to-date laws, guidelines, and standards will allow governments to fully embrace the green digital transition (World Bank 2002f).

### 3.4.3 E-Waste Regulations

#### **E-waste results from discarded electronic equipment.**

E-waste that is toxic and not biodegradable poses serious environmental risks and contributes to an increase in GHG emissions when burned. As countries digitalize and shift to a more digital public sector, e-waste is expected to rise. In fact, experts predict that 74.7 million Mt of e-waste will be generated by 2030, an increase from 53.6 million Mt in 2019 (Bogdan-Martin 2022). To fully embrace a green digital transition, countries will need to put in place regulations related to e-waste management. For example, Extended Producer Responsibility (EPR) schemes require manufacturers, distributors, or importers to be responsible for the end-of-life management of electronics sold, which includes proper disposal and recycling. Regulations can help clearly define e-waste stakeholders to help countries designate responsibility for end-of-life management to specific parties for efficient e-waste management.

**Countries can also put regulations in place to ensure that the cost of e-waste management is financed and sustainable.** For example, the Customs Division of the Ghana Revenue Authority introduced an e-waste eco-levy on end-of-life cycle or used electronic equipment to promote a longer-term and economically sustainable approach to e-waste management. Another concern is counterfeit electronic equipment, which can mean almost immediate e-waste.

To mitigate the issue, countries must enforce regulations to monitor the import of all electronic equipment to ensure that it meets minimum safety and technical requirements. The Zambia Information and Communications Technologies Authority (ZICTA) works closely with the Zambia Revenue Authority (ZRA) to ensure that all electronic equipment meets certain standards (Bogdan-Martin 2022).

### 3.4.4 Participatory Governance

**Government institutions, the private sector, academia, and civil society play an important role in the green digital transition.** Engaging these relevant stakeholders in policy dialogues supports a smoother process. Stakeholder engagement can ensure that the legal and regulatory frameworks associated with the digital transition are aligned with sustainable development priorities such as climate change. They can also, for example, put pressure on policy makers to take the needs of vulnerable groups into account.

**The Coalition for Digital Environmental Sustainability (CODES) is a UN-supported coalition consisting of 1,000 stakeholders from more than 100 countries.** It was formed in 2021 to promote collective action, address the need for new regulations, and steer the digital transition toward greener and more socially sustainable development (CODES 2022). Similarly, the Digital Agenda for Latin America and the Caribbean (eLAC2020) serves as a driver of regional cooperation to promote political dialogue, capacity building, and policy design on digital matters. It further outlines 39 goals for implementation, of which goal 23 focuses on “Promoting the use of digital technologies to prevent, mitigate and adapt to the effects of climate change and natural disasters, reduce greenhouse gas emissions and promote sustainable development” (ECLAC 2021).

#### Key Takeaways

- Countries need to ensure that legal and regulatory frameworks are responsive, forward looking, and inclusive to encourage a green digital transition.
- Countries should leverage existing green laws, policies, and standards to green the digital transition, enhance resilience to climate change, and accelerate the achievement of NDCs.
- Strong interoperability frameworks, supported by clear data and privacy laws, will allow governments to fully embrace the green digital transition and make service delivery more resilient to climate change impacts.
- E-waste regulations can help reduce adverse environmental and climate change impacts.
- Engaging relevant stakeholders in policy dialogues ensures a more inclusive green and digital transformation.

## 3.5 Policy Levers

**An effective digital transition requires that budget and planning are aligned with green digital priorities**, that climate change considerations are embedded in the pre-evaluation of digital investments and in public procurement, and that there are appropriate M&E systems in place. This section elaborates on how to mobilize and calibrate these policy mechanisms to promote a green digital transition.

### 3.5.1 Budgeting Practices

**The budgeting process can play a critical role in coordinating resources for greening GovTech.** Budgets are one of the main expressions of how a government intends to implement its political ambitions, and they play a core role in prioritizing and resourcing government actions.<sup>66</sup> Countries have identified the budget as a key element to use in tackling higher-level objectives, such as gender equality, citizen well-being, and the green transition (OECD 2021d). In the same way, the budgeting process can also be a critical tool to support and strengthen efforts in the green and digital agendas.

**The emergence of “green budgeting” in recent years reflects the importance that countries have placed on using the budget process to support the achievement of environmental and climate objectives** (OECD 2021c).<sup>67</sup> Governments and international organizations are increasingly focusing on green budgeting practices, and climate change considerations have consistently been at the center of recovery programs from the COVID-19 pandemic. In 2020, 14 out of 35 OECD countries (40 percent) reported practicing some form of green budgeting (OECD 2021c), as did 11 out of 27 European countries in 2021 (EC 2022b). As of 2020, at least 19 national and subnational governments had introduced a green budget tagging system, and several countries were in the process of adopting them. Developing countries in Asia were the frontrunners, with some of the earliest systems set up in Nepal, the Philippines, and Indonesia (World Bank 2021c).

**Countries have similar objectives in introducing green budgeting: to help them align their budget to climate change policy priorities, identify financing gaps, mobilize domestic and international finance, raise awareness, and make improvements in transparency and accountability** (World Bank 2021c). It is believed that a greater use of green budgeting tools will help to redirect public investment, consumption, and taxation to green priorities and away from harmful subsidies (EC 2019). Grenada is a recent example of a government, with World Bank support, currently developing and rolling out a climate budget tagging approach that will help

identify and monitor climate change–related spending and is expected to lead to additional investments in climate change mitigation and adaptation measures (World Bank 2022c).

**Green budgeting and climate budget tagging are also essential to generating data on the number of public expenditures invested in climate change mitigation and adaptation measures.** For example, Argentina’s 2019 Law on Minimum Budgets for Adaptation and Mitigation to Global Climate Change (Law 27520) establishes the minimum budgets for environmental protection to guarantee the adequate actions, instruments, and strategies for adaptation and mitigation to climate change.<sup>68</sup> With the objective of monitoring climate change measures across different levels of government, the law also creates the National Information System on Climate Change. It is evident that data and monitoring systems are critical to assessing compliance with and the impact of climate change policies, and green budgeting and climate budget tagging are among the tools for doing it.

**There is wide variation in green budgeting practices across several dimensions: definition of climate-relevant activities and expenditures; coverage; estimates; institutional roles and quality assurance; and timing within the budget process** (World Bank 2021c). For example, the majority of OECD countries—12 out of the 14 that practice green budgeting—employ more than one tool or method in its implementation (OECD 2021c). Among European countries that practice it, five use environmental impact assessments and six use green budget tagging (EC 2022b). A key distinction in green budgeting practices is whether the environmental impact assessments or the environmental cost-benefit analysis is done *ex ante* or *ex post*, since this timing crucially determines whether green budgeting is used for informing budget decisions or only for reporting purposes. Another key distinction is whether the estimation methodology focuses only on identifying activities that positively contribute to climate change mitigation (e.g., green tagging) or also on estimating the environmental impact of a given investment, including an adverse impact.<sup>69</sup>

**International experience highlights that green budgeting practices could be used more extensively, including in the ICT/digital sector and in efforts to align the green and digital transitions.** Green budgeting practices should be conducted *ex ante* to inform budget decisions, rather than *ex post* (see below). They should consider, identify, and tag activities and expenditures that have adverse climate

impacts, not only those with a positive contribution. Policy makers should set budget targets against which results should be measured and use results-based approaches in budgeting to show the achievements from a specified budgeted allocation in terms of climate and environmental objectives (OECD 2022). Specifically with respect to the ICT/digital sector, some countries focus green budgeting practices only on sectors or entities considered most relevant to climate change action, such as energy, transport, and water supply. The ICT/digital sector risks being overlooked, and it is therefore essential that there is sufficient awareness of the potential (positive or adverse) climate impact of ICT and other digital investments (see section 3.6) and that these investments are included in the green budgeting exercise.

### 3.5.2 Pre-evaluation of Digital Investments

**The pre-evaluation of investments can contribute to greening GovTech by explicitly considering the environmental impact of ICT/digital government projects and ensuring coordination of green and digital policies.** Across all sectors, the pre-evaluation of investments is a necessary step for ensuring that expected costs and benefits of a given investment are considered during the planning stage, and that necessary risk mitigation measures are designed in advance. The pre-evaluation of investments is also fundamental to avoid overlaps in investments, promote reuse, and ensure that relevant standards and guidelines are followed. For example, ICT investments can be pre-evaluated to ensure that they follow interoperability standards and a cloud-first approach, or to encourage the reuse of data centers or software across ministries.

