GovTech Maturity Index

The State of Public Sector Digital Transformation

Cem Dener, Hubert Nii-Aponsah, Love E. Ghunney, and Kimberly D. Johns

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Foreword

The World Bank Group's Development Committee paper, "Disruptive Technologies and the World Bank Group—Creating Opportunities—Mitigating Risks," prepared for the October 2018 Development Committee Meeting, acknowledged that fast-diffusing technologies are converging to disrupt traditional development pathways and that economic and societal transformations brought about by disruptive technologies can dramatically accelerate progress toward reaching the Sustainable Development Goals and the twin goals of the World Bank Group: ending extreme poverty and boosting shared prosperity. It stated, among other things, the World Bank Group's commitment to providing technical and financial support to enable client countries to harness the benefits of technological advancement and use technologies to deliver services to citizens. The launch of the World Bank's GovTech Partnership Initiative in 2019 was part of this agenda to help clients to harness technology for development.

GovTech is a whole-of-government approach to public sector modernization that promotes simple, efficient, and transparent government with citizens at the center of reforms. The GovTech Initiative provides support to client countries on how to design and implement digital transformation solutions in the public sector. As part of efforts to attain its twin goals, the World Bank Group provides substantial financial and technical assistance to low- and middle-income countries all over the globe to support the implementation of GovTech solutions. As the demand for GovTech solutions grows, so has the Bank's portfolio of GovTech investments that support the modernization and integration of government systems such as financial and human resource management information systems, public procurement portals, and public investment management systems as well as the enhancement and digitization of public services and government-citizen interactions.

The GovTech Maturity Index (GTMI) presented in this report was developed as part of the GovTech Initiative to introduce a measure of GovTech maturity in four focus areas: core government systems, service delivery, citizen engagement, and GovTech enablers. Constructed for 198 economies using consistent data sources, the GTMI is the most comprehensive measure of digital transformation in the public sector.

The key findings are delineated in several categories to highlight the important characteristics of the GovTech focal areas, the existence or lack thereof of an

enabling environment to foster the implementation of GovTech solutions, the relationship between the GTMI and other GovTech indexes, and best practices from around the world.

This is a crucial time for GovTech. The onset of the COVID-19 (Coronavirus) pandemic has laid bare both the need and urgency for some client countries to develop the ability to use foundational and frontier digital technologies to transform how they operate and deliver services. The GTMI, I believe, will serve as an important tool to help client countries to understand where they are on their GovTech maturity trajectory and the areas they could focus on to help policy makers and their advisers to make informed decisions on how to tackle specific country constraints to advancing public sector modernization using technology.

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Acknowledgments

Executive Summary

GovTech is a whole-of-government approach to public sector modernization that promotes simple, efficient, and transparent government, with citizens at the center of reforms. GovTech has great potential to deliver on the promises of the digital age by improving core government systems and enhancing citizen-centric services and citizen engagement. However, turning the promises of digital solutions into tangible, measurable, and consistent outcomes remains challenging in most countries. Governments must ensure that the appropriate enabling environment exists to facilitate digital transformation, while also adapting to changing societal demands that stem from digital advancements and phenomena such as the coronavirus pandemic (COVID-19).

Although existing digital government surveys and indexes are useful for monitoring progress in digital government initiatives and good practices in general, until now no single index had captured progress in all key GovTech areas based on a reliable global data set. The GovTech Maturity Index (GTMI) was developed to address this gap.

> The GTMI measures the key aspects of *four GovTech focus areas*—supporting core government systems, enhancing service delivery, mainstreaming citizen engagement, and fostering GovTech enablers—and assists practitioners in the design of new digital transformation projects.

The development of the GTMI was guided by the following key questions:

- Which key indicators can be used to measure the important characteristics of the four GovTech focus areas?
- Do reliable data exist for measuring specific aspects of the four GovTech focus areas?
- How does the GTMI correlate with relevant digital government and GovTech indexes?
- Do any good-practice examples demonstrate the maturity of GovTech focus areas?
- How can the conclusions and recommendations based on the GTMI assist practitioners and policy makers involved in designing and implementing GovTech solutions?

The target audience of the GTMI report consists of government officials (policy makers and technical specialists), World Bank task teams, and other practitioners involved in the design and implementation of GovTech solutions.

This study is informed by the following:

- Several decades of experience in the development of digital government solutions globally
- Availability of reliable global data sets (developed and expanded since 2014) to present the state of digital government in 198 economies
- Growing demand from citizens for improved online service delivery, transparency, accountability, and participation
- Widespread use of the internet and new or disruptive technologies for transforming the public sector.

METHODOLOGY

The GTMI is a composite index based on 48 key indicators defined to collect data from 198 economies in four categories: the Core Government Systems Index (CGSI), based on 15 indicators; the Public Service Delivery Index (PSDI), based on 6 composite indicators; the Citizen Engagement Index (CEI), based on 12 indicators; and the GovTech Enablers Index (GTEI), based on 15 indicators. The GTEI measures the presence of several cross-cutting enablers relevant to advancing GovTech; however, it does not quantify their effectiveness or performance.[1] The key GTMI indicators are explained in table 2.1 in chapter 2 and in appendix A.

In order to find the best fit for calculating the key component indexes, four options were examined: no weights, weights based on expert opinion, weights based on correlation analysis, and weights based on factor analysis. The GTMI scores were calculated using weights based on expert opinion to reflect the relative degrees of importance of the selected indicators, as determined by the extant literature, observations during the data collection process, and World Bank operational experience. All 198 economies were grouped from A (GovTech leaders) to D (minimal focus on GovTech) based on their GTMI score.

> Based on analyses comparing the GTMI with relevant indexes, the GTMI indicators were found to produce consistent results and to measure less-known dimensions related to GovTech foundations appropriately.

The GTMI was constructed based primarily on the World Bank's GovTech data set.[2] The data set presents comprehensive information collected from the government websites of 198 economies about the maturity of GovTech focus areas from two perspectives: (a) an international outlook, based on the data available on 198 economies, and (b) a regional outlook, based on a subset of data for 168 World Bank client countries benefiting from financial and technical assistance. Other data sets were also used to construct the GTMI: the 2020 United Nations e-Government Survey, the 2018 Identification for Development (ID4D) data set, and the 2019 Worldwide Governance Indicators (WGI). The GovTech data set contains the evidence collected for 42 GovTech key indicators defined by the Bank team and 6 additional indicators from other relevant data sets.

MAIN FINDINGS

> Interest in GovTech initiatives is growing around the world. Government entities leading the GovTech agenda exist in 80 economies out of 198 reviewed, and mature digital government and good practices are highly visible in 43 economies.

Focus on GovTech

Despite increasing investments in information and communication technology (ICT) infrastructure and the availability of digital government or GovTech institutions and strategy or policy documents, the maturity of GovTech foundations is lower than expected in most countries.

Visibility of Results

Few governments document and report transparently their investments in GovTech initiatives, results achieved, or challenges faced.

Core Government Systems

Most countries already have developed core government systems such as back- and front-office solutions, online service portals, and open-data platforms, but these systems are often fragmented and disconnected. There is room to improve interconnectivity, data exchange, and interoperability in most countries.

Shared Platforms and Standards

Many countries have shown an interest in developing shared GovTech platforms, such as cloud-based solutions, unified mobile apps, and a government service bus, to support the operational and service delivery requirements of public entities and satisfy the preferences of citizens.

Online Services

Integrated national portals are available in many countries to enable online service delivery. However, only a few countries—mainly in Groups A and B—have visible two-way information flow between government and citizens or businesses, universally accessible user-centric transactional services supported by mobile apps, and quality of service metrics.

Digital Citizen Engagement

Governments and civil society organizations have launched various technology solutions to improve digital citizen engagement, but it is difficult to find information about the impact of these tools, and government disclosure of service quality standards is not readily available. Only a relatively small group of countries have multifunctional citizen participation portals that provide capabilities for citizens to submit a petition, have their inputs published, and provide anonymous feedback, or for government to post its response.

GovTech Enablers

Most of the digital government strategies and action plans approved within the last five years include the establishment of enabling and safeguarding institutions to support the GovTech agenda, with more focus on a whole-of-government approach, data-driven public sector, digital skills development, and innovation labs.

Disruptive Technologies

Some high- and middle-income countries have recognized and harnessed the potential of new and disruptive technologies. They have national strategies and plans for artificial intelligence, blockchain, and other emerging technologies, and some GovTech leaders are already using these solutions in various sectors.

> The findings and good-practice cases presented in this study demonstrate that the GovTech focus areas identified by the World Bank are highly relevant to the digital transformation agenda in most countries.

KEY MESSAGES

- Commitment at high levels of government and the allocation of necessary resources are crucial for the sustainability of GovTech initiatives.
- Large-scale GovTech challenges are more evident in Sub-Saharan Africa and South Asia than in other regions, and more substantial resources are needed to address issues related to the digital divide, infrastructure, and governance in these regions.
- Countries could focus more on improving the interconnectivity and interoperability of existing systems and portals, and on the benefits of having a government cloud, service bus, and application programming interfaces (APIs) as cost-effective shared platforms in future GovTech initiatives.
- Next-generation online service portals could expand transactional services, saving substantial time, reducing costs, and improving the quality of services for citizens and businesses.
- GovTech initiatives could focus more on multifunctional citizen participation platforms to deepen the citizen-government relationship through effective CivicTech solutions,[3] improve accountability, and build public trust in government.
- Further investments in digital skills development and innovation in the public sector are crucial to supporting the transition to a data-driven culture and building strong technical skills.
- Governments could promote the use of open data to create added economic value by establishing public data platforms that individuals and firms can access. Government and other players in the public policy making process could also harness the data for better evidence-based policies and program adaptation.

- The *World Development Report 2021: Data for Better Lives* highlights the importance of data governance, which is highly relevant to the GovTech agenda (World Bank 2021b). The report offers five high-level recommendations: (a) forge a new social contract for data that (b) increases data use and reuse to realize greater value, (c) creates more equitable access to the benefits of data, (d) fosters trust through safeguards that protect people from the harm of data misuse, and (e) paves the way for an integrated national data system.
- Governments could increase citizen trust in data-driven societies and promote GovTech more effectively by adopting solid legal frameworks and establishing strong agencies for data protection.
- Interconnectivity between traditional and new (digital) data is necessary to advance digital transformation.
- Governments could better promote the development of local GovTech ecosystems by supporting local entrepreneurs and start-ups to develop new products and services.
- The use of frontier and disruptive digital technologies can greatly improve core government operations and online service delivery. For example, government agencies can use artificial intelligence and big data to mine data and offer predictive, customized services to citizens and businesses.
- Future GovTech initiatives could also consider six dimensions of a fully digital government: (a) digital by design, (b) data-driven public sector, (c) government as a platform, (d) open by default, (e) user-driven, and (f) proactiveness. These important aspects are defined in detail in the Digital Government Policy Framework of the Organisation for Economic Co-operation and Development published in October 2020 (OECD 2020).

The coronavirus pandemic has shed light on how GovTech solutions can help to ensure the continuity of core government operations, secure remote access to online services, and support vulnerable people and businesses in difficult times. Governments should allocate the necessary resources to improve the maturity of digital government during the COVID-19 recovery and resilience phase and adapt to the "new normal" through effective partnerships with all stakeholders.

This study is divided into five chapters. Chapter 1 presents the rationale and aims of the study and definitions used, along with a summary of relevant digital government indexes. Chapter 2 explains the methodology used to identify the important aspects of four GovTech focus areas, including the key indicators, the weight calculations, and the scoring scheme. Chapter 3 presents the key aspects of government practices in the GovTech domain, together with key findings. Chapter 4 describes some of the good practices visible in four GovTech focus areas. Chapter 5 summarizes the conclusions. Appendixes A–D present the details of key indicators, a description of the GovTech data set, results based on selected key indicators, and weight calculation options. Appendix E presents the GovTech references.

NOTES

1. The meaning of *enablers* in this context may be different from the use of enablers and foundations in other World Bank reports or tools, including World Development Reports and the Digital Government Readiness Assessment, and elsewhere within the GovTech context.
2. https://datacatalog.worldbank.org/search/dataset/0037889/GovTech-Dataset.
3. *CivicTech* relates broadly to ICT-based technologies that enhance engagement, participation, and the relationship between citizens and government.

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Abbreviations

AFR	Sub-Saharan Africa Region
AI	artificial intelligence
API	application programming interface
BRZ	Austrian Federal Computing Center
CAF	Corporación Andina de Fomento / Development Bank of Latin America
CEI	Citizen Engagement Index
CGSI	Core Government Systems Index
CGTI	CAF GovTech Index
COVID-19	coronavirus 2019
CPI	Corruption Perceptions Index
DAI	Digital Adoption Index
DGI	Digital Government Index
DGRA	Digital Government Readiness Assessment (toolkit)
DGSS	Digital Government Systems and Services (data set)
EAP	East Asia and Pacific Region
ECA	Europe and Central Asia Region
EGDI	e-Government Development Index
EPI	e-Participation Index
FMIS	financial management information system
GEA	government enterprise architecture
GIF	government interoperability framework
GII	Global Innovation Index
GPPD	Global Public Procurement Database
GSB	government service bus
GTC	GTMI calculated using weights based on correlation analysis with standardized scores
GTE	GTMI calculated using weights based on expert opinion
GTEI	GovTech Enablers Index
GTF	GTMI calculated using weights based on factor analysis with standardized scores
GTMI	GovTech Maturity Index

GT0	GTMI calculated using no weights
G2B	government to business
G2C	government to citizen
G2G	government to government
HCI	Human Capital Index
HIC	high-income country
HRMIS	human resource management information system
ICT	information and communication technology
ID	identification
IDA	International Development Association
ID4D	Identification for Development
INSEAD	Institut Européen d'Administration des Affairs
IoT	Internet of Things
IT	information technology
LCR	Latin America and Caribbean Region
LIC	low-income country
LMIC	lower-middle-income country
MIC	middle-income country
MNA	Middle East and North Africa Region
NOSI	Information Society Operational Unit
OECD	Organisation for Economic Co-operation and Development
OGP	Open Government Partnership
OSI	Online Service Index
OSS	open-source software
PSDI	Public Service Delivery Index
SAR	South Asia Region
SAR	Special Administrative Region
SITA	State Information Technology Agency
TII	Telecommunication Infrastructure Index
TOGAF	Open Group Architecture Framework
TSA	treasury single account
UMANG	Unified Mobile Application for New-Age Governance
UMIC	upper-middle-income country
UN	United Nations
URL	uniform resource locator
WDR	World Development Report
WGI	Worldwide Governance Indicators
WIPO	World Intellectual Property Organization

1 Introduction

Governments have been using technology to modernize the public sector for decades. Since the 1980s, the World Bank Group has been a partner, providing both financing and technical support for countries' digital transformation efforts. The GovTech Initiative was launched in 2019 to support the latest generation of these reforms.[1] Over the past five years, low- and middle-income countries have increasingly been requesting World Bank support to design more advanced digital transformation programs and increase the efficiency and quality of government service delivery, improve government-citizen communication, reduce corruption, improve governance and oversight, and modernize core government operations.[2] The World Bank's GovTech Initiative is responding to this growing demand.

The GovTech Initiative is a collaborative effort to modernize the public sector by leveraging digital advancements. It is led by the Governance Global Practice in partnership with other Bank global practices, including Digital Development, Finance, Competitiveness and Investment, and sectoral practices, such as Health, Nutrition and Population, Education, and Energy, through a whole-of-Bank approach.

The GovTech Maturity Index measures key aspects of four GovTech focus areas: supporting core government systems, enhancing service delivery, mainstreaming citizen engagement, and fostering GovTech enablers to support public sector modernization. It aims to assist practitioners in designing new digital transformation projects.

Several indexes and indicators are available in the public domain for measuring the specific aspects of digital government, including the United Nations (UN) eGovernment Development Index, the World Bank Digital Adoption Index, and the Organisation for Economic Co-operation and Development (OECD) Digital Government Index. However, these indexes do not fully capture key indicators that GovTech uses to assess the maturity of digital transformation in the public sector. For this reason, using existing indexes to assess GovTech may lead governments to overlook some of the critical focus areas and miss opportunities to develop robust GovTech solutions. To address this need, the World Bank created a comprehensive GovTech indicator to measure GovTech

maturity in countries, covering systems, strategies, interoperability, and other aspects that are not covered in the existing global data sets.

The GovTech Maturity Index (GTMI) is not intended to assess a country's readiness for or performance of GovTech; rather, it is intended to complement existing tools and diagnostics by providing a baseline and benchmark for GovTech maturity and identifying areas for improvement. The index is designed to be used by practitioners, policy makers, and task teams involved in the design of digital transformation projects and by client countries seeking to identify possible improvements in the four focus areas of GovTech.

This study addresses the following key questions:

- Which key indicators can be used to measure the important characteristics of the four GovTech focus areas?
- Is there visible evidence on government websites to measure the state of the four GovTech focus areas?
- How does the GTMI correlate with relevant digital government indexes?
- Do any examples of good practice demonstrate the maturity of GovTech focus areas?
- What are the conclusions and recommendations based on the GTMI to assist practitioners and policy makers involved in digital transformation initiatives and GovTech solutions?

The findings of this study have been shared with relevant specialists within the World Bank to validate the evidence collected, reflect other perspectives, and improve the accuracy of observations. The coronavirus pandemic that emerged in early 2020 made it difficult to receive detailed input from government officials involved in GovTech initiatives. However, the GovTech data set and this report will be publicly available, and comments from government officials involved in GovTech initiatives will be requested through the GovTech website and other channels to reflect developments and update relevant parts of the data set and GTMI components, as necessary.

WHAT IS GOVTECH?

GovTech is a whole-of-government approach to public sector modernization that promotes simple, efficient, and transparent government with the citizen at the center of reforms.

The GovTech approach represents the current frontier of government digital transformation as presented in figure 1.1. It is distinct from previous phases, as it emphasizes three aspects of public sector modernization:

- Citizen-centric public services that are universally accessible[3]
- A whole-of-government approach to public sector digital transformation[4]
- Simple, efficient, and transparent government systems.

The GovTech agenda also encompasses the effective use of disruptive technologies, including artificial intelligence and machine learning, cloud computing, and the Internet of Things; public data platforms facilitating the use of open public data by individuals and firms to create value; local GovTech ecosystems

FIGURE 1.1

Digital transformation of the public sector

Analog government
- Closed operations and internal focus
- Analog procedures
- Government as a provider

e-government
- User-centered approach, but supply driven
- One-way communications and service delivery
- ICT-enabled procedures, but often analog in design
- Sliced ICT development and acquisition
- Greater transparency
- Government as a provider

Digital government
- Procedures that are digital by design
- User-driven public services
- Government as a platform (GaaP)
- Open by default (co-creation)
- Data-driven public sector
- Proactive administration

GovTech
- Citizen-centric public services that are universally accessible
- Whole-of-government approach to digital transformation
- Simple, efficient, and transparent government systems

Source: World Bank, based on OECD 2019.
Note: ICT = information and communication technology. The term *sliced ICT development and acquisition* is the purchase and deployment of fragmented and disconnected ICT solutions with no or little focus on interoperability.

supporting local entrepreneurs and start-ups in developing new products and services for government; and greater use of public-private partnerships to draw on private sector skills, innovations, and investments to address public sector challenges.

GOVTECH FOCUS AREAS

The World Bank Group's vision of GovTech reflects an integrated approach to digital government and covers four focus areas, which are being implemented through projects, assessments, and policy dialogue:

1. *Supporting core government systems.* There is growing demand for modernizing and integrating government systems and for strengthening the GovTech approach. For example, the Bank's Governance Global Practice is focused on improving systems for public financial management, human resource management, tax administration, public procurement, and public investment management. As part of a whole-of-government approach, these interventions include developing an overarching digital transformation strategy and a set of principles to foster the effective use of digital platforms and data that are interoperable and secure.

2. *Enhancing public service delivery.* GovTech projects support the design of human-centered online services that are simple, transparent, and universally accessible. Special attention is paid to services that are accessible through low-cost digital solutions such as mobile phones and free open-source applications, tailored to digital literacy and reaching all intended beneficiaries and users.

3. *Mainstreaming citizen engagement.* CivicTech tools, including citizen feedback and complaint-handling mechanisms, can be developed and deployed in high- and low-connectivity countries using simple technology and free open-source applications. Activities focus on the use of accountability tools such as service charters and service standards with enforcement and monitoring mechanisms and the use of technology to advance governments' efforts to achieve greater transparency.

4. *Fostering GovTech enablers.* GovTech enablers are the cross-cutting drivers of the digital transformation agenda. They include digital skills in the public sector, an appropriate and conducive legal and regulatory regime, strong enabling and safeguarding institutions, and an environment that fosters innovation in the public sector. Effective regulations, improved technical skills, and accountable institutions are the *analog complements* of digital investments, as highlighted in *World Development Report 2016: Digital Dividends* (World Bank 2016b). The key foundations of internet connectivity, robust identification systems, digital signature, and other important dimensions are also included in this component.

These focus areas are fully explained in World Bank (2020d).

AN OVERVIEW OF EXISTING DIGITAL GOVERNMENT INDEXES

International organizations, academia, and the private sector have developed several digital indexes over the years to measure the state of play in digital government from different perspectives (table 1.1). They measure the state of online services, telecommunications infrastructure, human capital, citizen participation, research infrastructure, innovation, government regulations and institutions, and private sector involvement in GovTech programs. Several new indexes emerged in 2020, including the OECD Digital Government Index and the Development Bank of Latin America (CAF)

TABLE 1.1 A summary of digital government and GovTech indexes

INDEX	NUMBER OF ECONOMIES	LAUNCHED	LAST UPDATE
World Bank GovTech Maturity Index (new)	198	2020	2020
United Nations eGovernment Development Index	193	2003	2020
Cornell University, INSEAD, and WIPO Global Innovation Index[a]	131	2007	2020
European Commission eGovernment Benchmark	36	2012	2020
World Bank Identification for Development Index	198	2015	2018
World Bank Digital Adoption Index	180	2016	2018
CAF GovTech Index (new)	16	2020	2020
OECD Digital Government Index (new)	33	2020	2020

Source: World Bank compilation.
Note: CAF = Development Bank of Latin America. INSEAD = Institut Européen d'Administration des Affairs.
OECD = Organisation for Economic Co-operation and Development. WIPO = World Intellectual Property Organization.
a. Developed by Cornell University, INSEAD, and WIPO, a specialized agency of the United Nations.

GovTech Index, with smaller geographic coverage to measure progress in the adoption of digital government solutions and the maturity of GovTech ecosystems, respectively.

The 2020 UN *e-Government Development Index (EGDI)* captures the scope and quality of government online services, the status of telecommunication infrastructure, and existing human capacity in 193 UN member states (UN 2020). It is updated every two years. One chapter of the EGDI report is dedicated to the capacity for digital transformation in the public sector, highlighting relevant GovTech initiatives using country cases.

The *Global Innovation Index (GII)*, published jointly by Cornell University, Institut Européen d'Administration des Affairs (INSEAD), and the World Intellectual Property Organization (WIPO), examines the framework conditions and innovative capacity of 131 economies around the world (Dutta, Lanvin, and Wunsch-Vincent 2020). In its 13th edition released in 2020, the GII bases its assessment on 80 indicators and considers the effects of the coronavirus pandemic on innovation.

The European Commission's *eGovernment Benchmark 2020* presents improvements in the digital delivery of public services according to four benchmarks: user centricity, transparency, key technology enablers, and cross-border mobility (European Commission 2020).

The World Bank's *Identification for Development (ID4D) Index 2018* provides an estimate for the number of individuals without proof of legal identity in 198 economies and presents data on the entities responsible for identification (ID) and civil registration, the status of enabling legal and regulatory frameworks, and the digital ID solutions for identification and other services (World Bank 2018).

The World Bank's *Digital Adoption Index (DAI)* measures progress in digital adoption across three dimensions of the economy: people, government, and business (World Bank 2016a). The index covers 180 economies on a scale of 0 to 1 and emphasizes the "supply side" of digital adoption to maximize coverage and simplify theoretical linkages. The overall DAI is the simple average of three subindexes. The *Digital Government Systems and Services (DGSS)* global data set was used as an input for calculating the government subindex on systems and services in the DAI. This index is updated every two years, and DAI 2020 is expected to be published in 2021.

The CAF, together with Oxford Insights, has published the first Ibero-American *GovTech Index 2020* to measure the degree of maturity of GovTech ecosystems, the dynamism of tech-for-good start-up markets, and the degree of innovation of public institutions (Zapata et al. 2020).

The OECD's *Digital Government Index (DGI)* was first published in 2020 to translate the OECD's Digital Government Policy Framework into a measurement tool for assessing implementation of the OECD's Recommendation on Digital Government Strategies (Ubaldi, González-Zapata, and Piccinin Barbieri 2020). It covers 33 economies, comprising 29 OECD member countries and 4 nonmember countries—Argentina, Brazil, Panama, and Uruguay. This index measures the maturity of digital government with a focus on six key aspects: digital by design, data-driven public sector, government as a platform, open by default, user-driven approach, and proactiveness.

The following databases and toolkits are also useful for measuring the level of governments' digital maturity:

- The *Open Government Partnership (OGP)* database presents the status of commitments from 99 countries on publishing open-government data. Core eligibility metrics measure a government's performance across four key areas of open government: access to information, citizen engagement, fiscal transparency, and asset disclosure of public officials (OGP, various years).
- The World Bank's *Digital Government Readiness Assessment (DGRA)* toolkit can be used to assess a country's current status and aspirations in digital development and public sector transformation (World Bank 2020a). It assesses a country's readiness with regard to its enabling environment and can be used to track progress in its trajectory through repeat assessments to ensure that the legal, regulatory, human capital, technology, and safety aspects of government digitalization are addressed at any given time. The DGRA is being updated to include sections on COVID-19 resilience and remote work and business continuity. The tool has proved useful in the policy dialogue with clients in more than 15 countries and has been used by World Bank task teams in project preparation since 2019.
- The World Bank launched the *Global Public Procurement Database (GPPD)* in March 2020 as the first data set dedicated to the collection of country-specific public procurement information from 218 countries and territories (World Bank 2020b). The GPPD is intended to meet the growing demand, from both the public and the private sectors, for a comprehensive global knowledge product that captures data about countries' procurement systems and e-procurement implementation at a global level. The GTMI includes a specific indicator measuring the presence of e-procurement platforms, and the GPPD can be used as a complementary data set for exploring the details of country-specific platforms.

HOW IS THE GOVTECH MATURITY INDEX DIFFERENT?

Although existing digital government surveys and indexes are useful for monitoring the progress of digital government initiatives and good practices in general, none of them assess progress in all four GovTech focus areas defined earlier. The GTMI addresses this gap.

The GTMI has four components covering each GovTech focus area: core government systems, public service delivery, citizen engagement, and GovTech enablers. The GTMI is not intended to create a ranking of countries. Instead, it measures a country's position on the GovTech trajectory by measuring progress in the four GovTech focus areas.

The index is expected to assist practitioners in benchmarking countries to highlight gaps in terms of how far those countries are from the leaders at a specific time. The benchmarking approach used in the GTMI is more informative than a ranking.

The GTMI draws on an updated and expanded version of the World Bank's GovTech data set[5] that includes 48 GovTech key indicators defined by the World Bank team, including six external indexes—four key indicators extracted from the 2020 UN e-Government Development Index and e-Participation Index and two indicators from the 2018 ID4D data set—to provide a composite GTMI.

In future versions, the scope of the GovTech data set will be expanded to capture other relevant dimensions. For instance, there is minimal information

on government websites about the strength and effectiveness of data governance or GovTech institutional arrangements. However, related annual reports or assessments and audits may emerge in the coming years. As GovTech initiatives evolve, it may also be possible to expand the data set to measure the effectiveness of GovTech institutions and services.

NOTES

1. For more information on the GovTech approach, see World Bank (2020c, 2020d).
2. The term *government* refers mainly to the executive body of the state.
3. *Citizen-centric (or human-centered) public services* incorporate citizens' needs and concerns at every stage of design and delivery of the service by interacting and communicating with the people involved. *Universal accessibility* enables people with disabilities and vulnerable groups to gain access to all services and participate fully in all aspects of life in an inclusive society.
4. The *whole-of-government approach* emphasizes integration in terms of joint activities, plans, and platforms across government units instead of fragmentation and departmentalism. GovTech envisions a whole-of-government approach with interoperable government systems, seamlessly connected e-service solutions, and citizen service centers providing access to all public services and fostering easily accessible, efficient, and transparent government with citizens at the center of reforms.
5. The GovTech data set is available in the World Bank Data Catalog (World Bank 2021).

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2 Methodology

A five-step approach was used to measure and analyze key aspects of the four GovTech focus areas (figure 2.1).

DEFINITION OF INDICATORS

The first step was to identify the key indicators, based on the *questions* addressed in the GovTech Maturity Index (GTMI). Specific metrics (*points*) were defined for each indicator to measure government practices in GovTech focus areas. The key GTMI indicators were determined by considering the coverage and quality of existing and new data in World Bank global data sets and in consultation with experts involved in GovTech activities. The indicators measure specific aspects of focus areas only at the central government level, given the limited availability of data at the subnational level. The data collected for key indicators are from publicly accessible sources—mostly websites of ministries and other relevant government bodies—that are comparable and available across 198 countries and can be tracked over time. While some indicators capture the operational status of existing activities, none capture outcomes. A list of 48 GTMI indicators used to calculate four component scores is presented in table 2.1. The details of all 48 key indicators, relevant questions, and subcomponents are provided in appendix A.

Future versions of the index may aim to cover subnational governments and showcase good practices, which sometimes may be more visible at the subnational level in federalist countries—for example, Brazil, India, Indonesia, Mexico, and the United States. Furthermore, outcome measures across 198 economies guided by the most recent literature will also be considered in future updates of the GovTech data set and GTMI report.

The GTMI is the simple average of the normalized scores of four components—the Core Government Systems Index (CGSI), Public Service Delivery Index (PSDI), Citizen Engagement Index (CEI), and GovTech Enablers Index (GTEI)—measuring the maturity of GovTech focus areas based on 48 key indicators, as explained in this chapter. The four GTMI components are complementary so that improving one aspect of the GovTech focus areas improves the other parts.

Five-step process for analyzing the four GovTech focus areas

I	II	III	IV	V
Definition of indicators	Data collection and index construction	Data analysis	Validation of observations	Results reporting

Source: World Bank staff.