**Methodologies for ex ante measurement of benefits and costs of ICT/digital government projects exist and are considered a best practice for many countries, but globally, they are not yet used regularly or consistently** (OECD 2019a). In 2019, the use of standardized models/methods to develop and present business cases for the ex ante measurement of the benefits and costs of digital government projects was compulsory for all ICT projects in 15 percent of OECD countries, and required only for ICT projects that meet specific criteria (e.g., budget threshold) in 39 percent (OECD 2019a).<sup>70</sup> For example, in Portugal, ICT and digital projects with a budget of €10,000 or more must be pre-approved by the Administrative Modernization Agency, which verifies compliance with guidelines and the non-duplication of efforts and compares the prices and budgets with previous projects in order to ensure the best value for money (VfM) (OECD 2021b).

**Although there is a long tradition of cost-benefit analyses based on monetary or economic terms, there is an increasing tendency to include social and economic considerations in the pre-evaluation of investments.** Ex ante environmental impact assessments (or environmental pre-evaluations) are a specific tool of green budgeting whose goal is to measure ex ante the expected environmental benefits and costs of a given investment. For example, the EC's Environmental Impact Assessment Directive, adopted in 1985, ensures that environmental considerations are properly taken into account when project decisions are made (EC 2021). As another example, the government of Ethiopia, with the support of the World Bank, has recently developed a PIM guideline on mainstreaming climate and disaster risk in project planning and decision processes, and adopted a Climate and Disaster Risk Screening (CDRS) tool as a key instrument for project appraisal.<sup>71</sup>

**The pre-evaluation of investments, incorporating social and environmental concerns, should become a standard practice, including in the ICT/digital sector, at least for investments over a given budget threshold.** The existence of a pre-evaluation mechanism for ICT/digital investments applicable to different sectors of government would facilitate alignment across investments on national development objectives, including on the green transition. However, the lack of standard methodologies for these estimations is currently a barrier, as calculating the expected impact of investments along social and environmental dimensions is a difficult exercise. For example, although most OECD countries (78 percent) have a methodology in place to monitor or report the costs and benefits of business cases, only 11 percent with a standardized model stated that those business cases must highlight social and financial gains (OECD 2019a). As for all sectors, the pre-evaluation of investments can provide some estimations to guide policy-making, but it is important to consider that these estimations are indicative, especially when the evidence base is limited, there are data gaps, the impact of investments is driven by a myriad of different factors, and dimensions difficult to quantify (e.g., social and environmental) are taken into account. Still, some methodological advancements have been made, such as the life-cycle cost approach for public procurement and other GPP policies (see Section 3.5.3).

### 3.5.3 Public Procurement

**GPP is “a process whereby public authorities seek to procure goods, services and works with a reduced environmental impact throughout their life cycle when compared with goods, services and works with the same**

primary function that would otherwise be procured” (EC 2008). It is an important tool to promote the use of greener products and services by public authorities to achieve environmental policy goals relating to pollution reduction, resource efficiency, sustainable production and consumption, biodiversity loss, climate change, and disaster resilience. GPP is part of a broader sustainable public procurement (SPP) agenda that addresses economic, social, and environmental concerns (World Bank 2021f). Many governments have focused first on building up technical knowledge and implementation tools for ICT procurement but have missed the opportunity to communicate a compelling business case for GPP. Introducing GPP into the ICT procurement process can help countries reduce their environmental impact and GHG emissions while promoting sustainable development.

**Shifting procurement from a compliance-based process to a strategic function that delivers on environmental and climate goals requires that authorities not only build up new technical knowledge but also commit to a change management process.** This calls for understanding the

benefits that GPP can deliver in the domestic context, as well as the likely challenges that will be faced in implementation. The uptake of GPP requires buy-in not only from procurers but also the markets they buy from and the public they serve. Efforts to identify champions and raise awareness across society can significantly accelerate the adoption of green procurement. Effective communication campaigns can help governments to design an implementation strategy that prioritizes the most promising opportunities for success, avoids pitfalls, and scales up with experience.

**An enabling framework provides the strategic direction and credibility needed to drive green purchasing at scale.**

An enabling framework for GPP consists of laws, policies, and internal regulations that set out a pathway for GPP implementation with a clear scope, priorities, and targets. Such frameworks should be developed through wide consultations and aligned with national priorities. They are most effective when backed by high-level and inter-ministerial political commitment and have support from GPP stakeholders across the private sector, including NGOs and citizens.



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**BOX 11 - EC-Developed LCC Calculation Tools and Standardized EU GPP Criteria**

The EC developed five sector-specific LCC calculation tools aimed at facilitating consistent LCC calculations across member states on vending machines, imaging equipment, computers and monitors, and indoor and outdoor lighting. The EU Smart SPP Project developed a tool spreadsheet and user guide to calculate the life-cycle costs and CO2 emissions of energy-efficient technologies.

The EC has developed standardized EU GPP Criteria for 21 product groups. The criteria, whose application is voluntary, include selection criteria, technical specifications, award criteria, and contract performance criteria. The guidance distinguishes core criteria, which focus on key environmental impacts with minimum administrative costs, from comprehensive criteria, which encompass a wider range of environmental impacts and higher standards. The product categories cover many ICT-related categories, including data centers, server rooms, cloud services, imaging equipment, consumables, print services and computers, monitors, tablets, and smartphones.

**SPP, also called “smart” or “strategic” procurement, is a core element of modern procurement systems.** Closely related to GPP, SPP is defined as: “a process whereby public organizations meet their needs for goods, services, works and utilities in a way that achieves value for money on a whole life-cycle basis in terms of generating benefits not only to the organization, but also to society and the economy, whilst significantly reducing negative impacts on the environment.”<sup>72</sup> SPP entails a range of modern approaches aimed at shifting the procurement focus from lowest cost to achieving VfM. It uses the procurement function in a strategic way to achieve horizontal or secondary policy objectives linked to the three pillars of “sustainable development”: economic, environmental, and social. The most common horizontal objectives of SPP systems are the promotion of sustainable green growth, the development of small and medium-sized enterprises (SMEs) and women-owned businesses, innovation, standards for responsible business conduct, and broader industrial policy objectives (OECD 2019c).

**The life-cycle approach is an important concept to justify the shift of the procurement focus from choosing lowest cost tenders to achieving VfM.** The purchase price of a good, service, or work represents only the proverbial tip of the iceberg of the total cost incurred by a purchaser over its life cycle. The total cost of ownership (TCO) recognizes that purchases with a low initial price but high energy or water-use needs, maintenance requirements, and disposal costs can offer lower VfM. For example, the purchase price of a light bulb is small compared to the cost of energy over its lifetime of use. Life-cycle costing (LCC) is another concept that goes further than TCO by also considering the cost of environmental externalities that can be monetized (e.g., GHG emissions, pollution fees) (World Bank 2021f).

**Integrating environmental performance into technical specifications can be seen as more of an art than a science.** The right criteria will depend on the state of environmental technologies, local market realities, and scope of the tender. In selecting criteria for a tender, procurers should keep in mind the need to select requirements that “push” the market toward greening while being achievable to ensure a competitive response from bidders. Procurers will need to ensure that any criteria selected has a clear means for verification that is not overly burdensome to either the supplier or contract manager.

**In general, procuring entities can integrate environmental criteria at four stages of the procurement cycle, including supplier selection, technical specifications, award criteria, and contract performance.** Supplier selection criteria aim

to ensure that participating bidders have the fundamental technical capabilities, ethics, and management procedures in place to deliver on the desired environmental outcome. Technical specifications prescribe core environmental criteria that bidders must meet to satisfy the requirements of the tender (e.g., minimum recycled content, bans on toxic chemicals). Award criteria can include more comprehensive (optional) environmental criteria that encourage, challenge, and award bidders that propose solutions with improved environmental performance (e.g., higher percentage of recycled content, functional criteria that allow supplier innovation). Contract performance clauses can ensure that winning suppliers deliver on the contract in an environmentally friendly way and continuously improve their environmental performance through the contract duration.