TABLE 2.1 GovTech Maturity Index (GTMI) key indicators

INDICATOR	GTMI KEY INDICATORS	POINTS	WEIGHT
Core Government Systems Index (CGSI)			
I-1	Is there a government cloud available for all government entities?	0–2	4
I-2	Is there a government enterprise architecture?	0–3	4
I-3	Is there a government service bus or interoperability platform in place?	0–3	4
I-4	Is there an operational financial management information system to support central government public financial management functions?	0–3	1
I-5	Is a treasury single account linked with a financial management information system to automate payments and bank reconciliation?	0–3	1
I-6	Is there an operational tax management system?	0–3	1
I-7	Is there an operational customs system?	0–3	1
I-8	Is there a human resources management information system with an online service portal?	0–3	1
I-9	Is there an operational payroll system linked with a human resources management information system?	0–3	1
I-10	Is there an e-procurement portal supporting public procurement?	0–3	2
I-11	Is there an operational debt management system (foreign and domestic debt)?	0–3	1
I-12	Is there an operational public investment management system?	0–3	2
I-13	Is there a government open-source software policy or action plan for the public sector?	0–3	2
I-14	United Nations Telecommunication Infrastructure Index (four indicators)	0–1	6
I-15	Does the government have a specific national strategy for new or disruptive technologies?	0–2	4
Public Service Delivery Index (PSDI)			
I-16	United Nations Online Service Index (three indicators based on 148 questions)	0–1	6
I-17	Is there an online public service portal for citizens, businesses, and government entities?	0–2	2
I-18	Is there an operational tax system online service portal?	0–3	1
I-19	Is there an operational e-filing service portal for citizens and businesses?	0–3	1
I-20	Is there an online e-payment portal providing support for various e-services?	0–2	1
I-21	Is there an operational customs system online service portal?	0–3	1
Citizen Engagement Index (CEI)			
I-22	United Nations e-Participation Index (three indicators)	0–1	6
I-23	Is there an open-government portal?	0/1	2
I-24	Is there an open-data portal?	0–2	2
I-25	Are there national platforms that allow citizens to participate in policy decision-making?	0/1	4
I-26	If Yes > Is it for submitting petitions?	0/1	0.5
I-27	If Yes > Are citizens' inputs publicly available on the platform?	0/1	0.5
I-28	If Yes > Does the platform allow citizens to provide feedback anonymously?	0/1	0.5
I-29	If Yes > Is the government's response publicly available on the platform?	0/1	0.5

(continued)

TABLE 2.1, *continued*

INDICATOR	GTMI KEY INDICATORS	POINTS	WEIGHT
I-30	Are there government platforms that allow citizens or businesses to provide feedback?	0/1	4
I-31	If Yes > Does the government make the service standards available to the public?	0/1	0.5
I-32	If Yes > Are these universally accessible or provide support for users with disabilities?	0/1	0.5
I-33	Does the government publish its engagement statistics and performance regularly?	0/1	1
GovTech Enablers Index (GTEI)			
I-34	Is there a government body focused on GovTech or digital transformation?	0/1	4
I-35	Is there a government entity in charge of data governance or data management?	0–2	3
I-36	Is there a specific national GovTech or digital transformation strategy?	0–3	2
I-37	Is there a whole-of-government approach to implement data governance?	0–2	4
I-38	Are there national right-to-information laws to make data available to the public online?	0–2	1
I-39	Is there a data protection or privacy law?	0–2	1
I-40	Is there a data protection authority?	0–2	1
I-41	Is there a foundational unique national identification system in place?	0/1	2
I-42	Is there a digital identification that can be used for identification and services?	0/1	2
I-43	Is there a digital signature regulation and public key infrastructure to support operations and service delivery?	0–3	1
I-44	Is there a cybersecurity emergency response team or a computer emergency incident response team?	0–2	1
I-45	United Nations Human Capital Index (four indicators)	0–1	6
I-46	Is there a government strategy or program to improve digital skills or data literacy?	0–2	2
I-47	Is there a program to improve digital skills or data literacy and innovation in the public sector?	0/1	4
I-48	Is there a government entity or strategy focused on public sector innovation?	0–2	4

Source: World Bank compilation.

Core Government Systems Index

The CGSI is based on 15 key indicators measuring the key aspects of a whole-of-government approach, including government cloud, interoperability platforms, enterprise architecture, open-source solutions, and disruptive technologies as well as the core government systems visible in most of the countries included in the latest version of the GovTech data set.[1] Additionally, the United Nations (UN) composite Telecommunication Infrastructure Index (TII) is included to measure the state of other important dimensions. The TII is composed of four indicators: (a) estimated number of internet users per 100 inhabitants, (b) number of mobile subscribers per 100 inhabitants, (c) active mobile broadband subscriptions, and (d) number of fixed broadband subscribers per 100 inhabitants.

Public Service Delivery Index

The PSDI is based on six composite indicators that measure the existence of national online service portals and the maturity of services—informational or transactional—as well as the online services of revenue administrations. The UN Online Service Index (OSI) is included because it addresses many issues

related to citizen-centric services and the accessibility of government websites.[2] Although in most of the 198 economies it was not possible to find relevant data on more advanced features—such as human-centric services that are universally accessible—these indicators nevertheless present a useful overview of the current status of service delivery channels and highlight possible improvements.

Citizen Engagement Index

The CEI is based on 12 indicators. Nine of these indicators are related to citizen participation and feedback and government responsiveness. Among these nine indicators, three key questions call for binary responses, and positive answers generate six more in-depth questions to present the details of multifunctional participation platforms. Two key indicators measure the existence of open-government and open-data portals, with a focus on content—whether there are regular updates to justify an active portal or not. Additionally, the UN e-Participation Index (EPI) is used to indicate other important dimensions, including using online services to provide information to citizens (e-information sharing), interact with stakeholders (e-consultation), and engage in decision-making processes (e-decision-making).

GovTech Enablers Index

The GTEI is based on 15 indicators. Twelve of these indicators measure the enabling environment for digital government and GovTech and include the whole-of-government approach as one of the priorities of the digital agenda. They also include digital skills, enabling and safeguarding institutions, laws and regulations, strategy, cybersecurity, digital signature, and innovation in the public sector. The UN Human Capital Index (HCI) is also used to measure the following: (a) the adult literacy rate; (b) the combined primary, secondary, and tertiary gross enrollment ratio; (c) expected years of schooling; and (d) average years of schooling.[3] Moreover, two indicators from the World Bank Identification for Development (ID4D) global data set are used to highlight the countries with a unique national identification (ID) system in place and a digital ID that can be used for online identification and services.

The data governance indicators I-35, I-38, I-39, and I-40 in table 2.1 were defined jointly with the World Development Report (WDR) team and used in the *World Development Report 2021: Data for Better Lives* (World Bank 2021b). The WDR 2021 aims to answer two fundamental questions. First, how can data better advance development objectives? Second, what kind of governance arrangements are needed to support the generation and use of data in a safe, ethical, and secure way, while also delivering value equitably? The GovTech enablers and other GTMI components are also linked to the data value chain because they drive innovation and capability growth:

- *Data use: indicators that capture the demand side of GovTech.* Capacity gaps such as data literacy among decision-makers, media, or the general population may affect the demand for and use of data.
- *Data services: indicators that capture the supply side.* The data-driven public services component is as important as universal access, since it captures the interaction between supply and demand that meets needs and entitlements and drives innovation.

- *Data products: data products that are used to provide public services.* These products need to be relevant, timely, comprehensive, and granular if they are to meet user needs.
- *Data infrastructure: the foundation of performance.* For sustainable performance to be assured, the foundations need to be strong, with effective "hard wiring" through a law or policy on independence, data sharing, privacy, openness, governance, and planning, and with "soft wiring" through skills, reputation, and system maturity.

Based on the availability of data, specific indicators that capture these aspects of the data value chain may be included in future versions of the data set and report.

Appendix B describes the GovTech data set and the observations based on 12 key GovTech indicators related to less-known aspects of the focus areas for which limited or no data are available in other global data sets. Additionally, appendix C compares the GTMI with several other relevant GovTech indexes to demonstrate the consistency of findings and observations.

The GovTech data set presents comprehensive information about the maturity of GovTech focus areas from two perspectives: (a) an *international outlook,* based on the data available on 198 economies, and (b) a *regional outlook,* focusing on 168 World Bank client countries benefiting from financial and technical assistance. The detailed information on how the data set was compiled and validated is presented in the next section and in appendix B. The data set of 198 economies is the largest possible set of data available on the web and includes all 188 World Bank member countries, together with some of the large economies from the Asia-Pacific Economic Cooperation member states, European Union, and Organisation for Economic Co-operation and Development (OECD). It covers a broad spectrum of GovTech systems, services, and enabling environments.

The GovTech data set includes several sections for visualizing data and results on all 48 key indicators. Appendix B provides the list of 198 economies, including the 168 World Bank client countries in the regions.

DATA COLLECTION AND INDEX CONSTRUCTION

The GovTech Maturity Index was constructed based primarily on the GovTech data set, which includes key indicators covering 198 economies (World Bank 2021a). The data set comprehensively accounts for the recent transition of governments from e-government to digital government and further to GovTech, consistent with the United Nations,[4] European Union,[5] and OECD[6] definitions and indexes.

The GovTech data set detailed in appendix B is an extended version of a global data set on government systems and services, originally developed in 2014 and updated every two years during the preparation of several World Bank studies and flagship reports. The data set contains a rich set of data covering important aspects of GovTech initiatives. It includes web links to relevant institutions and systems, coupled with basic information on the operational status and capabilities of government systems, online services, and portals. The data set was updated and expanded in 2020 to include new indicators for calculating the GTMI.

The following approach was used to expand and validate the GovTech data set. The World Bank team collected data on all GTMI indicators from

government, civil society organization, and other relevant websites. More than 170 digital government websites present the institutional framework, policy or strategy, online service platforms, and systems or services. This approach led to a comprehensive data set since all countries have a substantial web presence, and relevant information on existing systems and services is visible on the web.

The data collected from government websites mostly reflect de jure practices. Generally, it was possible to verify the existence of an approved policy or strategy document, an effective law, an established institution, or a system or services, but ascertaining the implementation status or progress of these platforms over the years was challenging. As noted in table A.1 in appendix A, only a few indicators capture the implementation status of the program or GovTech component of interest. Also, it was not possible to account for the results and outcomes of these government platforms, strategies, or programs. Hence, countries may not be implementing some practices or using existing systems effectively, as there is minimal reporting of results and outcomes on the web. This lack of reporting should be considered when interpreting the data set. The next update of the data set and report may be based on surveys and interactions with country officials to verify evidence and gather information about the implementation status and outcomes of GovTech activities.

In addition to the indicators on relevant institutions, strategy, and online service delivery platforms, the data set presents the status of the core public financial management systems, including financial management information systems; tax, customs, and human resource management information systems; payroll, e-procurement, debt management, and public investment management systems; and related services such as digital signature, e-filing, and e-payments. The existing World Bank global data set captures the details of management information system solutions funded by the World Bank mainly in the domain of public financial management since 1995. The data on solutions used in health, education, social protection, transport, agriculture, land management, trade, and other sectors are limited. Therefore, the CGSI and PSDI are based mainly on the data available on core public financial management systems and services in 198 economies.

It was not possible to interact with government officials through an online survey or other channels for the validation of results due to the coronavirus pandemic and other constraints. Nevertheless, the World Bank team managed to collect relevant information on all 48 indicators and constructed the GTMI based on a rich set of data covering 198 economies. The GovTech data set was shared with experts working on digital government or GovTech projects within the World Bank Group to validate GTMI scores, key findings, good-practice cases, and conclusions. The data set was also shared with government officials through the GovTech website and Community of Practice distribution groups, which include more than 1,400 officials from 143 countries, and their comments on various GovTech indicators were considered.

The GTMI is not intended to be another digital government index for ranking 198 economies. Based on the GovTech data set, the GTMI provides a snapshot of the current status of digital government institutions, strategy documents, online service delivery channels, core government systems, and other relevant dimensions using remotely measurable indicators.[7]

The GovTech data set will be updated every two years to reflect progress in the GovTech domain globally. The latest version of the GovTech data set

includes new data on GovTech initiatives that have emerged mostly within the last five years, together with new indicators on public sector use of disruptive technologies and data governance initiatives, in addition to digital skills and innovation strategies and programs in the public sector. The data set includes a "metadata" sheet presenting a detailed description of all data fields and sources of information. The definitions of key indicators are also visible as comments on the header row of the data set ("DGSS" sheet). Graphical presentations of all indicators are visible in the "DGSS Stats" and "GT Stats" sheets, with linked formulas for automatic updates.

Other data sets used to construct the GTMI include the 2020 UN e-Government Survey (193 economies),[8] and the 2018 ID4D data set (198 economies). Specifically, indicators from the UN e-Government Development Index (EGDI), including the OSI, TII, and HCI, were used to calculate the GTMI, together with the EPI. Since all three components of the EGDI and EPI are highly relevant to the GovTech domain, these indexes were used to calculate the composite GTMI, in addition to 42 specific indicators included in the GovTech data set.

Construction of the GTMI

The GTMI is the simple average of the four components measuring the maturity of GovTech focus areas, which are computed as the normalized weighted averages of relevant indicator scores. The GTMI satisfies four main axioms to ensure consistency and meet its objectives. First, the index satisfies monotonicity, meaning that, all else being equal, an increase in the score of one indicator increases the overall score of the index. Second, the index satisfies subgroup decomposability, implying that it can be decomposed into subgroups for further analysis. Third, the index satisfies the replication axiom such that if a set of indicator scores is formed by replicating the existing set and order of scores an arbitrary number of times, the GTMI score remains the same. Fourth, the index is non-negative and equal to zero if and only if all indicators record zero scores.

Furthermore, the GTMI is a transparent index that is easy to understand and use since gaps can be readily noted and the indicators are actionable. The index is also flexible and could incorporate outcome measures in future versions. The composite GTMI was calculated as follows:

$$\text{GTMI} = (\text{CGSI} + \text{PSDI} + \text{CEI} + \text{GTEI}) / 4. \tag{2.1}$$

Each component index was calculated as the weighted average of relevant key indicator scores:

$$CGSI = \frac{\sum_{i=1}^{15} X(i) * W(i)}{\sum_{i=1}^{15} Xmax(i) * W(i)} \qquad PSDI = \frac{\sum_{i=16}^{21} X(i) * W(i)}{\sum_{i=16}^{2} Xmax(i) * W(i)}$$

$$CEI = \frac{\sum_{i=22}^{33} X(i) * W(i)}{\sum_{i=22}^{33} Xmax(i) * W(i)} \qquad GTEI = \frac{\sum_{i=34}^{48} X(i) * W(i)}{\sum_{i=34}^{48} Xmax(i) * W(i)} \tag{2.2}$$

X(i) denotes the score of each key indicator *(i)* (from 1 to 48) used to calculate four component indexes. *W(i)* is the weight of each key indicator, and *Xmax(i)* is the maximum score of each key indicator.

Calculation of Weights

In order to find the best fit for calculating the four key component indexes, the following options were examined:

1. *GT0: no weights.* Simple mathematical average of four component index scores (CGSI, PSDI, CEI, GTEI).

2. *GTE: weights based on expert opinion.* Average of four weighted component index scores using specific weights that the authors and other experts involved in digital government or GovTech projects identified for selected key indicators, which are not measured in well-known surveys or indexes.

3. *GTC: weights based on correlation analysis with standardized scores.*[9] Average of four weighted component scores, using correlation analysis applied to all key indicators.

4. *GTF: weights based on factor analysis with standardized scores.* Mathematical average of four weighted component scores, using factor analysis applied to all key indicators.

GT0: No Weights

The GT0 option was used to calculate the GTMI for 198 economies based on a simple mathematical average of four normalized component index scores:

$$CGSI = \frac{\sum_{i=1}^{15} X(i)}{\sum_{i=1}^{15} Xmax(i)} \qquad PSDI = \frac{\sum_{i=16}^{21} X(i)}{\sum_{i=16}^{21} Xmax(i)}$$

$$CEI = \frac{\sum_{i=22}^{33} X(i)}{\sum_{i=22}^{33} Xmax(i)} \qquad GTEI = \frac{\sum_{i=34}^{48} X(i)}{\sum_{i=34}^{48} Xmax(i)}$$

$$(2.3)$$

$W(i)$ is equal to 1 for all indicators. The sum of $Xmax(i)$ is 41 for 15 CGSI indicators, 14 for 6 PSDI indicators, 13 for 12 CEI indicators, and 27 for 15 GTEI indicators.

GTE: Weights Based on Expert Opinion

The GTE option relies on specific weights identified for selected key indicators to emphasize their importance in improving four GovTech focus areas:

$$CGSI = \frac{\sum_{i=1}^{15} X(i) * We(i)}{\sum_{i=1}^{15} Xmax(i) * We(i)} \qquad PSDI = \frac{\sum_{i=16}^{21} X(i) * We(i)}{\sum_{i=16}^{21} Xmax(i) * We(i)}$$

$$CEI = \frac{\sum_{i=22}^{33} X(i) * We(i)}{\sum_{i=22}^{33} Xmax(i) * We(i)} \qquad GTEI = \frac{\sum_{i=34}^{48} X(i) * We(i)}{\sum_{i=34}^{48} Xmax(i) * We(i)}$$

$$(2.4)$$

$X(i)$ denotes the score of each key indicator *(i)* (from 1 to 48) used to calculate four component indexes, $We(i)$ is the weight of each key indicator based on expert opinion, and $Xmax(i)$ is the maximum score of each key indicator. The sum of $Xmax(i)*We(i)$ is 85 for 15 CGSI indicators, 21 for 6 PSDI indicators, 24 for 12 CEI indicators, and 61 for 15 GTEI indicators.

The following weights were given to selected key indicators (31 out of 48 indicators). The default weight for all remaining indicators is 1.

- *CGSI.* Government cloud [$We(1)$ = 4]; government enterprise architecture [$We(2)$ = 4]; government interoperability framework or government service bus [$We(3)$ = 4]; government procurement portal [$We(10)$ = 2]; public investment management system [$We(12)$ = 2]; open-source software in the public sector [$We(13)$ = 2]; UN Telecommunication Infrastructure Index [$We(14)$ = 6]; national strategy on disruptive technologies [$We(15)$ = 4].
- *PSDI.* UN Online Service Index [$We(16)$ = 6]; online public service delivery portal [$We(17)$ = 2].
- *CEI.* UN E-Participation Index [$We(22)$ = 6]; open-government portal [$We(23)$ = 2]; open-data portal [$We(24)$ = 2]; national website for citizen participation [$We(25)$ = 4]; four subindexes related to citizen participation website [$We(26–29)$ = 0.5 each]; national website for citizen and business feedback [$We(30)$ = 4]; two subindexes related to citizen feedback website [$We(31–32)$ = 0.5 each].
- *GTEI.* GovTech institutions [$We(34)$ = 4]; data governance institutions [$We(35)$ = 3]; national digital government or GovTech strategy [$We(36)$ = 2]; whole-of-government approach as a part of national digital government strategy [$We(37)$ = 4]; national ID system [$We(41)$ = 2]; digital ID for services [$We(42)$ = 2]; UN Human Capital Index [$We(45)$ = 6]; strategy on digital skills development in the public sector [$We(46)$ = 2]; programs for digital skills and innovation [$We(47)$ = 4]; strategy or entity focused on public sector innovation [$We(48)$ = 4].

The weights of selected new indicators were based on World Bank operational experience to (a) amplify the effects of specific indicators highly relevant to the improvement of four focus areas, (b) reflect observations from existing studies, and (c) present a more realistic view of GovTech maturity compared to quantitatively generated weights. In this way, the World Bank team placed greater emphasis on more recent GovTech activities that are essential to digital transformation. Relatively lower weights were given to some of the new indicators—for example, I-31 and I-32 in table 2.1—when it was not possible to find comprehensive information on the web. This was also the case when several relevant dimensions were measured using the same indicator, such as I-17, which measures both the existence of a portal and the level of services available. Also, an indicator measuring the existence of a new strategy document was given a lower weight (weight = 2) than an indicator measuring the existence of a digital skills program or public sector innovation lab launched to implement the new strategy (weight = 4). As explained in appendix C, this approach was also used by the creators of the Development Bank of Latin America's GovTech Index published in 2020 (Zapata et al. 2020).

The alternative quantitative indexes (GTC and GTF) also provide robustness checks to the subjectively determined weights, as explained in appendix D. In particular, the weights constructed by correlation and factor analyses are endogenously determined by the variance of the data itself. Consequently, they ensure that the weights based on expert opinions are not determined arbitrarily since the subjective weights identified by experts are measurable, observable, and guided by the quantitatively constructed weights.

The weighted average for each component index was computed by a variation of the standard weighted average formula to ensure that the values are normalized to fall between 0 and 1. The approach involves dividing the sum of the multiplication of the indicators with their respective weights (the numerator) by the sum of the multiplication of the maximum indicator values with their respective weights (the denominator). The details of GTC and GTF weight calculations are presented in appendix D. A summary of these two options is presented below.

Before calculating the other two options, the Z-score standardization procedure was implemented for each component indicator to ensure that the overall GTMI is equally decided by the four component indexes—that is, each component index presents comparable variance after the Z-score standardization. This method was also used to calculate the UN EGDI. In the absence of the Z-score standardization treatment, the GTMI would depend mainly on the component index with the greatest dispersion. After the Z-score standardization, the arithmetic sum becomes a good statistical indicator, where "equal weights" truly mean "equal importance."

GTC: Weights Based on Correlation Analysis with Standardized Scores

In the GTC option, a simple Pearson's correlation analysis was performed to generate the weights.[10] First, a simple average of GTMI across 198 economies using the raw scores was computed. Subsequently, these scores were standardized for each indicator using the mean and standard deviation of each indicator (see appendix B). The correlation coefficients between the unweighted GTMI scores and the standardized indicator Z-scores were computed and used as the weights. The standardization transforms all of the scores such that all indicators have the same mean (= 0) and variance (= 1), which makes them comparable. Another practical advantage of this transformation is that if outliers (that is, extremely large or small values) are present in the collected data, they can be accounted for and do not skew the overall composite index.

The standardized scores were multiplied by their respective weights, and the weighted average was computed for each GovTech focus area using the standard weighted average formula. The weighted averages of the focus areas (from the Z-scores) were normalized using the min-max approach to fall between 0 and 1. The min-max approach subtracts the minimum value of the indicator across countries from the weighted average score of the country for the focus area in question and divides the outcome by the range of the indicator (the difference between the maximum and minimum values of the indicator across countries). Finally, the weights calculated through the correlation analysis were applied to all raw scores to compute a separate GTMI for comparison purposes.

GTF: Weights Based on Factor Analysis with Standardized Scores

In the GTF option, a factor analysis closely guided by the proposed approach of the OECD (2008) was employed to calculate the indicator weights (see also Greco et al. 2019; UN 2020). This approach assigns higher weights to indicators that explain a higher proportion of the variation in all indicators. This is operationalized by using the observed indicator scores to construct unobserved factors that are common to all indicators in the dataset. The highest estimated association between an indicator and the common factors (factor loadings) was used to calculate its weight since doing so shows the degree of the data that the indicator explains through the common factors. The factors and factor loadings

were first estimated by factor analysis—in particular, principal components analysis—based on the indicator scores. After rotating the ensuing matrix to simplify the structure, the maximum factor loading of a given indicator was identified and squared. The outcome was normalized by the variance explained by its factor; see appendix B for further discussion. The approach is valuable for endogenously generating weights based on latent relationships among the indicators. These weights are applied separately to the raw data and standardized Z-scores.

The details of weight calculations and comparison of results are presented in appendix D.

DATA ANALYSIS

While all GTMI calculation results are shown here for comparison purposes, this report focuses on the GTMI scores computed with specific weights based on expert opinion, to reflect the relative degrees of importance of the selected indicators. After normalized GTMI scores reflecting the key aspects of four GovTech focus areas were calculated, the 198 economies included in the GovTech data set were grouped into four categories, A to D (table 2.2). The purpose was not to rank countries in terms of performance, but to illustrate the state of GovTech focus areas globally and to identify good practices and areas for possible improvement.

The number of economies falling into each group for the GTMI and its four components, calculated with and without weights, is shown in table 2.3. The average scores for the GTMI and four component indexes based on the GTE option are shown in table 2.4, together with the average scores for all 198 economies.

TABLE 2.2 Definition of GovTech Maturity Index (GTMI) groups

GROUP	SCORE	GTMI	DESCRIPTION OF GOVERNMENT PRACTICES
A	0.75–1.00	Very high	GovTech leaders demonstrating advanced or innovative solutions and good practices in all four focus areas
B	0.50–0.74	High	Governments with significant GovTech investments and good practices in most of the focus areas
C	0.25–0.49	Medium	Governments with ongoing activities to improve some of the GovTech focus areas
D	0–0.24	Low	Governments with minimal focus on GovTech initiatives

Source: World Bank staff.

TABLE 2.3 GovTech Maturity Index (GTMI) calculations, by number of economies in each group

	A. GT0: NO WEIGHTS					B. GTE: WEIGHTS (EXPERT OPINION)				
GROUP	GTMI	CGSI	PSDI	CEI	GTEI	GROUP	GTMI	CGSI	PSDI	CEI	GTEI
A	**44**	60	76	26	65	A	**43**	34	73	52	56
B	**61**	96	58	42	53	B	**59**	57	63	31	45
C	**74**	27	48	33	49	C	**63**	77	43	42	56
D	**19**	15	16	97	31	D	**33**	30	19	73	41
Totals	**198**	198	198	198	198	Totals	**198**	198	198	198	198

Source: World Bank staff calculations.
Note: CGSI = Core Government Systems Index. PSDI = Public Service Delivery Index. CEI = Citizen Engagement Index. GTEI = GovTech Enablers Index.

TABLE 2.4 Average GovTech Maturity Index (GTMI) and component scores based on the GTE option, by group

GROUP	GTMI	CGSI	PSDI	CEI	GTEI
A	**0.86**	0.78	0.89	0.86	0.89
B	**0.64**	0.58	0.73	0.58	0.67
C	**0.36**	0.34	0.51	0.24	0.34
D	**0.18**	0.19	0.22	0.13	0.17
198 economies	**0.52**	0.48	0.61	0.46	0.53

Source: World Bank staff calculations.
Note: CGSI = Core Government Systems Index. PSDI = Public Service Delivery Index. CEI = Citizen Engagement Index. GTEI = GovTech Enablers Index. Average scores for 198 economies.

> The GTMI scores were calculated using the weights based on expert opinion to reflect the relative degrees of importance of the selected indicators, as determined by the extant literature, observations during the data collection process and World Bank operational experience.

VALIDATION OF OBSERVATIONS

The observations and findings were validated by a group of World Bank experts involved in the design and implementation of public sector digital transformation activities globally. Early in the development process, the team validated the approach to data collection, analytic methodology, and selection of indicators with a multidisciplinary set of specialists to ensure adequacy of coverage, confirm relevance to key focus areas, and determine expert weighting. Multiple stakeholder consultations were undertaken to present the methodology, data collection, and results. Based on expert feedback, the indicators comprising the four subindexes were revised to ensure robustness of the resulting index.

The observations and selection of good practices were also validated by the expert group. Further, the GovTech global data set was made publicly available through the World Bank Data Catalog to benefit from the feedback of experts and practitioners involved in digital transformation activities.[11] The publication of the underlying data set provides opportunities to replicate the study and track changes over time.

REPORTING OF RESULTS

The observations and findings of each key indicator are presented in chapter 3. To verify whether the findings of the study are consistent with key observations from other digital government indexes, the relationships between the GTMI and UN EGDI and other indexes were also analyzed. An overview of some of the good practices in GovTech focus areas is presented in chapter 4.

To identify and promote exemplary GovTech initiatives and good practices in four focus areas, the findings of this study are published together with the latest version of the GovTech data set on the GovTech website. Country officials and practitioners are welcome to comment on the content and suggest possible improvements.

NOTES

1. GovTech data set (World Bank 2021a) is an updated and expanded version of the Digital Government Systems and Services (DGSS) data set, originally developed in 2014.
2. The 2020 UN Online Service Questionnaire consists of 148 questions covering a broad range of indicators, including "information about" laws, policies, legislation, or expenditures; "existence of" social networking and other tools; and "ability to do something" on government websites. Government officials from 193 countries have answered these questions, and at least two researchers have reviewed the responses. The researchers have assessed each country's national website in the native language, including the national, e-services, and e-participation portals and the websites of the ministries of education, labor, social services, health, finance, and environment, as applicable. Responses have generally been based on whether the relevant features can be found and accessed easily, not whether they exist but are hidden somewhere on the site.
3. The UN HCI is a subcomponent of the e-Government Development Index (EGDI). It is not the same as the World Bank's Human Capital Index (released in 2018 and updated in 2020, covering 174 economies), which "quantifies the contribution of health and education to the productivity of the next generation of workers." The UN HCI embodies both current and expected education measures. For the methodology of the UN EGDI, see https://publicadministration.un.org/egovkb/en-us/about/methodology. For the World Bank Human Capital Index, see https://datacatalog.worldbank.org/search/dataset/0038030 /Human-Capital-Index.
4. According to the United Nations, *e-government* is the use of information and communication technologies (ICTs) to deliver government services more effectively and efficiently to citizens and businesses. It is the application of ICT in government operations, achieving public ends by digital means. More recently, the definition of *digital government* is focused on the transformation of public institutions—and the public sector landscape more broadly—and their ability to deliver services using new technologies. For the UN definition of e-government, see https://publicadministration.un.org/egovkb/en-us/About /UNeGovDD-Framework#. For the UN definition of digital government, see https:// publicadministration.un.org/en/Research/UN-e-Government-Surveys.
5. According to the European Union, digital government transformation within the last 20 years covers four phases: e-government (1.0), which focuses on the applications of World Wide Web technology in the public sector; open government (2.0); smart government (3.0); and eventually transformed government (4.0), which is a citizen-driven government that uses cognitive systems and advanced analytics. See Egidijus et al. (2019).
6. The OECD defines *digital government* as "the use of digital technologies, as an integrated part of governments' modernization strategies, to create public value. It relies on a digital gov-[ernment] ecosystem comprised of gov[ernment] actors, non-gov[ernmental] organizations, businesses, citizens' associations, and individuals which supports the production of and access to data, services, and content through interactions with the government" (OECD 2014).
7. Due to the lack of resources and time, the GovTech data set was originally developed using publicly available data and reports on government websites. Collecting data through survey forms or interactions with government officials was not possible due to the broad spectrum of systems and services covered. Some of the capabilities related to citizen participation and feedback are only accessible when a citizen actually signs into the portal, and these embedded features may have been missed while collecting data. Also, the data set may not capture the presence of a national citizen participation portal in some of the federal countries, although such platforms may exist for different ministries and agencies or at the provincial or state level.
8. The UN EGDI and the World Bank Worldwide Governance Indicators (WGI) data sets are available for 193 and 196 economies, respectively. The GTMI scores for seven economies—Hong Kong SAR, China; Kosovo; Macao SAR, China; Monaco; West Bank and Gaza; San Marino; and Taiwan, China—not included in the EGDI or WGI data sets were calculated without including missing dimensions (and by reducing the sum of maximum scores accordingly). These specific calculations are detailed in the GovTech data set.
9. The Z-score standardization procedure was implemented for each component indicator to ensure that the overall GTMI is equally decided by the four component indexes—that is, each component index presents comparable variance after the Z-score standardization, similar to UN EGDI calculations.

10. For a description of Pearson's correlation, see https://en.wikipedia.org/wiki/Pearson_correlation_coefficient.
11. The Data Catalog is available at https://datacatalog.worldbank.org.

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3 Findings

This chapter provides an overview of the GovTech Maturity Index (GTMI) results, together with the challenges and opportunities in the GovTech domain.

STATE OF GOVTECH AROUND THE WORLD

There are 80 GovTech initiatives around the world, and good practices are highly visible in 43 economies out of 198 reviewed.

The maturity of GovTech in the GTMI groups is depicted on map 3.1. All 198 economies are grouped from A to D based on their average GTMI score.