**A common perception of GPP is that it is complex, requiring procurers to familiarize themselves with complicated environmental criteria and design tailor-made tenders for each ICT procurement need.** In fact, GPP comprises a variety of procurement approaches that range in complexity and scale. In countries where there are central procuring authorities, several options exist to reduce the administrative and technical burden on individual contracting authorities to buy green. Below is a list of procurement approaches that governments can adopt to implement GPP (World Bank 2021f).

- **Needs assessment and stock management.** Often the greenest option is not to buy at all. GPP in GovTech starts with rethinking ICT procurement needs and exploring options to improve stock management, share and repurpose supplies across units, and reduce unnecessary or surplus purchases. Such needs assessments can offer immediate and significant cost-savings, especially if coordinated from the central level.
- **Framework agreements.** Central procurement bodies (CPBs) have an important role to play in setting up framework agreements for commonly purchased green ICT goods and services. This reduces the administrative burden on individual contracting authorities and makes it easy for procurers to gain experience in buying green.
- **Green product lists and marketplaces.** Governments can create lists or online databases of pre-approved green ICT goods, works, and services and make these available to procurers across government. When created, online monitoring of these green purchases and participating authorities is simplified.



- **Mandatory GPP requirements.** Countries can set mandatory GPP requirements for priority spend categories, starting with the most important and realistic criteria, such as Electronic Product Environmental Assessment Tool (EPEAT)-certified IT equipment. Doing so removes the legal uncertainty and risk perceived by procurers, simplifies the design of green tenders for GovTech and ICT, and sets a common practice for all contracting authorities.
- **Joint procurements.** Joint procurements for ICT can be organized by CPBs or multiple government units that have common identified procurement needs. This approach aggregates demand, improving the government's ability to negotiate lower prices and motivate suppliers to offer innovative solutions.
- **Product service systems.** Contracting authorities can explore the potential to avoid outright purchases by renting or leasing products or entering into service agreements. Doing so transfers purchase risks and maintenance and disposal costs to the suppliers and can be cost-effective. This is an area of innovation, with many companies offering new state-of-the-art solutions in GovTech and ICT (e.g., energy service companies).
- **Innovation procurement.** Governments can use public procurement as a tool to stimulate innovation in the development of green GovTech and ICT goods, services, and works (e.g., competitive dialogues, design contests, innovation partnerships, pre-commercial procurement). This allows authorities to steer market innovation and research and development toward new solutions that directly meet existing and emerging public needs.

**When procuring ICT technology specifically, information systems, such as core government systems and e-services that provide public service delivery adoption and change management, are important considerations.** Procurement of new technology and existing technology upgrades will require clear functional and technical requirements, including change management. As noted above, new technologies can have a leapfrogging effect and avoid sunk costs, although adoption can be challenging, especially in developing countries.

### 3.5.4 Monitoring and Evaluation

**An effective M&E system could be a useful tool to systematically combine GovTech with climate change**

**considerations and further highlight how GovTech can contribute to the green agenda.** M&E is a continuous management function to assess whether progress has been made in achieving expected results, to spot bottlenecks in implementation, and to highlight whether there are any unintended effects (positive or negative), and it can refer to programs, projects, reforms, policies, or strategies.<sup>73</sup> M&E is necessary for project management, transparency, and accountability, as well as for building knowledge on which interventions work for a specific development objective and therefore support the continuous improvement of the project design. M&E is also useful to generate evidence and data on the realized impact of investments, and it is therefore a critical contributor to the continuous improvements and refinements of the methodologies for the pre-evaluation of investments and, ultimately, to better decision-making in the future (see Section 3.5.2). The quality of the M&E system is one of the factors determining the success of an intervention, as demonstrated by Raimondo (2016) from an analysis of data from 1,300 World Bank projects evaluated between 2008 and 2014. From a whole-of-government perspective, a comprehensive M&E system could also be an effective mechanism for improving policy coordination and coherence across ministries and sectors, such as in the case of the green and digital transitions.

**Despite these benefits, the adoption of M&E systems and their quality vary across countries.** For example, a [report](#) from the Global Partnership for Effective Development Cooperation shows that only 35 percent of governments have data and systems to track implementation of national strategies (Global Partnership 2019). There are various challenges related to building an effective M&E system, which should include: the results framework and set of indicators, plans, and methods for data collection and analysis; a vision of how data and results will inform relevant decisions; coordination mechanisms across the appropriate actors; and strategies for communication and engagement with stakeholders. Governments typically face challenges with respect to all of these elements, in particular on institutionalizing and coordinating M&E systems, aligning and coordinating them across sectors, building internal staff capacity, defining the appropriate measurement framework, and using M&E data for decision making (Biscaye et al. 2015). As demonstrated by the GTMI 2022 indicators (Table 5), there are still gaps in data availability, quality, and integration for many countries, limiting the construction of effective M&E systems.

**TABLE 5 - Snapshot of Data Governance and Data Management Worldwide**

	% of Countries
Have a data quality framework (I-3.6)	31
Have an open data portal (I-29)	75
Have a dedicated government entity in charge of data governance or data management (I-34)	19
Is there an operational information system for the following:	
• Financial Management (I-5)	95
• Tax Management (I-7)	91
• Customs Management (I-8)	93
• Human Resource Management (I-9)	80
• Primary Management Information System / Pension Management Information System (I-11)	96
• e-Procurement Portal (I-12)	82
• Public Investment Management System (I-14)	35
Do the following exchange with other systems:	
• Financial Management Information System (I-5.13)	17
• Tax Management Information System (I-7.7)	21
• Customs Management Information System (I-8.8)	18
• Human Resource Management Information System (I-9.7)	18
• Primary Management Information System / Pension Management Information System (I-11.9)	20
• e-Procurement Portal (I-12.6)	18
• Public Investment Management System (I-14.6)	6

Source: World Bank GTMI at <https://www.worldbank.org/en/programs/govtech/gtmi>.

### Monitoring and evaluating the impact of GovTech on climate change has additional specific challenges.

The first relates to the definition of the appropriate indicators and the availability of the necessary data. An M&E system for climate change adaptation or mitigation typically uses indicators on: risk reduction; policy and administrative management; environmental education and training; research; and coordination (Lamhauge, Lanzi, and Agrawala

2012). The most common GovTech interventions focus on building the necessary legal and regulatory framework and the infrastructure for digitalizing government functions and services. Although it is straightforward to monitor the adoption of policies and laws and the setup of e-Government systems, the next step would be to monitor the take-up across ministries and public entities at different levels of government. For example, the adoption of a GPP (see section 3.5.3) framework

and the implementation of related capacity building do not necessarily imply that contracting entities will start using GPP tools, and this aspect should be monitored separately (see Box 12). As another example, the European Digital Economy and Society Index (DESI) includes an indicator on “ICT for environmental sustainability” that measures ICT’s level of

support for enterprises to engage in more environmentally friendly actions.<sup>74</sup> Green budgeting and green budget tagging (see section 2.5.1) are also tools that help to create the necessary data and information systems for monitoring the actual implementation of climate-related interventions, including GovTech.

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## BOX 12 - Green Public Procurement Indicators

An increasing number of countries—36 percent in 2021—have adopted some sort of GPP institutional arrangement. However, many fewer countries currently monitor or report on the adoption of GPP approaches in their procurement operations. The widespread adoption of e-Procurement systems provides an opportunity to embed GPP indicators and thereby facilitate systematic data entry, collation, and reporting on GPP operations. The variety of GPP approaches complicates the definition of a global measurement framework. Nonetheless, the following is a list of relatively generic indicators that can be applied across different settings to monitor the take-up of GPP tools:

- **Indicators to identify green purchases**, such as purchases that incorporate environmental considerations into award criteria and contracts with clauses that define sustainability standards;
- **Indicators to identify contracts with green suppliers**, such as suppliers registered in certification programs and deemed responsible;
- **Indicators to identify purchases of green products**, such as products with an ecolabel or certified as sustainable.