As shown in table 3.1, 43 leading economies (21 percent) are using advanced or innovative digital solutions and demonstrating good practices in all four GovTech focus areas, whereas 33 governments (17 percent) have placed minimal or no emphasis on the GovTech agenda. Fifty-nine economies (30 percent) have made significant investments in various GovTech focus areas, and 63 governments (32 percent) have ongoing projects to improve maturity.

Based on the information presented on 198 government websites and in published documents, the average GTMI score is 0.52 out of 1 (figure 3.1). The average score is 0.48 for the Core Government Systems Index (CGIS), 0.61 for the Public Service Delivery Index (PSDI), 0.46 for the Citizen Engagement Index (CEI), and 0.53 for the GovTech Enablers Index (GTEI), as shown in table 2.4 in chapter 2. The higher average score for the PSDI than for other focus areas indicates that many countries have national online service portals, but that few countries have visible and universally accessible citizen-centric services. Also, a relatively lower average CGSI score indicates that, despite substantial investments in core government systems, few countries are focused on a whole-of-government approach to improve the integration of systems and services based on an interoperability framework. Similarly, government initiatives are emerging on the effective use of technology for citizen engagement. Regarding the enablers, most of the countries have updated digital government strategies with an emphasis on the GovTech agenda.

On average, countries in Group A have the highest index score, as expected, and the gap between A and D is wide, as presented in figure 3.1, panel a.

State of GovTech around the world, by GTMI group, as of December 2020

Source: World Bank data (198 economies).
Note: Presents average GTMI scores. GTMI = GovTech Maturity Index. CGSI = Core Government Systems Index. PSDI = Public Service Delivery Index. CEI = Citizen Engagement Index. GTEI = GovTech Enablers Index.

TABLE 3.1 Overview of GovTech maturity, 2020

GROUP	GTMI	COUNTRIES OR ECONOMIES IN GROUP	ECONOMIES NUMBER	ECONOMIES %	REGIONS NUMBER	REGIONS %
A	Very high: GovTech leaders	Argentina; Australia; Austria; Belgium; Brazil; Canada; Chile; Colombia; Croatia; Denmark; Estonia; Finland; France; Germany; Greece; Hong Kong SAR, China; India; Israel; Italy; Japan; Korea, Rep.; Lithuania; Luxembourg; Malaysia; Malta; Mexico; Netherlands; New Zealand; Norway; Peru; Portugal; Singapore; Slovenia; South Africa; Spain; Sweden; Switzerland; Thailand; Turkey; United Arab Emirates; United Kingdom; United States, Uruguay	43	21	23	14
B	High: significant focus on GovTech	Albania; Armenia; Azerbaijan; Bahrain; Bangladesh; Belarus; Bhutan; Bolivia; Bulgaria; Cabo Verde; China; Costa Rica; Cyprus; Czech Republic; Dominican Republic; Ecuador; Egypt, Arab Rep.; El Salvador; Georgia; Ghana; Honduras; Hungary; Iceland; Indonesia; Ireland; Jamaica; Jordan; Kazakhstan; Kenya; Kyrgyz Republic; Latvia; Mauritius; Moldova; Mongolia; Montenegro; Morocco; North Macedonia; Nepal; Oman; Pakistan; Panama; Paraguay; Philippines; Poland; Qatar; Romania; Russian Federation; Rwanda; Saudi Arabia; Serbia; Slovak Republic; Sri Lanka; Taiwan, China; Tanzania; Tunisia; Uganda; Ukraine; Uzbekistan; Vietnam	59	30	56	33

(continued)

TABLE 3.1, *continued*

GROUP	GTMI	COUNTRIES OR ECONOMIES IN GROUP	ECONOMIES		REGIONS	
			NUMBER	%	NUMBER	%
C	Medium: some focus on GovTech	Afghanistan; Algeria; Andorra; Angola; Antigua and Barbuda; Bahamas, The; Barbados; Belize; Benin; Bosnia and Herzegovina; Botswana; Brunei Darussalam; Burkina Faso; Burundi; Cambodia; Cameroon; Côte d'Ivoire; Cuba; Dominica; Eswatini; Ethiopia; Fiji; Grenada; Guatemala; Guyana; Haiti; Iran, Islamic Rep.; Kosovo; Kuwait; Lebanon; Lesotho; Liechtenstein; Macao SAR, China; Madagascar; Malawi; Maldives; Mali; Monaco; Mozambique; Myanmar; Namibia; Nicaragua; Nigeria; Papua New Guinea; Senegal; Seychelles; Sierra Leone; Solomon Islands; St. Kitts and Nevis; St. Lucia; St. Vincent and the Grenadines; Suriname; Syrian Arab Republic; Tajikistan; Timor-Leste; Togo; Tonga; Trinidad and Tobago; Vanuatu; Venezuela, RB; West Bank and Gaza; Zambia; Zimbabwe	63	32	58	34
D	Low: minimal focus on GovTech	Central African Republic; Chad; Comoros; Congo, Dem. Rep; Congo, Rep.; Djibouti; Equatorial Guinea; Eritrea; Gabon; Gambia, The; Guinea; Guinea-Bissau; Iraq; Kiribati; Korea, Dem. People's Rep.; Lao PDR; Liberia; Libya; Marshall Islands; Mauritania; Micronesia, Fed. Sts.; Nauru; Niger; Palau; Samoa; San Marino; São Tomé and Príncipe; Somalia; South Sudan; Sudan; Turkmenistan; Tuvalu; Yemen, Rep.	33	17	31	19
Total			198		168	

Source: World Bank data.
Note: % of economies = % of 198 economies included in the relevant group. % of regions = % of 168 World Bank client countries included in the relevant group.

Similarly, a substantial gap exists between the average GTMI scores of high- and low-income countries, whereas the average scores for upper- and lower-middle-income countries are close to each other, as shown in figure 3.1, panel b. These observations are consistent with the findings of the *World Development Report*s for 2016 and 2021, according to which the digital divide continues to grow, especially in low- and middle-income countries (World Bank 2016b, 2021). The COVID-19 pandemic also has exposed both persistent social inequalities and an increasing digital divide. Access to information and public services is much better in the high-income world than in low- and middle-income countries. However, many middle- or low-income and rural communities, as well as in large urban areas, still lack reliable and affordable access.

The state of GovTech in the regions is illustrated in figure 3.2, together with the total number of countries in each region. The largest group of countries focused on the GovTech agenda is in the Europe and Central Asia region—26 out of 30 (87 percent) in Groups A and B. Other regions follow, with 16 countries in

FIGURE 3.1

Average GovTech Maturity Index score, by GTMI group and income level, 2020

a. By GTMI group

b. By income level

Source: World Bank data (average scores for 198 economies).
Note: GTMI = GovTech Maturity Index. Numbers in parentheses are the number of countries in the group or income level.

FIGURE 3.2

State of GovTech in World Bank client countries, by region and group, 2020

Source: World Bank data (168 client countries).

Latin America and the Caribbean, 12 in East Asia and Pacific, 11 in Middle East and North Africa, 8 in Sub-Saharan Africa, and 6 in South Asia.

The Digital Economy for Africa Initiative of the World Bank (described in box 3.1) was launched in 2018 to support relevant government initiatives for Africa's digital transformation.

Across groups, figure 3.3 indicates that countries generally score higher on core government systems, online services, and GovTech enablers than on citizen engagement, with the exception of economies in Group A. Countries in other groups record their lowest scores on citizen engagement, which suggests that

BOX 3.1

Digital Economy for Africa Initiative

The World Bank Group is focused on improving the digital economy in the Africa region in collaboration with the African Union. Under the Digital Economy for Africa Initiative, the World Bank aims to support the regional digital transformation strategy for Africa to accelerate the achievement of the United Nations Sustainable Development Goals and promote the development of the digital economy.[a] Funding of between US$62 billion and US$79 billion is needed to establish the foundations for an Africa-wide digital economy. The initiative is focused on improving connectivity and access to digital services, developing digital skills, and expanding access to e-commerce and entrepreneurship opportunities for all African citizens and businesses. GovTech is represented in the framework as part of the Digital Public Platforms pillar. Under the initiative, interest in and focus on GovTech platforms, policies, and initiatives have significant potential to grow. The next iteration of the GovTech Maturity Index is expected to reflect these developments.

a. For more on the initiative, see https://www.worldbank.org/en/programs/all-africa-digital-transformation. For more on the Sustainable Development Goals, see https://sdgs.un.org/goals.

FIGURE 3.3

Average GovTech Maturity Index component score, by GTMI group, 2020

Source: World Bank data (198 economies).
Note: GTMI = GovTech Maturity Index. CGSI = Core Government Systems Index. PSDI = Public Service Delivery Index. CEI = Citizen Engagement Index. GTEI = GovTech Enablers Index. The numbers in parentheses are the total number of countries in each group.

governments may be making relatively lower investments in GovTech solutions to enhance their engagement with citizens.

The regional variation in the GTMI component scores for different groups is presented in figure 3.4, panels a–f. The regional distribution indicates the progress made in all four GovTech focus areas, together with the gaps in specific areas. The largest gap in all regions reflects the ineffective use of technology for citizen engagement, followed by lack of adoption of the whole-of-government approach. In the Sub-Saharan Africa region, a relatively small group of countries has made significant investments in all GovTech focus areas. Most countries

Regional average GovTech Maturity Index component score, by GTMI group and region, 2020

Source: World Bank data (168 client countries).
Note: GTMI = GovTech Maturity Index. CGSI = Core Government Systems Index. PSDI = Public Service Delivery Index. CEI = Citizen Engagement Index. GTEI = GovTech Enablers Index. The numbers in parentheses are the total number of countries in each GTMI group.

have a substantial gap in citizen engagement, service delivery, and GovTech enablers. In four regions—East Asia and Pacific, Latin America and the Caribbean, Middle East and North Africa, and South Asia—nearly half of the countries demonstrate progress in all GovTech focus areas, but notable gaps are evident in the areas of citizen engagement, whole-of-government approach, and service delivery in the remaining half. Europe and Central Asia is the most advanced region regarding the maturity of GovTech, despite the gaps in citizen engagement and enablers in several countries.

The maturity of GovTech initiatives is presented next from two different perspectives: (a) income-level distribution for 198 economies (*international outlook*) and (b) regional distribution for 168 World Bank client countries (*regional outlook*).

Income level

The maturity of GovTech foundations in 198 economies based on income level is shown in figure 3.5. Most of the GovTech leaders—33 out of 43 (77 percent)—are

from high-income countries, as expected. Most upper-middle-income and lower-middle-income countries are in Groups B or C. Most of the low-income countries have minimal focus on GovTech; 27 out of 29 are in Groups C or D. All 39 fragile states are in Groups C or D, with little or no focus as yet on the GovTech agenda.

Regional distribution

The average state of GovTech maturity in 168 World Bank client countries by region is presented in figure 3.6. Among the regions, Europe and Central Asia is

FIGURE 3.5

GovTech Maturity Index: International outlook, by GTMI group and income level, 2020

Source: World Bank data (198 economies).
Note: GTMI = GovTech Maturity Index.

FIGURE 3.6

GovTech Maturity Index: Regional outlook, by GTMI group and region, 2020

Source: World Bank data (168 client countries).
Note: GTMI = GovTech Maturity Index.

the leader in GovTech activities, with 26 out of 30 countries in Groups A or B; Latin America and the Caribbean follows, with all 32 countries in Groups A, B, or C. Countries in East Asia and Pacific, Middle East and North Africa, and South Asia show some good practices in the GovTech domain—about 50 percent of countries are in Groups A or B. Only a few examples of good practice are evident in Sub-Saharan Africa, where only 8 out of 48 countries are in Groups A or B, and many are in Groups C or D.

FINDINGS

This section presents the findings on specific areas that are critical components of a sustainable GovTech ecosystem—(a) institutions, policies, and strategies; (b) emerging GovTech initiatives; and (c) the whole-of-government approach— followed by an overview of the key findings on all four GovTech focus areas.

Institutions, policies, and strategies

Based on the GovTech data set, there are 174 dedicated e-government or digital government entities with approved strategies or action plans (figure 3.7). Most of these countries are improving the digital government ecosystem to address

FIGURE 3.7

Diffusion of digital government and GovTech initiatives, 2000–20

Source: World Bank data (198 economies).

country-specific challenges in line with their priorities, policies, and action plans, using available capacity and budget resources. Despite increasing investments in infrastructure and the availability of GovTech institutions and strategy documents, many governments around the world continue to face challenges in the implementation of solutions related to capacity and resource constraints, digital inclusion, data privacy, cybersecurity, and other factors.

A review of the information on government websites shows growing interest in establishing GovTech units close to the center of government to promote a whole-of-government approach, reduce the duration and cost of GovTech interventions, and maximize the impact of investments in key digital transformation programs.

- *Institutional developments.* Dedicated central government GovTech units have been established in 80 countries. Data governance bodies are operational in 61 countries. These bodies are mostly autonomous entities focused on the challenges of protecting data and privacy, using data for digital entrepreneurship, and contributing to the development of the digital economy. Data protection authorities exist in 103 countries, and cybersecurity emergency response teams have been established in 131 countries.[1]
- *Policy and strategy developments.* Since 2015, governments have increasingly published new policy and strategy documents to support the digital transformation of the public sector. Country-specific strategies and action plans have been approved to promote the use of disruptive technologies and open-source software in about 79 countries and to enhance digital skills in the public sector in 83 countries.
- *Investment developments.* Government clouds—infrastructure, platform, or software as a service—exist in 106 countries. Government interoperability frameworks or service bus platforms have been established in 94 countries, and government enterprise architecture has been developed in 61 countries. These investments are increasing steadily, together with the expansion of digital skills development programs, which are present in 107 countries. Also, innovation labs have been established in 100 countries to support public sector modernization.

A group of 43 countries is leading digital transformation in the public sector, with highly visible good practices in all four GovTech focus areas, as shown in table 3.1. However, few governments presently record or report transparently the full details of government investments in GovTech initiatives and the results achieved or the challenges faced. Therefore, it is difficult to monitor progress in the implementation of most GovTech initiatives and to document cases of good practices based solely on the information available on the web and government websites. Nevertheless, the observations and findings of this report may be useful in raising awareness among government officials of the importance of sharing the results, successes, and failures of GovTech initiatives transparently. Furthermore, if GovTech investments are made with poor preparation and lack of focus on defining the relevant problem, outcomes may be suboptimal. Based on the availability of relevant data and reports, it may be possible in the next version of the report to analyze in detail the challenges faced as well as the unintended outcomes experienced in various GovTech initiatives. Such analysis would be useful for informing the design of new GovTech activities.

GovTech initiatives

Several types of GovTech initiatives have emerged within the last decade to support public sector digital transformation through country-specific programs. Most of these GovTech initiatives—63 out of 80 (79 percent)—have been launched by government entities, and the rest are led by civil society organizations. Among 63 government entities, 42 institutions leading GovTech initiatives are connected to either the president's or prime minister's office or the ministry of information and communication technology (ICT); the rest are led by autonomous agencies or other government entities. Another 14 GovTech initiatives are led by civil society organizations, event organizers, or the private sector to facilitate interactions among government officials, start-ups, and investors—for example, GovTech Brazil, GovTech Program Denmark, GovTech Gruppe in Germany, and GovTech Institute Netherlands. Most of these initiatives are focused on all four focus areas highlighted in this report; selected good-practice cases are summarized further in chapter 4.