Additionally, there is an increasing effort to measure the environmental impact of public procurement. Although this is methodologically challenging, standardized metrics have been developed to estimate the environmental impact of some product categories (such as computers and printers). These standardized metrics provide measures of CO<sub>2</sub> emissions (or their equivalent) based on the exact product specifications, and they are becoming available for an increasingly large set of product categories.

*Source: World Bank (2021f).*

**The second specific challenge relates to the difficulty in establishing definitive links between GovTech and environmental indicators, such as CO<sub>2</sub> emissions.** Although for climate change adaptation and mitigation measures (e.g., reforestation and construction of stormwater drainage infrastructure in targeted areas) there are direct expected environmental benefits, this might be less clear for GovTech interventions. For example, a GovTech action to address climate change and strengthen resilience might include the creation of digital service centers to ensure continuity of services in the event of climate-related shocks and the use of data to enhance entities’ capacity to plan and respond to climate

events. These activities strengthen institutional capacity to manage climate change, but it would be difficult to measure their direct contribution to the improvement of environmental outcomes and reduction of CO<sub>2</sub> emissions. This exercise could apply to specific GovTech interventions for which it is possible to map and measure all steps in a theory of change. For example, a World Bank–funded project in Bangladesh on digital PFM (World Bank 2021a) provides estimates on the expected reductions in travel times and paper consumption associated with moving from paper-based to electronic public procurement, and therefore on the associated CO<sub>2</sub> emissions reductions (see sections 2.2.1 and 2.3.1 and Box 5).

## Key Takeaways

- Green budgeting practices: are best conducted ex ante, should consider both the beneficial and the adverse climate impacts of investments, should be complemented with budget targets, and should be applied to all sectors.
- The pre-evaluation of digital investments from an environmental perspective could become a more widely adopted practice if there were further advancements and developments in standard methodologies for estimations.
- GPP of ICT and GovTech solutions does not have to be complex as there are a variety of procurement approaches. Options also exist to reduce the administrative and technical burden on contracting authorities.
- Monitoring and evaluating the impact of GovTech on climate change requires data for the construction of relevant indicators and a precise theory of change to map and measure how GovTech interventions could have environmental consequences.

## 3.6 Green Digital Competencies

**This section outlines the importance of professionalizing public officials in green digital competencies.** It discusses existing digital frameworks and the needed competencies and entry points to integrate green skills into the digital sector. Although this is a new topic, awareness of green digitalization has been at the forefront in recent years, as workers increasingly appreciate the environmental impact of their actions.

### 3.6.1 Mainstreaming Green Digital Culture across the Public Sector

**Training staff on greening digital skills involves enhancing their understanding of the potential benefits and consequences of both action and inaction.** Article 11 of the Paris Agreement emphasizes that developing countries and small island states, particularly those with low capacity, should have access to climate finance for education, training, and public awareness on the adverse effects of climate change. Capacity building should be country-driven and respond to national, subnational, and local needs. A collaboration with developed countries is essential to enhance support for capacity building actions in developing countries with the initiatives included in the appropriate institutional arrangements under the Convention that serves the Paris Agreement (UN 2015).

### 3.6.2 Key Priorities for the Public Sector to Secure Green Digital Talent

**There is no one path to engaging green digital talent, though the local culture should be taken into account.** As

a starting point, the OECD Recommendation on Public Service Leadership and Capability (OECD 2019b, 28) gives insight on how countries can ensure their public sector employees are capable of carrying out the digital and green agendas.

#### **3.6.2.1 ENABLING THE PUBLIC SECTOR TO BE FIT FOR THE FUTURE**

**The OECD Recommendation's principles start with enabling public sector leadership to develop a value-driven culture and responsive and adaptive public service systems.** This includes incorporating green digital competencies, data-driven decision making, and strategic leadership to design a future public sector workforce that is environmentally conscious (OECD 2019b). The value added is a workforce that is resilient to changes in technology and adaptive to innovation and sustainability in the global market.

#### **3.6.2.2 TRAINING IN GREEN DIGITAL SKILLS AND INTERNATIONAL ALLIANCES**

**Training in green digital competencies can facilitate a successful implementation.** Training should highlight the importance of green digital competencies and the benefits and added value of having international alliances. The OECD Framework for digital capacity in the public sector provides five layers of skills that are required to support digital government maturity and can be adapted to incorporate a green or environmentally friendly component in a framework for future training programs (OECD 2020). No matter the role or position, these can be a priority for governments:

1. The starting point is a baseline for 21st century skills in society
2. Digital government user skills
3. Digital government socio-emotional skills
4. Digital government professional skills
5. Digital government leadership skills

**These priorities can help to develop a core understanding of green digital thinking and practice throughout all levels of the public sector (OECD 2020).** Over time, individuals will learn the skills needed to thrive in the green digital age. While prioritizing capacity building, there should be ongoing efforts to continuously upskill to ensure that employees remain fully equipped over the long term. As an example, in Argentina, the government’s plan is to share knowledge on digital skills and lessons learned to gain experience on the implementation of digital systems and e-Services at the national and subnational levels. To strengthen the existing digital infrastructure, the government of Argentina plans to implement a federal

training plan as well as a training campaign for digital service center operators.

### **3.6.2.3 TARGETED GREEN DIGITAL SKILLS, CREATING AN AWARENESS FOR STAFF**

The EC’s DIGIT team stated that out of the 13,000 skills represented in their skills classification, environmentally conscious digital competencies are included in computing skills and green digital services. The team mentioned that some agricultural departments in the EU have targeted digital green skills, especially in water scarcity, ensuring that national policies are in line with the EU’s. To contribute to awareness and knowledge sharing they have conducted staff trainings on reducing digital waste. The team also mentioned that employees are reminded to switch off lights and avoid printing and to use emails, messages, and video calls as necessary. Seeing these reminders and taking action contribute to emission reduction in a substantial way.<sup>75</sup>



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#### **BOX 13 - United States and Canada Launch GGI**

In April 2021, the United States and Canada launched, as a global effort, the Greening Government Initiative (GGI) to engage and support governments around the world in greening national government operations. The objective of this international community of practice is to enable countries to share knowledge and lessons learned, promote innovation, and support the greening goals underway to help countries meet their Paris Agreement commitments. The collaborative effort includes bilateral work to leverage shared purchasing power to drive government operations to net-zero GHG emissions and increase the climate resilience of fixed assets. Both countries agreed to work together to identify a pathway to net-zero supply chains for buildings (renewable energy, concrete, steel), and fleets (zero-emission vehicles and clean fuels).

Source: Greening Government Initiative at <https://www.sustainability.gov/ggi/>; and White House, “The Governments of the United States and Canada Announce New Greening Government Initiative,” [Press Release, April 22, 2021](#).

**In line with the green digital agenda, the EC has developed rights and principles for the digital decade to help member states and companies to deal with new technologies.**

The green agenda promotes digital devices that can support sustainability and a green transition, raising awareness of the impacts their devices have on energy consumption and the environment. The Commission, through a governance framework, will work with member states to develop objectives and targets for Europe's digital transformation. Trajectories for each target and a national strategic roadmap will also be developed. For these changes to take place at the national and EU levels, a long-term plan of action and investments must be in place.<sup>76</sup> Raising awareness on the use of digital devices and equipment, studying how it impacts the environment and documenting these in long term plans and strategies can aid development of future best practices of green digital competencies.

### 3.6.3 Enablers to Build Green Digital Competencies

**One of the greatest challenges to a green digital government is maintaining support between political cycles.** Most importantly, is embedding a deep understanding of green GovTech among all those involved in policy and service design and delivery, regardless of their role. Standards should be developed that emphasize capacity, talent, and skills, as well as staff incentives to gain knowledge. The following are some guiding steps (OECD 2020).

- **Good practice guidance**, such as style guides, service manuals, and other documentation, on green digital practices
- **How to access capacity in terms of green talent and skills** to address recruitment, retention, training, and working with the private sector. Including these skills in the job descriptions and in training programs helps to develop an awareness of the new normal for staff.
- **A focus on green digital inclusion**, prioritizing green digital literacy, connectivity, and accessibility to ensure that green digital government does not worsen any digital divides.
- **Data-driven public sector approaches**, in line with the recommendations of the OECD's framework (OECD 2020).

Although different countries are at different levels of digital maturity, especially in the greening digital competencies initiative, reaching a universal standard for green digital literacy should be a policy priority distinct from the specific challenges of digital government. In many countries where private sector advantages and competition are strong, the public sector struggles to attract and retain employees with these specific technical skills (World Bank 2022d).

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#### **BOX 14 - Sweden: Investigating Long-Term Strategies for Reducing Greenhouse Gas Emissions**

In January 2020, the Swedish government tasked the Swedish Environmental Protection Agency with investigating the possibility of incorporating Article 12 of the Paris Agreement into the country's long-term strategies for reducing GHG emissions. Article 12 states "Parties shall cooperate in taking measures, as appropriate, to enhance climate change education, training, public awareness, public participation and public access to information, recognizing the importance of these steps with respect to enhancing actions under this Agreement." The Agency has reported recommendations to the government on how the work on Article 12 can be strengthened and contribute to the achievement of national climate goals, an objective in which government authorities, civil organizations, and higher education institutions play an important role.

Source: Sweden, Government of, "Sweden's Long-Term Strategy for Reducing Greenhouse Gas Emissions" (Stockholm: Ministry of the Environment, 2020), [https://unfccc.int/sites/default/files/resource/LTS1\\_Sweden.pdf](https://unfccc.int/sites/default/files/resource/LTS1_Sweden.pdf).

**To reduce the expected employment challenges, incentives and awards should be included in the competencies and selection criteria for jobs advertised.**

Green digital knowledge should also be a core element of the skills of public officials, regardless of their role in government. In many developing countries, the public sector workforce, particularly outside of the Office of the Chief Information Officer, staff is not expected to have a strong understanding of basic digital government. In those circumstances, private sector training in green digital skills will add value and should be a government priority.

There are challenges that prevent modernization of public sector infrastructure like firstly, the lack of aligned incentives as different parts of the public sector have differing values and missions. Secondly, an aversion to risk and change, especially since infrastructure modernization and professionalizing skills can be complicated. Even if the decision is made to

professionalize staff to green digital skills, those lacking these technical skills can feel pressured and opt out.<sup>77</sup>

### 3.6.4 Green Digital Leadership: The Public Sector and the Role of Stakeholders

**Digital transformation, especially one that is environmentally conscious, is not the role of IT departments.** It requires a multifaceted approach that goes beyond the digitalization of government.<sup>78</sup> As mentioned in section 3.3 on Institutional Leadership and Coordination, the main drivers in achieving and maintaining sustainable GovTech are political will and organizational and societal leadership. Although governments are at different stages of green maturity, an awareness of future green digital fluency and digital mindfulness tied to environmental goals should be communicated to ensure alignment across all levels of government.

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#### BOX 15 - Green Digital Leadership

##### The Moroccan Greening Government Program

The Moroccan National Sustainable Development Strategy (NSDS) sets out 31 policy actions. The Strategy underscores a proactive policy for sustainable government operations supported at the highest levels, the important role of a dedicated agency, and shared lessons learned on financing this work. According to the Strategy, Morocco's government needs to hire people who are aware of the new environmental policy changes and standards. In addition, environmental requirements and the promotion of sustainable development should be included in staff training. Finally, the results should be monitored and measured using indicators.

Source: "National Sustainable Development Strategy (NSDS)," [eng-sndd\\_resume\\_executif-v24-d \(1\).pdf](#).

##### French Digital Directorate (DINSIC)

In France, the public service realized that senior leaders attended only short trainings on digital government that were superficial in nature, creating a challenge to promoting GovTech. The French Digital Directorate (DINSIC) stepped in and established a coaching program for senior leaders from digital professionals. This coaching helped senior managers to overcome traditional notions of public service leadership based on legal compliance or process management and to embrace and lead the digital transformation.

Source: OECD, "The Future of Work in the Public Service: Preparing the Workforce for Change in a Context of Uncertainty," Working Party on Public Employment and Management (Paris: Public Governance Directorate, 2020), <https://www.oecd.org/gov/budgeting/preparing-the-workforce-for-change-in-a-context-of-uncertainty.pdf>.

## EC Volunteer Initiative

As part of its corporate social responsibility measures, the EC is developing several initiatives to help groups of volunteers to include social activities alongside environmental ones and to introduce purely “green volunteering” actions as part of the “Volunteer for a Green Change” program.

Source: EC (2022c).

## Mint: The Private Sector

The firm Mint works with government entities to empower their staff to create change. Governments are increasingly realizing the importance of ensuring that their employees are digitally empowered to enable transformation. Mint has been implementing change management in the financial services industry to help full service providers to unlock the full potential of their people and technology.

Through the Office 365 Enablement Offering, Mint aims to empower public sector organizations to deliver transformative client engagement experiences and services by ensuring that staff have the right technologies available that match their skills, coupled with the drive and focus to apply these systems for success.

Source: <https://us.mintgroup.net/solutions/public-sector/empower-your-staff-with-o365/>

## Key Takeaways

- An investment in civil servants’ capabilities is needed to transform the public sector.
- Capacity building should be country-driven and respond to national, subnational, and local needs.
- Identifying green digital skills and competencies that deliver value to society and the environment must be continuously reviewed across political cycles.
- By reviewing and updating the skills requirements at all levels of government while keeping pace with changing technology needs and environmental demands, the public sector can attract and retain employees with the required competencies (OECD 2019b).





## >>> Conclusion

**Today across the globe, government efforts to go digital and go green are currently widespread, but these policy actions frequently happen in parallel, missing the opportunity to align the two.** Most countries now prioritize the digital transformation of their public sectors, and the 2022 GTMI<sup>79</sup> demonstrates this increasing trend. Nevertheless, an effective link between GovTech policies and climate change mitigation and adaptation is frequently still missing, even in highly developed countries. Considering the climate emergency underway, the increasingly omnipresent nature of digital technologies, and the fundamental influence of government in economies and societies, a policy alignment of the digital and green agendas—the greening of GovTech—should be a critical priority for all sectors and levels of government.

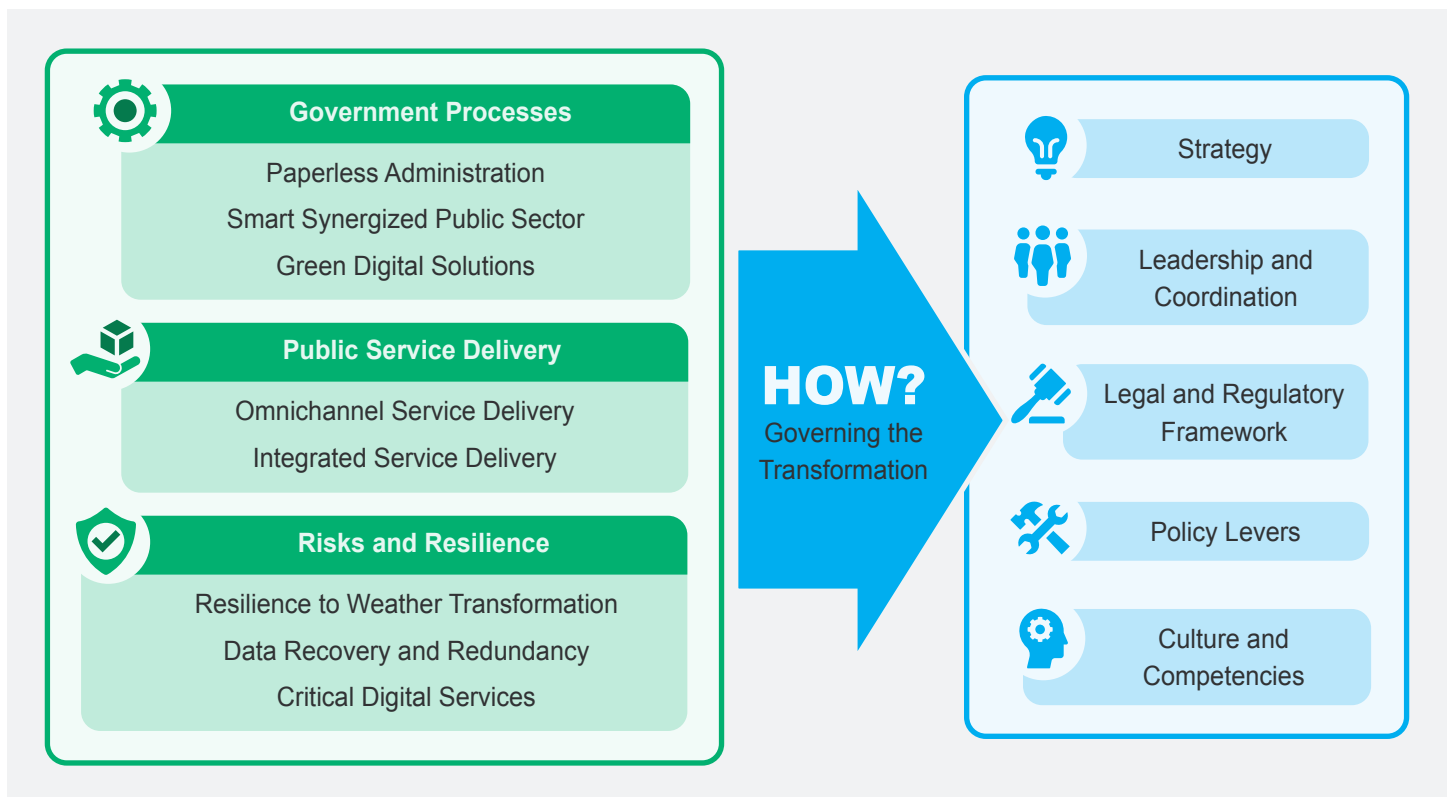
**Building on the work developed government and nongovernment stakeholders, this guidance note provides guidance on green GovTech policy approaches to help promote a sustainable, inclusive, and resilient public sector transformation.** The note provides information and guidance on how governments can address the climate emergency when designing and implementing the digitalization of their public sectors. It also describes how the transformation of government through digital technologies and data can contribute to the cross-cutting policy effort toward net-zero carbon emissions.