GovTech initiatives are growing globally, and more countries are looking to learn about initiatives and good practices. In 2020 several regional and international virtual events were organized to rethink how governments can operate and thrive in the post-COVID-19 world—for example, the GovTech Summit in Paris, GovTech Global in the United Kingdom, and Campus Party in Latin America and the Caribbean.[2]

Multiple supply- and demand-side factors contributing to the success of digital transformation and GovTech initiatives are outlined in World Bank (2020). These factors include sustained high-level commitment of government leadership, allocation of necessary resources, dedicated teams to drive the public sector modernization agenda, allocation of budget funds for innovation and training, and investments to enhance digital infrastructure and improve interoperability and user adoption. In many low- and middle-income countries, the digital divide is significant, in terms of not only connectivity but also the devices, digital literacy, and skills necessary to take advantage of GovTech services and solutions.

Whole-of-government approach

Based on the GovTech data set, 84 economies have digital government strategy documents that refer to the whole-of-government approach in specific areas as a part of medium-term action plans for public sector modernization. Most of these countries are focused on the effective use of shared platforms to improve the interconnectivity and interoperability of government systems, automate data exchange, and provide integrated online channels for service delivery. Of the 84 economies promoting a whole-of-government approach, only 16 countries are more advanced in the effective use of whole-of-government solutions. A whole-of-government approach is also important for developing a coherent and comprehensive model of data governance, as explained in a recently published Organisation for Economic Co-operation and Development (OECD) report on data governance in the public sector (OECD 2019). About 10 good-practice cases presented in the OECD report demonstrate how holistic data governance can help to connect government as a whole. The report reviews the whole-of-government approach from several perspectives, including the presence of specific targets in strategy documents; the existence of institutions,

regulations, and shared platforms; and the development of digital skills. A more integrated approach to public service delivery, shared digital government infrastructure, effective data governance, and interoperability frameworks will be the focus of whole-of-government solutions in the coming years.

The rest of this section analyzes the four GovTech focus areas based on the data collected on 48 GTMI indicators.

GovTech focus areas

In this report, the specific aspects of the four GovTech focus areas are presented by grouping all 198 economies into groups from Group A (GovTech leaders) to Group D (minimal focus on GovTech) based on their GTMI scores to distinguish good practices and highlight innovative solutions. The purpose of this grouping is to present the current status of four GovTech focus areas globally. This section illustrates the progress made in all four focus areas, using 48 key indicators to provide a more detailed view of the trends and gaps identified in each category.

State of core government systems

Substantial investments have been made in government systems and telecommunications infrastructure globally. However, many governments do not focus on some key aspects of the whole-of-government approach. The current status of core government systems based on the CGSI is presented in map 3.2.

There are 15 key indicators presented in two parts related to core government systems. The first part consists of six indicators and covers less-known aspects of core government operations, such as the existence of government cloud

MAP 3.2

State of core government systems, by GTMI group, as of December 2020

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Source: World Bank data (198 economies).
Note: Presents scores on the Core Government Systems Index (CGSI). GTMI = GovTech Maturity Index.

platforms and a government service bus and initiatives exploring the use of disruptive technologies (figure 3.8).

As shown in figure 3.8, the focus on more advanced solutions—for example, government cloud, government enterprise architecture, government service bus, open-source software, and disruptive technologies—is much lower than the focus on other aspects of GovTech, even among Group A, the GovTech leaders. The digital government strategies and action plans approved by 84 countries since 2018 include these critical aspects to promote the use of shared platforms and minimize the cost of operating core systems and services in the future. Among these strategies and plans, new strategy documents updated by 17 countries in 2020 aim to improve remote connectivity, access to online services, and business continuity solutions, based on lessons learned during the COVID-19 pandemic.

The second part, with nine indicators and shown in figure 3.9, presents the details of core systems based on the GovTech data set, including a new indicator capturing progress in public investment management systems. Key CGSI indicators are summarized below to explain the trends.

Most countries already have operational core public financial management and other systems to support core central government operations. As shown in figure 3.9, financial management information systems; tax, customs, debt management, and human resource management information systems; and payroll systems are visible in all four groups. However, most of these systems are not interconnected, and data exchange is not sufficiently automated using web services or application programming interfaces (APIs). Also, front-office systems and portals supporting online services, such as government e-payments, e-filing, e-declaration, and e-tendering, are often less developed than back-office system

FIGURE 3.8

State of GovTech core government systems, by GTMI group (Part 1), 2020

Source: World Bank data (198 economies).
Note: Presents scores on the GovTech Core Government Systems Index (CGSI). GTMI = GovTech Maturity Index. CGSI = Core Government Systems Index. GCL = government cloud. GEA = government enterprise architecture. GSB = government interoperability framework or government service bus. OSS = open-source software in the public sector. eTII = United Nations Telecommunication Infrastructure Index. DT = national strategy on disruptive technologies.

State of GovTech core government systems, by GTMI group (Part 2), 2020

Source: World Bank data (198 economies).
Note: Presents scores on the Core Government Systems Index (CGSI). GTMI = GovTech Maturity Index. FMIS = financial management information system Index.
TSA = treasury single account. Tax = tax management system. Cust = customs system.
HRM = human resource management information system. Payr = payroll system.
e-GP = government e-procurement system. Debt = debt management system.
PIMS = public investment management system.

capabilities, such as the registration of taxpayers, accounting, reporting, and announcement of tenders. Therefore, future GovTech initiatives are expected to focus on improving the interconnectivity and interoperability of existing systems and portals and having a government service bus and government cloud as shared platforms. There is also growing interest in public investment management systems to enhance performance and transparency and reduce the cost and duration of large infrastructure investments. Most of these solutions (58 out of 61) have been developed by high- and middle-income countries, and about 40 percent of these systems have emerged within the last five years.

State of public service delivery

Good practices in transition to citizen-centric services that are universally accessible are visible in GovTech leaders and several other countries (in Groups A and B) where the design of online services considers device- and internet-access limitations, digital literacy, cultural norms, and other factors that might inhibit access. Some of the advanced service delivery portals can measure the quality of services, provide access to citizens to monitor the progress in their applications, and submit their consent to use their personal data as part of the process. Such portals are visible at the national or state level in most of the European Union

member countries, Australia, Brazil, Canada, Colombia, India, the Republic of Korea, Singapore, the United Kingdom, the United States, and several other countries. The current status of public service delivery based on the PSDI is presented in map 3.3.

The GovTech PSDI is based on six key indicators, including an important secondary resource, the United Nations (UN) Online Service Index (OSI), as shown in figure 3.10. Most of the existing government service portals support one-way flow of information from government portals to citizens or businesses about services or open data. Two-way flow of information, interactions, and access to transactional services are visible mainly in Groups A and B, and most of these countries are focused on expanding transactional services to save time and reduce the cost of services. The PSDI includes indicators measuring the capabilities of tax and customs service portals based on data available in the GovTech data set.

According to the UN 2020 OSI, countries in diverse geographic regions have made significant progress in digital services (UN 2020). E-participation and data-centric approaches have also been enhanced, and the focus on building digital skills has increased. As highlighted in the UN OSI findings, more than 1 billion people live with some form of disability, and 80 percent of them reside in low- and middle-income countries.[3] The provision of online services catering to the needs of persons with disabilities varies widely: 152 countries have government portals that integrate responsive web design, while only 75 have national portals that are accessible for persons with disabilities (meeting the requirements of the Web Content Accessibility Guidelines in line with World Wide Web Consortium Guidelines).[4]

MAP 3.3

State of public service delivery, by GTMI group, as of December 2020

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Source: World Bank data (198 economies).
Note: Presents scores on the Public Service Delivery Index (PSDI). GTMI = GovTech Maturity Index.
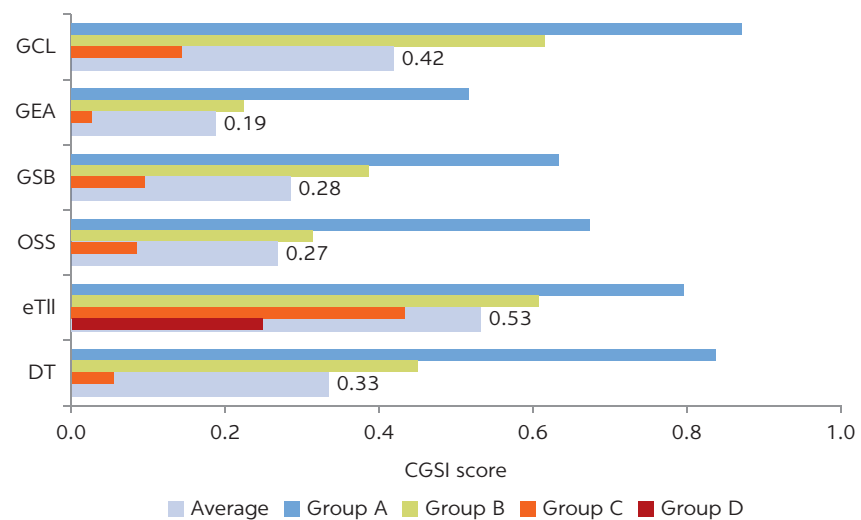
FIGURE 3.10

State of GovTech public service delivery, by GTMI group, 2020

Source: World Bank data (198 economies).
Note: Presents scores on the Public Service Delivery Index (PSDI). GTMI = GovTech Maturity Index.
eOSI = United Nations Online Service Index. eSrv = online public service portal. TaxS = tax system
online service portal. eFil Srv = e-filing service portal. ePay Srv = online e-payment service portal.
CusS = customs system online service portal.

Despite improvements in the delivery of online services, several challenges remain: (a) the growing concern by governments about cybersecurity and by people about data privacy and protection; (b) the need to provide multiple channels for service delivery so that citizens have a choice of service access, particularly those who do not have adequate connectivity, devices, or literacy; and (c) limited government financial and human resources for developing and implementing digital government policies.

State of citizen engagement

The new GovTech indicators defined for measuring the scope of citizen participation and feedback sites found 82 government websites providing opportunities for e-participation beyond the provision of information, mainly in countries in Groups A and B. However, limited options are available for communicating with the government on these websites, and only about half of the e-participation platforms have online forms available for submitting a petition, publishing citizens' inputs, allowing the provision of anonymous feedback, or posting the government's response. The current status of citizen engagement based on the CEI is presented in map 3.4.

There are 75 countries, mostly in Groups A and B, with a national citizen feedback portal including online grievance redress mechanisms, and only about 58 of these platforms provide information on service standards, such as expected or actual response times and quality of service. Only 28 citizen engagement government portals are universally accessible or provide support for users with disabilities, including availability of voice command or sign language support.[5] Finally, only 25 countries publish digital citizen engagement performance and

MAP 3.4

State of citizen engagement, by GTMI group, as of December 2020

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Source: World Bank data (198 economies).
Note: Presents scores on the Citizen Engagement Index (CEI). GTMI = GovTech Maturity Index.

relevant statistics. Furthermore, there is minimal or no focus on digital citizen engagement in GovTech Groups C and D countries, mainly due to capacity, resource, and infrastructure constraints, in addition to lack of political will and demand-side gaps. Challenges in internet access and affordability are other important factors limiting the potential of e-participation initiatives.

The GovTech CEI is based on 12 indicators, as shown in figure 3.11. Citizen engagement is the most difficult component of the GTMI to measure due to the lack of adequate data on government websites about the level of citizen participation and feedback as well as about the transparency and accountability of governments. Although several studies present digital solutions to improve citizen engagement,[6] it is difficult to find reliable information about the impact of these tools and the government's disclosure of service quality standards or responsiveness. Institutional capacity also needs to be strengthened to mitigate increasing risks to cybersecurity, data protection, and privacy, while expanding the use of shared platforms, e-services, and citizen feedback mechanisms.

According to the findings of the UN 2020 e-Government Survey, most governments—170 out of 198 (86 percent)—publish information in each of the six sectors considered in the survey: health, education, employment, social protection, environment, and justice (UN 2020). A small group of countries offer a range of opportunities for e-participation beyond the provision of information—only about 50 countries have websites for online consultations in each of the six sectors assessed. However, the extent of online consultations differs widely across regions, as does the level of transparency on how citizens' inputs are included in decision-making.
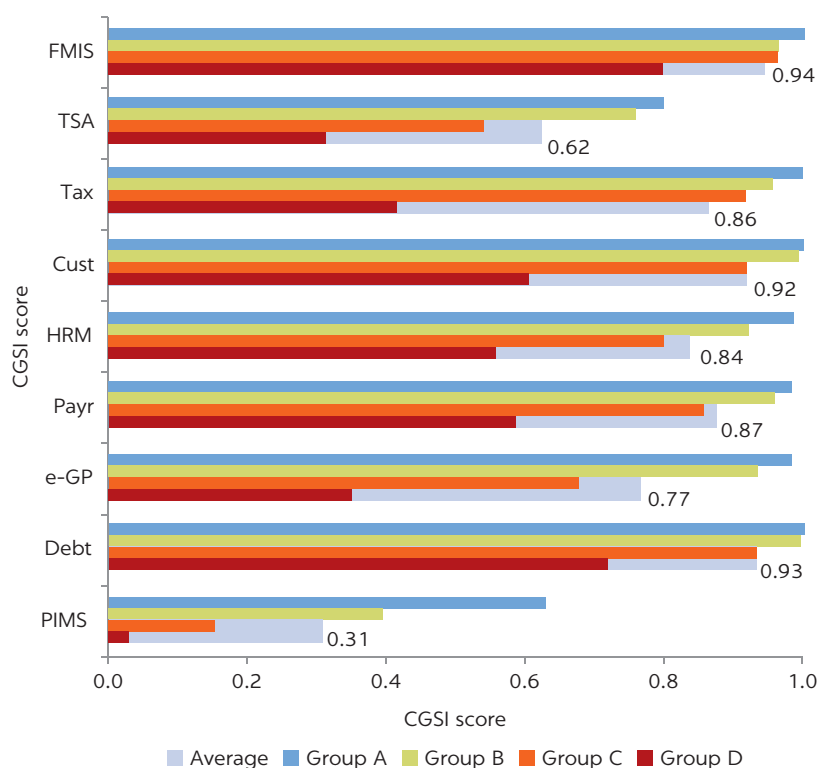
FIGURE 3.11

State of GovTech citizen engagement, by GTMI group, 2020

Source: World Bank data (198 economies).
Note: Presents scores on the Citizen Engagement Index (CEI). GTMI = GovTech Maturity Index. ePart = United Nations e-Participation Index. OGI = open-government initiatives. ODP = open-data portal.
There are four subcategories under Part I-25: National website for citizen participation, namely, Part-Petit (I-26), Part-Publ (I-27), Part-Anym (I-28), and Part-Resp (I-29).
Part = national website for citizen participation. Part-Petit = Is it for a petition? Part-Publ = Are citizens' inputs publicly available on the platform? Part-Anym = Does the platform allow citizens to provide feedback anonymously? Part-Resp = Is government response publicly available on the platform? GRM = national website for citizen and business feedback or grievance feedback management. GRM-Serv = Does the government make the service standards available to the public? GRM-Acce = Are these platforms universally accessible or is support provided for users with disabilities? Perf = Does the government publish its engagement statistics and performance regularly?

Private e-participation initiatives such as those implemented and monitored by civil society or other organizations are not reviewed in this report, which focuses on the public sector's use of technology to engage with citizens.

The UN e-Participation Index covers the private sector dimension, highlighting that "boundaries between public and private initiatives in e-participation have become blurrier, as both the private sector and not-for-profit organizations have built platforms for citizen action or user feedback" (UN 2020). Also, it is not clear whether the availability of expanded digital platforms has translated into broader or deeper participation. In many cases, the take-up of e-participation solutions remains low.

State of GovTech enablers

The GovTech Enablers Index measures the state of four main cross-cutting drivers of the digital transformation agenda in the public sector: digital skills in the public sector, an appropriate and conducive legal and regulatory regime, strong enabling and safeguarding institutions, and an environment that fosters innovation in the public sector. The current status of GovTech enablers based on the GTEI is presented in map 3.5.