The note provides recommendations for solutions to green the fabrics of government through digitally transformed processes and services. The contribution of an increasingly paperless, connected, and data-driven administration is demonstrated, showing that the digital benefits of “doing more with less” can also help to reduce the public sector’s carbon footprint. In other words, the delivery of digitally integrated and omnichannel services can contribute to a greener administration, generating carbon savings on the part of both the government and individual citizens. GovTech policies can also decisively make public sectors more resilient to natural disasters and other emergencies generated by climate change, creating redundancies, for instance, for data saving and service delivery.

The note provides additional recommendation for approaches and tools needed to secure green GovTech policies across different sectors and levels of government (see Figure 10). A whole-of-government approach is critical, including an explicit policy strategy, committed institutional leadership, and extensive inter-agency coordination. Policy levers, such as budgeting, procurement, and monitoring, are important mechanisms to enforce the greening GovTech policies in a coherent and sustainable way. Regular updates of the legal and regulatory frameworks will also be required, as will the existence of a widespread green digital culture and sufficient staff competencies in these areas.

> > >

**FIGURE 10 - Institutional Leadership and Coordination for Green and Digital Government**



Source: Authors.

Considering the high demand from World Bank teams and clients for structured experience and knowledge on green GovTech, a second volume of the guidance note is planned. Based on a literature review, analysis of the World Bank database of GovTech projects, interviews with numerous stakeholders, and data analysis, this continuation of the greening GovTech work will complement the current analysis to better illustrate the implementation and management of the public sector’s green digital transformation. The focus will be three country case studies that illustrate some of the innovative practices currently in use, sharing knowledge and implementation-oriented insights. Particular attention will be paid to digitally advanced countries to determine if their existing practices can be spread globally, and if other World Bank client countries can replicate them. The selection of the three case studies will be based on their relevance and impact, innovative outreach, and also scalability and replicability in different contexts.

**The second volume will also explore how to measure the green dimensions of GovTech solutions and GovTech's contribution to a greener future, further developing the topic of how to quantify the benefits.** Identifying the impacts of GovTech policies and solutions on the fight against climate change is critical to sound policy coordination and implementation. At the same time, it is one of the more challenging tasks countries currently face, since data on the effective economic and social impacts of public sector digitalization are still far from reaching the proper maturity. GovTech policy makers and practitioners can easily plan outputs, but identifying the outcomes—and particularly the impacts—of GovTech policies requires further research. Building on the World Bank work on calculating climate change co-benefits, the next volume will also add to the practical knowledge on how to measure the benefits and risks of GovTech as they relate to climate change.

**More practical guidance on greening GovTech should also be explored in future work.** For instance, public servants are frequently reminded to switch off lights and reduce printing, but other digital behaviors, such as emails or video calls, might be adding to emissions production. The identification and

dissemination of good digital behavior practices in the public sector requires further consideration. Also to be explored is the creation of “how-to-notes” that can provide detailed guidance on implementing specific green GovTech initiatives. This possible future work will be considered based on the demand from senior GovTech officials in client countries, as well as from the Bank's TTLs involved in GovTech activities.

**As the digital transformation accelerates and the climate emergency poses severe threats to economies and societies across the globe, the importance of greening GovTech policies also increases.** Building on the diversity of GovTech stakeholders and bearing in mind that each country will need to develop its own approach, governments should prioritize policies that can properly connect and synergize the most important objectives of today: going digital and going green. This policy note, “Greening Public Administration with GovTech,” in this current volume and the forthcoming one, significantly contributes to these goals by providing knowledge, frameworks, and practical examples on how to structure policy action for efficient, inclusive, and coherent green digital public sectors.



## Notes

1. Estimates vary online due to differences in assumptions and data sources. See Ekholm (2019).
2. Article 10 of the Paris Agreement includes several points critical role of technologies for climate change mitigation and adaptation. See UN (2015).
3. Thales, "[Digital Dividends: The Positive Effects of Digital Identity](#)" (Paris: Thales, 2021).
4. M.A. Tomovska, "[The Future of Government: Serbia's Growing Bet on Digital Transformation Pays Off.](#)" *Governance for Development* (blog), November 23, 2021.
5. E. Labram and W. Pearson, "[Measuring the Climate Impact of Our Digital Services at GDS.](#)" *Government Digital Service* (blog), October 3, 2019.
6. The World Bank (2022d) defines the whole-of government approach as when a government utilizes a range of structural and organizational incentives to improve coordination across administrative boundaries to achieve an integrated response to the uptake of GovTech solutions or any other policies.
7. S. Muench and others, *Towards a Green and Digital future: Key Requirements for Successful Twin Transitions in the European Union*, Joint Research Centre (Brussels: European Union, 2022), [https://joint-research-centre.ec.europa.eu/jrc-news/twin-green-digital-transition-how-sustainable-digital-technologies-could-enable-carbon-neutral-eu-2022-06-29\\_en](https://joint-research-centre.ec.europa.eu/jrc-news/twin-green-digital-transition-how-sustainable-digital-technologies-could-enable-carbon-neutral-eu-2022-06-29_en).
8. See [https://ec.europa.eu/info/business-economy-euro/recovery-coronavirus/recovery-and-resilience-facility\\_en](https://ec.europa.eu/info/business-economy-euro/recovery-coronavirus/recovery-and-resilience-facility_en).
9. Although resilience to weather transformation is fundamental, other phenomenon also require resilience, such as wars (e.g., Russia-Ukraine) or health-related disasters (e.g., COVID 19).
10. Initiatives, such as the European Green Digital Coalition (EGDC), aim to capture the emissions-reducing potential of digital solutions in all sectors of the economy. Pilots are underway to estimate both the reduction in GHG emissions and the direct footprint of digital technologies.

11. See World Bank, “Service Upgrade: The GovTech Approach to Citizen Centered Services” (Washington, DC: World Bank, 2022g); World Bank, “GovTech: The New Frontier in Digital Government Transformation” (Washington DC: World Bank 2020a), and section 1.4 of this paper.
12. As discussed during the authors’ consultation with the EC, the reduction of paper consumption at more advanced stages of the digitalization process can be explained by two effects: a) reduced printing needs of integrated and interoperable IT systems and b) improved and innovative printer management.
13. Tomovska, 2021. “The Future of Government: Serbia’s Growing Bet on Digital Transformation Pays Off.”
14. Inputs shared by the World Bank procurement team in Bangladesh.
15. For a more detailed analysis of energy consumption in the ICT sector, see, for example, S. Lange, J. Pohl, and T. Santarius, “[Digitalization and Energy Consumption. Does ICT Reduce Energy Demand?](#)” *Ecological Economics* 176 (2020); and World Bank, “[Catalyzing the Green Digital Transition](#)” (Washington, DC: World Bank, 2022).
16. World Bank, “[Interoperability: Towards a Data-Driven Public Sector. Equitable Growth, Finance and Institutions Insight – Governance.](#)”, 2022
17. For details on GovTech and mobile government, World Bank. “[Mobile Government How-To Note](#)” (Washington, DC: World Bank, 2023).
18. J. Timperley, “[Will Working from Home Help the Environment?](#)” *BBC Science Focus Magazine*, February 4, 2022.
19. D. Crow and A. Millot, “[Working from Home Can Save Energy and Reduce Emissions. But How Much?](#)” *International Energy Agency*, June 12, 2020.
20. H. von der Burchard, “[European Commission to Close Half of its Buildings as Telework is ‘New Norm’](#)” *POLITICO*, May 25, 2021.
21. “[Public Service Workers to Benefit from Remote Working from October 1.](#)” *Times of Malta*, July 15, 2021; and Malta, Government of, “Remote Working: Policy and Guidelines on Its Implementation” (Valleta: Office of the Prime Minister, 2021). [https://publicservicecms.gov.mt/en/Documents/Public\\_Service\\_Management\\_Code/Remote\\_Working\\_Policy.pdf](https://publicservicecms.gov.mt/en/Documents/Public_Service_Management_Code/Remote_Working_Policy.pdf)
22. See worst case scenario by Andrae and Edler (2015) and Monnin (2019). For a comprehensive discussion of the issue, see also: World Bank, “[Catalyzing the Green Digital Transition](#)” (Washington, DC: World Bank, 2022).
23. Examples are Andrae and Edler (2015); and S. Lange and T. Santarius, *Smart Green World?: Making Digitalization Work for Sustainability* (Milton Park, UK: Routledge, 2018).
24. World Bank (2022a).
25. Monnin (2019); and L. Belkhir and A. Elmeligli, “Assessing ICT Global Emissions Footprint: Trends till 2040 & Recommendations,” *Journal of Cleaner Production* 177 (2018): 448–63.

26. World Bank (2022a).
27. Ibid.
28. For a comprehensive and more detailed review and analysis of the energy/electricity consumption and GHG emissions of the entire ICT sector, see World Bank (2022a).
29. United Kingdom, Government of, “Greening Government: ICT Strategy” (London: Government of the United Kingdom, 2020); and Germany, Government of, “[Green-IT-Initiative des Bundes \(Federal Green IT Initiative\)](#)” (Berlin: Federal Ministry for the Environment, Nature Conservation, Nuclear Safety and Consumer Protection, 2021).
30. World Bank (2022a); World Bank (2022b); Forschungsverbund Nachhaltige Rechenzentren Baden-Württemberg, “Nachhaltige Rechenzentren Leitfaden (Sustainable Data Centers Guidelines),” 2020; and BMUV, “Blauer Engel, Energieeffizienter Rechenzentrumsbetrieb (Energy Efficient Data Center Operations),” 2019.
31. IT Planungsrat, “Green IT Strategie des IT-Planungsrates,” 2022; and Bundesregierung, “Koalitionsvertrag zwischen SPD, Bündnis 90/Die Grünen und FDP (Coalition Agreement 2021–2025 between the SPD Bündnis 90/DIE Grünen and FDP),” 2022.
32. See the [Green Data Centres Practice Guide V1.0 \(beamsociety.org.hk\)](#).
33. For more details on cloud computing, see also World Bank ([World Bank 2023b](#)).
34. Microsoft and WSP, “The Carbon Benefits of Cloud Computing” (Seattle, WA: Microsoft Corporation, 2020).
35. A comprehensive overview of green public procurement is provided by World Bank (2021f).
36. Procurement of energy-efficient IT hardware is often an important element in public and private sector green IT initiatives, such as in the example of the German Federal Administration in Box 3 above.
37. S. Podder, “[Why We’re on the Cusp of a New Era of Carbon-Efficient Software](#),” LinkedIn, February 17, 2022; and S. Podder and others, “[How Green Is Your Software?](#)” *Harvard Business Review*, September 18, 2020.
38. More info can be found on the Green Software Foundation website: [Green Software Foundation | GSF](#).
39. “Dark Data,” Gartner, <https://www.gartner.com/en/information-technology/glossary/dark-data>; and “Dark Data,” Wikipedia.
40. A. Tan, “[Dark Data is Contributing to Carbon Emissions](#),” *Computer Weekly*, April 24, 2020.
41. Sustainable Development Goal 13 aims to “Integrate climate change measures into national policies, strategies and planning,” measured by indicator 13.2.2, Total greenhouse gas emissions per year. Additional information available at: <https://unstats.un.org/sdgs/metadata/?Text=&Goal=13&Target=>.

42. Sustainable Development Goal 16.6 aims to “develop effective, accountable and transparent institutions at all levels,” measured by indicator 16.6.2, the “proportion of the population satisfied with their last experience of public services.” Additional information available here: <https://unstats.un.org/sdgs/metadata/?Text=&Goal=16#:~:text=Goal%2016..inclusive%20institutions%20at%20all%20levels>.
43. The four stages of service modernization are Rationalization, Reengineering, Digitization, and Delivery. The four stages are underpinned by several cross-cutting activities: coordination and project management, mainstreaming citizen engagement and feedback, monitoring and control, and communication and training. See World Bank (2021g).
44. According to the Wikipedia, “Greenwashing (..) is a form of advertising or marketing spin in which green PR and green marketing are deceptively used to persuade the public that an organization’s products, aims and policies are environmentally friendly. Companies that intentionally take up greenwashing communication strategies often do so in order to distance themselves from the environmental lapses of themselves or their suppliers.” See <https://en.wikipedia.org/wiki/Greenwashing>.
45. The use of online services is supported by a mediator who helps the citizen to handle a service. This kind of service provision is frequently found in public internet access spaces where citizens can use the available computers connected to the internet to ask for a certificate or to submit their tax declaration, with the proper support of a technician that guides them step by step.
46. Since the development of a clear and consistent methodology on the impact of greening public digital services is still underway, the presented calculations should be considered an example and should not be understood as an official World Bank methodology or that of any Global Program on this topic.
47. The tentative methodological approach presented will be further explored in upcoming greening GovTech analytical work. A future piece on monitoring the greening of GovTech will focus on models for calculating the impact of omnichannel service delivery.
48. As mentioned in the Introduction of this policy note, the rebound effect of digitalization of services should not be minimized in the current analysis. Although integrated service delivery leads to substantial efficiency per service delivery, the gains in efficiency can be outweighed by the increase in consumption due to new public digital services made available. See Santarius (2017).
49. World Bank (2021h).
50. According to the 2021 GTMI at <https://www.worldbank.org/en/programs/govtech/gtmi>.
51. See the GTMI webpage at <https://www.worldbank.org/en/programs/govtech/gtmi>.
52. See <https://www.gov.scot/policies/digital/>.
53. S. Sikkut, *Digital Government Excellence: Lessons from Effective Digital Leaders* (New York: John Wiley and Sons, 2022), 226–27.