The GTEI is based on 15 key indicators, as presented in figure 3.12. As explained earlier, new GovTech institutions and dedicated data governance bodies have emerged in countries in Groups A and B within the last decade. It is encouraging that most of the digital government strategies and action plans updated within the last five years include the establishment of enabling and safeguarding institutions to support the GovTech agenda, with more focus on the whole-of-government approach, digital skills, and innovation in the public sector. These advanced capabilities of a local GovTech ecosystem are more visible in Groups A and B; some countries in Groups C and D, such as Angola, Cuba, Guatemala, Nigeria, and Senegal, also have focused on improving data governance, digital skills, data literacy, and public sector innovation.

All countries have made good progress on the establishment of data protection agencies, cybersecurity emergency response teams, and digital skill development programs. Also, more than 130 countries (65 percent) in all groups have adopted right-to-information and data protection laws and regulations. About half of these institutions and regulations were established and became effective within the last decade.

MAP 3.5

State of GovTech enablers, by GTMI group, as of December 2020

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MAY 2021

Source: World Bank data (198 economies).
Note: Presents scores on the GovTech Enablers Index (GTEI). GTMI = GovTech Maturity Index.

FIGURE 3.12

State of GovTech enablers, by GTMI group, 2020

Source: World Bank data (198 economies).

Note: Presents scores on the GovTech Enablers Index (GTEI). GTMI = GovTech Maturity Index. GT = GovTech institutions. DaG = data governance institutions. DGSt = data government or GovTech strategy. WoG = whole-of-government approach. RTI = right-to-information laws. DPL = data protection or privacy laws. DPA = data protection agency. NatID = unique national identification system. e-ID = digital identification. dSign = digital signature. Cyber = cybersecurity agency. eHCI = United Nations Human Capital Index. DSSt = strategy on digital skills in public sector. DSI = digital skills and innovation program. PSI = entity or strategy focused on public sector innovation.

Based on information in the Identification for Development (ID4D) data set, about 1 billion people do not have official proof of identity, although 186 economies (94 percent) in all GovTech groups have mandatory birth registration systems, and 180 economies issue a national identification (ID) to citizens. Among those that issue national IDs to citizens, 19 countries issue the national ID at birth, while others issue the ID after a certain age. Also, the national ID is mandatory in 151 economies (76 percent). Based on the 2018 update of the ID4D data set, 161 economies have ID systems using digital technologies, reinforcing the need for robust privacy and data protection safeguards.

Countries in GovTech Groups B and C are leading the implementation of unique national ID systems and digital ID solutions to improve service delivery. There is no unique national ID system in some of the GovTech leaders: Australia, Canada, New Zealand, the United Kingdom, and the United States. Regarding the use of digital signatures in the public sector for operations and service delivery, countries in Groups A and B are leading, and good practices are emerging in other groups of countries as well.

CHALLENGES AND OPPORTUNITIES

Challenges

Despite achievements in the GovTech domain, key challenges remain.

- Trust in government is low (World Bank 2017). More transparency and inclusiveness are needed to improve service quality and satisfaction and strengthen confidence in government and institutions.
- Commitment at high levels of government and the allocation of required resources are crucial to implementing the whole-of-government approach, removing inefficiencies, and reducing the risks of fraud and corruption.
- Implementing whole-of-government digital government strategies and large-scale public sector reforms is difficult, especially in low- and middle-income countries.
- Substantial investments in hardware, software, change management, and skills to support the transition to integrated digital solutions and shared platforms are needed.
- Mitigating increasing risks to cybersecurity, data protection, and privacy through stronger institutions and a stronger regulatory environment is necessary for increasing public trust, uptake, and use of public sector platforms, e-services, and citizen feedback mechanisms.
- Digital investments need the support of "analog complements" (World Bank 2016b): effective regulations that empower businesses to leverage the internet to compete and innovate, improved technical skills to take full advantage of digital opportunities, and accountable institutions to respond to citizens' needs and demands.
- It is important to ensure that GovTech solutions do not exacerbate existing divides, especially with regard to the accessibility of services and the distributional implications of the cost of mobile data or internet (especially in low-income countries), as well as access to devices, inclusion, and literacy.
- Low-income countries and some middle-income countries are experiencing structural difficulties relating to digital and hard infrastructure, low levels of internet use, low purchasing power, high cost of smart mobile devices, and inadequate awareness of and skills to use digital technologies.

Regarding equitable access to GovTech services and solutions, the level of penetration and use of the internet and the reach of digital infrastructure both within countries and across regions could either promote equality or increase inequality. The CGSI includes the UN Telecommunication Infrastructure Index (TII), which captures relevant dimensions, including the percentage of population using the internet and the number of mobile cellular subscriptions per 100 inhabitants.[7] Figures 3.13 and 3.14 compare these two indicators for the GTMI groups to reflect the substantial gap between Groups A and D.

Additionally, the relative cost of mobile data varies by country.[8] Since individuals in low- and middle-income countries rely primarily on mobile data, the real costs to consumers may exacerbate the digital divide.

The variation in the cost of mobile data, by GTMI group and income level, is shown in figure 3.15. Access to GovTech services and solutions is enjoyed primarily by wealthier populations and is not equitable at national and subnational levels, mainly due to the lack of adequate infrastructure and digital literacy, especially in rural areas. The cost of mobile data is relatively low in middle-income countries and Group B countries (mostly middle-income countries) compared to other groups and is high in low-income countries.

Opportunities

The World Bank has a comparative advantage in providing global knowledge and experience to support client countries seeking to develop effective GovTech solutions in the following areas:

- *COVID-19 recovery and resilience.* GovTech solutions are crucial for ensuring the continuity of core government operations and the security of remote access for government officials, supporting vulnerable people and businesses, and deploying less expensive and more reliable ICT infrastructure solutions, such as a government cloud and mobile or portable data centers, for rapid modernization of existing systems and services.
- *Government core operations.* Modernization and digitalization can make core government functions more efficient, effective, and transparent. Also, digital government capacity is positively associated with lower perceptions of corruption. While digital technologies can be used effectively to detect and reduce corruption and mitigate other risks, they also can provide opportunities for new types of corruption.

FIGURE 3.13

GovTech Maturity Index and internet users as a percentage of the population, by GTMI group, 2019

Source: World Bank data (198 economies).
Note: GTMI = GovTech Maturity Index.

FIGURE 3.14

GovTech Maturity Index and mobile subscribers per 100 population, by GTMI group, 2019

Source: World Bank data (198 economies)
Note: GTMI = GovTech Maturity Index.

FIGURE 3.15

GovTech Maturity Index and average cost of 1 gigabyte of mobile data, by GTMI group and income level, 2020

Source: World Bank data (188 economies).
Note: GTMI = GovTech Maturity Index.

- *Human-centered service delivery.*[9] GovTech envisions a whole-of-government approach with integrated e-service solutions and e-kiosks such as online access to tax information; registries for citizens, businesses, property, and land; and applications for certificates and passports. Interoperability of government systems enables governments to generate data for more informed decision-making, compliance, and monitoring.
- *Citizen engagement.* GovTech facilitates citizen engagement by promoting continuous two-way communication between governments and citizens through digital solutions such as text messaging, open-source applications, social media, and online petition platforms.
- The IDA19 policy commitments include support for at least 12 International Development Association (IDA) countries to adopt universally accessible services and improve core government systems, with a focus on fragile and conflict- and violence-affected countries.[10]
- The UN sustainable development agenda includes ambitious GovTech-related targets to be achieved by 2030.
- GovTech projects can support the digital governance reform and investment needs identified in digital economy country diagnostics, such as digital infrastructure, platforms, financial services, businesses, and skills.
- GovTech projects can also support the jobs and economic transformation agenda in low- and middle-income countries.

The GovTech approach also provides an opportunity to increase collaboration among World Bank global practices involved in digital and disruptive technology applications and support a whole-of-Bank approach to presenting the World Bank capabilities to member countries and development partners with a shared vision.

To turn these opportunities into sustainable outcomes, government officials and task teams involved in GovTech initiatives could consider the following aspects:

- While the whole-of-government approach is important to enhance core government systems and promote human-centered design, it requires establishing an integrated national team, including all key stakeholders, seamlessly building and improving on the GovTech results. These key entities include the ministries and agencies of telecommunications and digital economy, finance, interior, education, health, and social protection. Similarly, effective donor coordination and collaboration are needed to ensure sustainable investments and outcomes.
- GovTech teams could focus on balancing personal data protection, data sharing, and cybersecurity measures, without which all government efforts may be at substantial risk.
- Allocation of adequate resources and development of guidelines for the procurement of new and disruptive technology solutions are essential to ensure the sustainability of GovTech investments and measure government performance accordingly.
- Investments in government cloud solutions, open-source applications, web services, APIs, interoperability standards, a government service bus, and other shared platforms could reduce the cost and shorten the implementation time of digital transformation in the public sector.

- GovTech initiatives could also focus on interconnecting government offices, schools, and hospitals through a secure, safe, and sustainable broadband strategy in collaboration with private partners.
- Improving government-to-person payments through digitization has become more important as governments worldwide have sought ways to respond to the economic and social consequences of the COVID-19 pandemic. The use of digital solutions and mobile devices for transferring cash to the vulnerable population can reduce costs for governments, significantly improve recipients' access to payments, and bring digital payments one step closer to becoming the large-scale conduit for financial inclusion.
- The World Bank Group and development partners could also improve coordination and collaboration and adopt a whole-of-Bank approach to ensure that the advice and technical assistance provided to client countries are consistent with future demand.

NOTES

1. The integrity and security of GovTech applications require regular audits performed by independent certified information technology (IT) auditors. The next versions of the data set and report could include additional indicators to measure the role and capabilities of supreme audit institutions in performing IT audits of core government systems, as well as performance and compliance audits, if relevant data are available in 198 economies.
2. On the GovTech Summit, held in Paris in September 2020, see https://www.govtechsummit.eu. On GovTech Global, scheduled to be held in the United Kingdom in October 2021, see https://govtechglobal.co.uk. On Campus Party, held in Latin America and the Caribbean in January 2021, see https://www.campus-party.org.
3. See https://ida.worldbank.org/cross-cutting/disability.
4. For the Web Content Accessibility Guidelines, see https://www.w3.org/WAI/standards-guidelines/wcag/.
5. More than half of these portals are in Europe and Central Asia. The European Union policy on web accessibility is available at https://ec.europa.eu/digital-single-market/en/web-accessibility.
6. *Digital citizen engagement* is defined as the use of new media or digital information and communication technologies to create or enhance the communication channels that facilitate the interaction between citizens and governments or the private sector. See World Bank (2016a).
7. For the share of population using the internet, see https://data.worldbank.org/indicator/IT.NET.USER.ZS. For mobile cellular subscriptions, see https://data.worldbank.org/indicator/IT.CEL.SETS.P2.
8. For pricing in 188 economies, see https://www.cable.co.uk/mobiles/worldwide-data-pricing/.
9. *Human-centered services*, also referred to as *user-centered services*, are based on the use of techniques that communicate, interact, emphasize, and stimulate the people involved, obtaining an understanding of their needs, desires, and experiences. The goal of human-centered design is to find a solution that meets people's needs, with little wasted effort and reduced risk. For use of the 18F Methods in the US government, see https://methods.18f.gov.
10. For more on IDA19, see https://ida.worldbank.org/replenishments/ida19.

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4 Good Practices

Based on the findings of this study, this chapter highlights 22 good-practice cases in relation to GovTech focus areas (see table 4.1).[1] The discussion focuses not only on established systems or implemented services but also on new initiatives to proffer insights and share experiences with other countries in similar contexts.

GovTech good practices entail the following:

- Promotion of a whole-of-government approach while modernizing or integrating core government systems and online services
- Support for citizen-centric services that are universally accessible
- Promotion of digital citizen engagement or CivicTech activities and the effective use of existing service portals for citizen participation and feedback
- Focus on improving the local GovTech ecosystem supporting local entrepreneurs and start-ups to develop new products and services for the government
- Use of new or disruptive technologies for public sector modernization—for example, artificial intelligence (AI) and machine learning, cloud computing, and the Internet of Things (IoT)
- Support for public data platforms and promotion of the use of open public data by individuals and firms to create value.

This chapter presents 22 good-practice cases, together with the GovTech Maturity Index (GTMI) scores and links to relevant websites. The average GTMI and component scores are shown behind each country-specific score.

GROUP A: GOVTECH LEADERS

Argentina

The digital agenda of Argentina is focused on strengthening GovTech enablers, core government systems, and online services to support public sector modernization (figure 4.1). The Undersecretariat of Open Government and Digital Country, under the Cabinet of Ministers, is leading the GovTech

TABLE 4.1 Good practices in the GovTech domain, by group, income level, and region

INDICATOR	NUMBER OF COUNTRIES	ECONOMIES WITH GOVTECH GOOD PRACTICES
Group		
A	11	Argentina; Australia; Austria; Brazil; Colombia; India; Korea, Rep.; Singapore; South Africa; Switzerland; United Arab Emirates
B	9	Albania; Bhutan; Cabo Verde; Indonesia; Mauritius; Moldova; Rwanda; Tunisia; Vietnam
C	2	Madagascar; Togo
Income level		
High-income	8	Australia; Austria; Korea, Rep., Mauritius; Singapore; Switzerland; Tunisia; United Arab Emirates
Upper-middle-income	6	Albania; Argentina; Brazil; Colombia; Indonesia; South Africa
Lower-middle-income	4	Bhutan; India; Moldova; Vietnam
Low-income	4	Cabo Verde; Madagascar; Rwanda; Togo
Region		
Sub-Saharan Africa	6	Cabo Verde; Madagascar; Mauritius; Rwanda; South Africa; Togo
East Asia and Pacific	5	Australia; Indonesia; Korea, Rep.; Singapore; Vietnam
Europe and Central Asia	4	Albania; Austria; Moldova; Switzerland
North and South America	3	Argentina; Brazil; Colombia
Middle East and North Africa	2	Tunisia; United Arab Emirates
South Asia	2	Bhutan; India

Source: World Bank staff.

FIGURE 4.1

GovTech Maturity Index and component scores for Argentina, 2020

Source: World Bank data.
Note: CEI = Citizen Engagement Index. CGSI = Core Government Systems Index. GTEI = GovTech Enablers Index. GTMI = GovTech Maturity Index. PSDI = Public Service Delivery Index.

reforms, and the provinces have similar GovTech initiatives—for example, the Secretariat of Modernization of the Government of Entre Ríos.[2]

The government promotes the use of citizen-centric online services and citizen engagement. Several innovative solutions are available for promoting the whole-of-government approach, including the Digital Solutions for Public Administration, Wi-Fi Country Digital, and Virtual Learning Platform to improve the quality and scope of online services and digital inclusion (figure 4.2).[3]

Consulta Pública is an open-source public consultation platform for dialogue and debate that allows interaction between the government and the community, promotes citizen participation, and helps to strengthen democracy. Punto

FIGURE 4.2

GovTech good-practice cases from Argentina

a. Servicios Digitales

b. Consulta Pública

Sources: For Servicios Digitales, https://www.argentina.gob.ar/jefatura/innovacion-publica/gobierno-abierto-y-pais-digital/serviciosdigitales. For Consulta Pública, https://consultapublica.argentina.gob.ar/.

Digital, established 10 years ago, is the country's most extensive digital inclusion and technology training initiative. The miArgentina app provides access to all online services and public information.[4]

LABgobar was established in 2016 to enhance public sector innovation and strengthen the digital skills of public employees and entities.[5] This innovation lab has applied design thinking for solving problems collectively, focusing solutions on people, generating diverse alternatives, and promoting experimentation. The website presents a summary of the results achieved in public sector innovation and citizen participation projects (2017–19).