54. Denmark, Government of, “Green Procurement for a Green Future - Strategy for Green Public Procurement” (Copenhagen: Ministry of Finance, 2020), <https://oes.dk/media/39012/strategi-for-groenne-indkoeb-engelsk.pdf>.
55. NDCs are specific targets set by countries (or parties) to the Paris Agreement to mitigate GHG emissions and adapt to climate change impacts.
56. See the GTMI at <https://www.worldbank.org/en/programs/govtech/gtmi>.
57. Ibid.
58. Australia’s NDC. Available at: <https://unfccc.int/sites/default/files/NDC/2022-06/Australias%20NDC%20June%202022%20Update%20%283%29.pdf>
59. See the GTMI at <https://www.worldbank.org/en/programs/govtech/gtmi>.
60. Brazil’s NDC. Available at: <https://unfccc.int/sites/default/files/NDC/2022-06/Updated%20-%20First%20NDC%20-%20%20FINAL%20-%20PDF.pdf>
61. Nigeria’s NDC. Available at: [https://unfccc.int/sites/default/files/NDC/2022-06/NDC\\_File%20Amended%20\\_11222.pdf](https://unfccc.int/sites/default/files/NDC/2022-06/NDC_File%20Amended%20_11222.pdf)
62. Pakistan’s NDC. Available at: <https://unfccc.int/sites/default/files/NDC/2022-06/Pakistan%20Updated%20NDC%202021.pdf>
63. This information was shared through a bilateral meeting between the Greening GovTech team and DIGIT at the EC. Its positions are available at <https://op.europa.eu/en/web/who-is-who/organization/-/organization/DIGIT>.
64. EC, “Public Procurement,” [https://single-market-economy.ec.europa.eu/single-market/public-procurement\\_en](https://single-market-economy.ec.europa.eu/single-market/public-procurement_en).
65. EC, “European Data Governance Act,” <https://digital-strategy.ec.europa.eu/en/policies/data-governance-act>.
66. A budget is “a comprehensive statement of government financial plans which include expenditures, revenues, deficit or surplus and financing. The budget is the government’s main economic policy document, demonstrating how the government plans to use public resources to meet policy goals” (OECD 2018).
67. “Green budgeting” means using the tools of budgetary policy making to help achieve climate and environmental goals. Green budgeting provides policy makers with a clearer understanding of the environmental and climate impacts of budgeting choices, with the objective of better aligning budgetary policies to environmental goals (OECD 2021d). The implementation of green budgeting involves having national climate change and environmental strategies, budgeting tools such as green budget tagging, the use of green budget statements to inform relevant stakeholders, and a modern budget framework linking strategic planning and budgeting (OECD 2021c).
68. The law (Ley de Presupuestos Mínimos de Adaptación y Mitigación al Cambio Climático Global) is available at: <https://www.boletinoficial.gob.ar/detalleAviso/primera/224006/20191220>.



69. France is currently the only country to tag expenditures on activities that have an adverse impact on the environment ([World Bank 2021c](#)).
70. A budget threshold is a management tool to streamline internal procedures, for example, setting fast-track procedures for implementing investments under a certain limit for ICT/digital investments and thus boosting agility in implementing a digital government strategy ([OECD 2021b](#)).
71. The World Bank provided technical assistance to the Ethiopian Government with a series of PIM guidelines to implement the Public Project Administration and Management System Proclamation. The Proclamation obliges every project to use the tool and obtain approval from the Planning and Development Commission prior to submitting budget proposals to the Ministry of Finance during the annual budget process. It is expected that the impact of the PIM guidelines will cascade on all projects, from concept notes to feasibility studies, to appraisal processes. Further support to the implementation of the CDRS will be provided through (i) the MDTF project for Ethiopia Governance Advisory Support on PIM and IFRS (P179405) and (ii) ENB climate TA on Climate Resilient Green Economy (CRGE) Strategy and Facility (P171116).
72. Definition adopted by the Marrakech Task Force on Sustainable Public Procurement led by Switzerland (membership includes Switzerland, United States, United Kingdom, Norway, Philippines, Argentina, Ghana, Mexico, China, Czech Republic, State of Sao Paulo [Brazil], United Nations Environment Programme [UNEP], International Institute for Sustainable Development, International Labor Organization, EC [DG-Environment], and the International Council for Local Environmental Initiatives [ICLEI]) in the context of the Marrakech Process on Sustainable Production and Consumption led by the UNEP and UN Department of Economic and Social Affairs. Note, however, that this definition has raised recent critiques for focusing on “impact mitigation” and “reduction of negative impacts” while inherently supporting an expanding and harmful model of economic growth.
73. See Food and Agriculture Organization, “Monitoring and Evaluation for Learning and Performance Improvement,” <https://www.fao.org/investment-learning-platform/themes-and-tasks/monitoring-and-evaluation/en/>.
74. The indicator measures the number of environmental actions (maximum 10) reported by enterprises to have been facilitated using ICT. See “Digital Economy and Society Index (DESI),” <https://digital-strategy.ec.europa.eu/en/policies/desi>.
75. Bilateral peer consultation held on September 21, 2022 with Aldo Laudi and Silvia Corrado at DIGIT, EC.
76. EC, “Towards a Green, Digital and Resilient Economy: Our European Growth Model,” [https://ec.europa.eu/commission/presscorner/detail/en/ip\\_22\\_1467](https://ec.europa.eu/commission/presscorner/detail/en/ip_22_1467); and EC, “Europe’s Digital Decade: Digital Targets for 2030,” [https://ec.europa.eu/info/strategy/priorities-2019-2024/europe-fit-digital-age/europes-digital-decade-digital-targets-2030\\_en](https://ec.europa.eu/info/strategy/priorities-2019-2024/europe-fit-digital-age/europes-digital-decade-digital-targets-2030_en).
77. Capturing value from IT infrastructure modernization in the public sector. By Arnab Das, Ankur Ghia, Mike Joyce, and David Zhang. November 20, 2019. McKinsey and Company.

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79. World Bank (2022) “WBG GovTech Maturity Index 2022 Update: Trends in Public Sector Digital Transformation” World Bank, Washington. <https://documents1.worldbank.org/curated/en/099035001132365997/pdf/P1694820bcef0903e091160315d2050d03b.pdf>



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# Annex 1. Definitions

**Adaptation and Resilience** – Adjustments to ecological or socioeconomic systems in response to actual or expected climate change and its effects on human and natural systems, including steps to achieve climate change benefits.

**Digitalization** – The process of moving to a digital business by transforming processes which leverage digital technologies making them more effective and efficient.

**Digitization** – Process which describes the analog-to-digital conversion of existing data and documents.

**Decarbonization** – Process of reducing net GHG emissions to zero. It is increasingly used in place of mitigation, the term that appears in the Paris Agreement and many national climate change strategies, because it better captures the key policy objective. Decarbonization requires more fundamental structural changes in economic activity along four fronts: decarbonization of energy sources; electrification; increased energy efficiency; and preservation and increased use of natural carbon sinks for carbon dioxide removal.

**GovTech** – In a whole-of-government approach, GovTech emphasizes three aspects of public sector modernization: citizen-centric public services that are universally accessible, digital government transformation, and simple, efficient, and transparent government systems ([World Bank 2020a](#)).

**GovTech whole-of-government approach** – When a government utilizes a range of structural and organizational incentives to improve coordination across administrative boundaries to achieve an integrated response to the uptake of GovTech or any other desired policies ([World Bank 2020a](#)).

**Green GovTech** – GovTech policies, initiatives, or solutions that embrace environmental considerations by design. It considers and addresses the environmental impacts of GovTech, including negative pollution/waste, biodiversity loss, and climate change.

**Greenhacking the bureaucracy** – Development of innovative and disruptive GovTech prototypes to address climate change challenges, as well as finding new ways in bureaucracy to develop environmentally responsible GovTech solutions envisaging large impact with modest investments and changes in behavior.

**Greenwashing** – A form of advertising or marketing in which green public relations and green marketing are deceptively used to persuade the public that an organization's products, aims, or policies are environmentally friendly. Companies that intentionally take up greenwashing communication strategies often do so to distance themselves from their own environmental lapses or those of their suppliers (see <https://en.wikipedia.org/wiki/Greenwashing>).

**Multichannel service delivery** – An approach in which the administration provides services to citizens using different channels, such as face-to-face, telephone, online portal, mobile apps, or SMS. In this system, the processes in the different channels are not properly connected and typically do not benefit from a common user experience. This approach is often observed when public sector digitalization has been prioritized but not in a fully coherent way.

**Omnichannel service delivery** – An approach in which the user benefits from several possible channels of public service provision, such as face-to-face, telephone, online portal, mobile apps, or SMS, which are all properly integrated and offer a common user experience. This allows the user to navigate seamlessly between the different channels in the different stages of service delivery, thus benefiting from high-quality delivery. This approach is typically observed in mature stages of GovTech development.

**Unichannel service delivery** – The experience of user benefits from one or very few channels of interaction with the public sector, such as face-to-face encounters and/or conventional mail. This approach is typically used before public sectors become digitized.

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