Australia

In 2018, the Australian government released its digital transformation strategy, providing a clear vision for the modernization of public services by 2025, led by the Digital Transformation Agency. As highlighted in UN (2020), the strategy includes a strong focus on making public agencies user-centric and widening the accessibility of digital services to ensure their availability for all (figure 4.3). The Australian Data and Digital Council was formed to embed the national strategy in subnational and local structures.[6]

Australia has a central digital government portal, myGov, providing access to more than 900 online services (figure 4.4). Citizens can submit a complaint or provide feedback about online services. The GovTech legal framework ensures that personal digital data are protected and gives citizens a de facto right to digital government. Gov.au Observatory identifies potential and actual problems that people experience when using government services online. A government cloud was launched in 2018 as a shared platform that helps teams to build digital services quickly. The cloud will be decommissioned by September 2021. A Cloud Marketplace was created to provide cloud services for government.[7]

FIGURE 4.3

GovTech Maturity Index and component scores for Australia, 2020

Source: World Bank data.
Note: CEI = Citizen Engagement Index. CGSI = Core Government Systems Index. GTEI = GovTech Enablers Index. GTMI = GovTech Maturity Index. PSDI = Public Service Delivery Index.

FIGURE 4.4

GovTech good-practice cases from Australia

a. Services Australia

b. Artificial Intelligence Roadmap

Sources: For Services Australia, https://www.servicesaustralia.gov.au/. For the AI Roadmap, https://data61.csiro.au/en
/Our-Research/Our-Work/AI-Roadmap.

The Australian government published an AI strategy in November 2019 to capture the benefits of AI in the public and private sectors and has plans geared toward other disruptive technologies, including blockchain and IoT. It is also working on a new digital identity to provide Australian people and businesses with a single, secure way to access government and other services online.[8]

Austria

Austria is a GovTech leader, with high scores in all four focus areas (figure 4.5). Austria's service delivery score is especially noteworthy because the country has taken impressive steps to use the potential of digitization to engage citizens and deliver services. Austria places third in Europe on four benchmark components of e-government: user-centricity, transparency, cross-border access, and basic infrastructure.

Austria also has a public sector digital skills and innovation website, GovLab Austria, which provides training on innovation methods and a platform for exchanging ideas with other innovators in administration (figure 4.6).[9] Austria's digital strategy presents a very strong vision and pillars to underpin the country's digitization journey. It provides the vision to digitize responsibly and securely, considers the legal foundations of digitization and infrastructure equity, and puts forth various initiatives to promote the whole-of-government approach.

Currently, Austria's transition to mobile government (m-Gov) is a flagship initiative. The oesterreich.gv.at platform was launched in 2019 to provide access to comprehensive online administrative information and services through various devices, including the Digitales Amt (Digital Office) mobile app. The right to interact electronically with the administration entered into force in 2020.[10]

FIGURE 4.5

GovTech Maturity Index and component scores for Austria, 2020

Source: World Bank data.
Note: CEI = Citizen Engagement Index. CGSI = Core Government Systems Index. GTEI = GovTech Enablers Index. GTMI = GovTech Maturity Index. PSDI = Public Service Delivery Index.

FIGURE 4.6

GovTech good-practice cases from Austria

a. Digital Austria

b. GOVLAB Austria

Sources: For Digital Austria, https://www.digitalaustria.gv.at/. For GOVLAB Austria, https://www.govlabaustria.gv.at/.

The Austrian Federal Computing Center (BRZ) is the technology partner of the public sector and a key contributor to the GovTech agenda.[11] The BRZ develops and implements information technology (IT) applications and e-government solutions. The BRZ's Innovation Factory explores new ways of developing ideas. The BRZ also operates one of Austria's largest data centers for the public sector.

Brazil

Brazil is a GovTech leader in core government systems and enablers (figure 4.7). The country's Digital Governance Committee is responsible for digital

advancement in government. The digital government website presents the planned trajectory of digital transformation, including the 2020–22 digital government strategy as well as data governance, security, and data protection frameworks.[12] Brazil's new AI strategy was published for consultations in December 2019.

Brazil has a federal government portal that allows citizens to use a unique login identification (ID) and password to access public services.[13] There are currently more than 80 million users of the portal, representing an increase of 40 times the number of users in January 2019. Services of the National Institute of Social Security are among the services provided in the portal.

Brazil's interoperability standards (ePING) were launched in 2014 and revised in 2019. The use of open-source software in the public sector is being promoted through the Software Público Brasileiro portal launched in April 2007, which currently provides free access to 60 solutions for different sectors. The Integrated Ombudsman and Information Access (Fala.BR) platform is another important site for managing citizen feedback and posting the government's responses (figure 4.8).[14]

The new digital government strategy focuses on citizen-centric policies and services, aiming to transform the state into a service provider that seeks to understand the needs of service users and offers value and a good user experience for citizens and civil society organizations. In addition, the first GovTech Brazil event was organized in 2018, and Brazil Lab actively supports public sector innovation.[15]

FIGURE 4.7

GovTech Maturity Index and component scores for Brazil, 2020

Source: World Bank data.
Note: CEI = Citizen Engagement Index. CGSI = Core Government Systems Index. GTEI = GovTech Enablers Index. GTMI = GovTech Maturity Index. PSDI = Public Service Delivery Index.
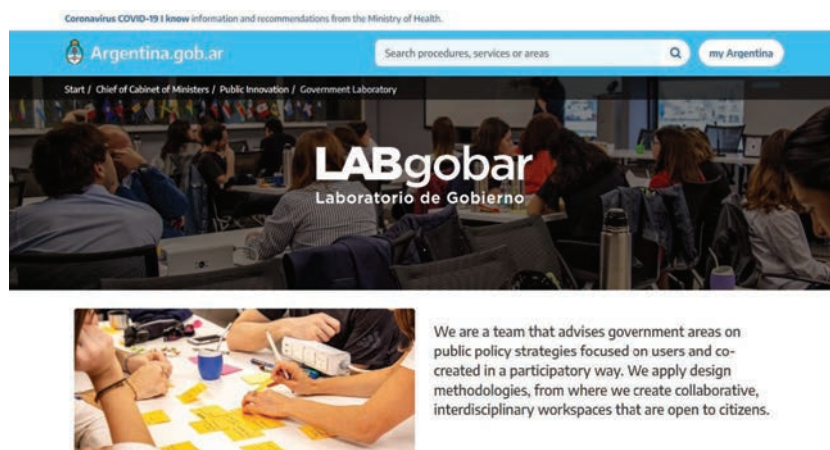
GovTech good-practice cases from Brazil

a. Digital Government

b. Integrated Ombudsman and Information Access Platform (Fala.BR)

Sources: For Digital Government, https://www.gov.br/governodigital/pt-br. For Fala.BR, https://falabr.cgu.gov.br/publico /Manifestacao/SelecionarTipoManifestacao.aspx.

Colombia

Colombia is in Group A on the GovTech Maturity Index and ranks third on the Organisation for Economic Co-operation and Development (OECD) 2019 Digital Government Index, which rates the digital transformation policies of 33 countries (figure 4.9). Digital government is a national priority, and the Ministry of Information Technology and Communications is leading the GovTech initiatives to improve internet connectivity and access to online services, particularly for the more vulnerable groups in society.[16]

A new digital government portal presents the links to a large number of websites providing access to GOV.CO (single portal), digital single windows, Data Sandbox Digital Space, free open-source software, the Center for Digital Public Innovation, and more (figure 4.10).[17]

Urna de Cristal was launched in 2010 as a multifunctional citizen participation portal.[18] Currently, the government is improving connectivity through more than 800 new digital zones—free internet connection points. Digital zones will continue providing 24/7 free internet services in around 10,000 rural and remote communities at least until 2030 as a result of a US$2 billion investment.

The GOV.CO/Territorial portal provides access to all available territorial websites created since 2010 with the goals of encouraging citizen participation, promoting citizen oversight, and improving countrywide access from any mobile device, tablet, or web.[19]

A Digital Government Index was created to measure progress through interactive, territorial, national, and international indexes; the results are

FIGURE 4.9

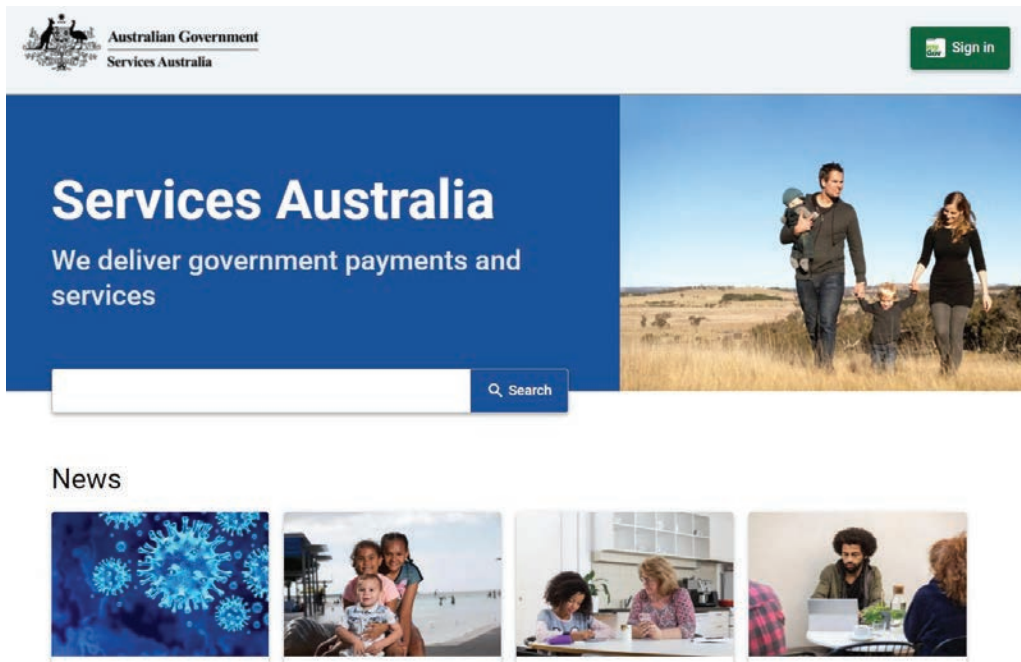**GovTech Maturity Index and component scores for Colombia, 2020**

Source: World Bank data.
Note: CEI = Citizen Engagement Index. CGSI = Core Government Systems Index. GTEI = GovTech Enablers Index. GTMI = GovTech Maturity Index. PSDI = Public Service Delivery Index.

FIGURE 4.10

GovTech good-practice cases from Colombia

a. Gobierno Digital

b. Urna de Cristal

Sources: For Gobierno Digital, https://gobiernodigital.mintic.gov.co/portal/. For Urna de Cristal, https://www.urnadecristal.gov.co/.

posted annually on the web.[20] Additionally, success stories and regular updates on all digital government initiatives are published on the digital government website.

India

The Digital India Program, launched in 2015, is the country's key GovTech initiative, with a vision to improve digital infrastructure, access to online services, and digital literacy (figure 4.11). All major GovTech initiatives are presented on the Digital India website. The Aadhar unique identity system is one of the key pillars of Digital India.[21] As of December 2020, about 1.276 billion unique ID numbers had been issued, and 49.7 billion authentications had been completed using Aadhar.

India's National Government Services portal lists more than 9,960 services for 15 key public service sectors (figure 4.12). MyGov is a participatory governance platform designed as an interface with citizens, enabling the exchange of ideas and views. The Unified Mobile Application for New-Age Governance (UMANG) is an all-in-one secure multichannel, multiplatform, multilingual, multiservice freeware mobile app for accessing more than 2,000 central and state government services. DigiLocker—a digital wallet—is a secure cloud-based platform for issuing, sharing, and verifying critical lifelong documents and certificates.[22]

A national strategy for AI has been published, and the Centre of Excellence for IoT was established to jump-start the IoT ecosystem. The Accessible India campaign (and mobile app) is a nationwide flagship campaign for achieving universal accessibility that enables people with disabilities to gain access to services

FIGURE 4.11

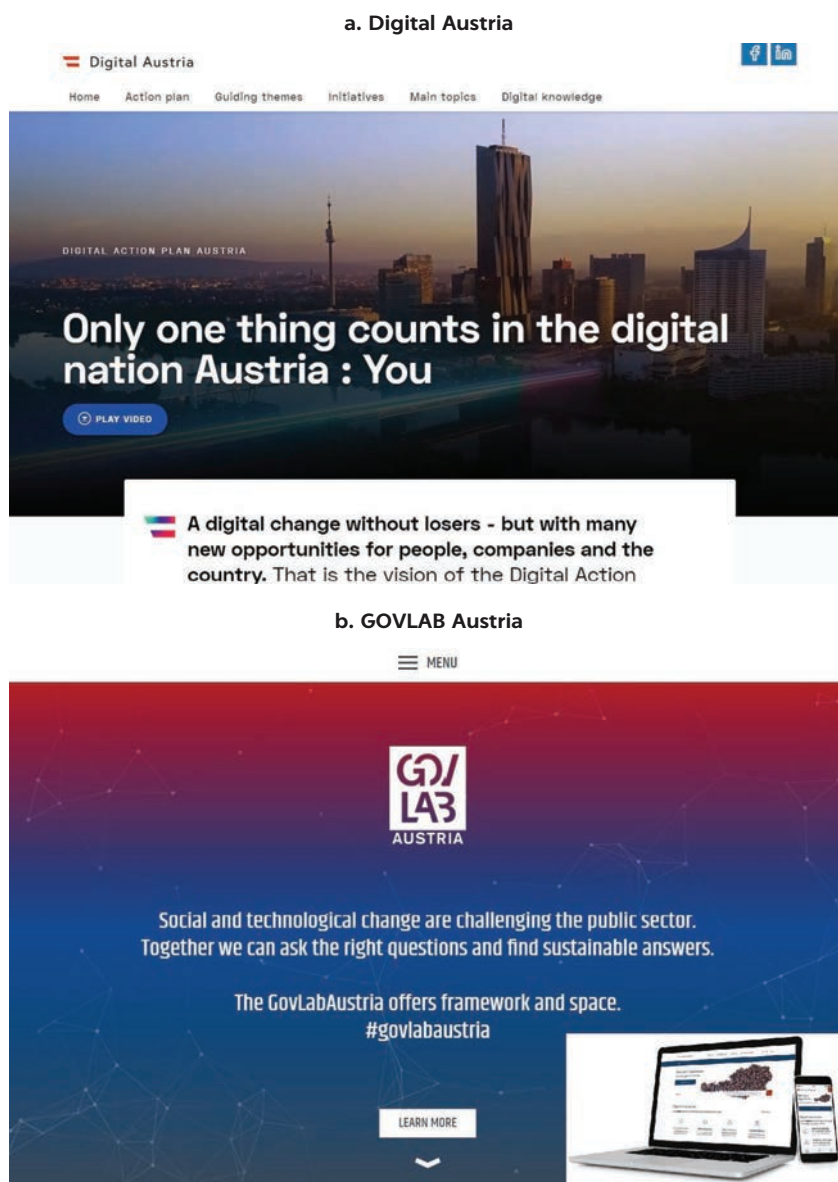**GovTech Maturity Index and component scores for India, 2020**

Source: World Bank data.
Note: CEI = Citizen Engagement Index. CGSI = Core Government Systems Index. GTEI = GovTech Enablers Index. GTMI = GovTech Maturity Index. PSDI = Public Service Delivery Index.

FIGURE 4.12

GovTech good-practice cases from India

a. National Government Services portal

b. National e-Government Division

Sources: For the National Government Services portal, https://services.india.gov.in/. For the National e-Government Division website, https://negd.gov.in/.

and participate fully in all aspects of life. India is one of the founding members of the Global Partnership on Artificial Intelligence, established in June 2020 (currently 19 countries) for sharing multidisciplinary research and identifying key issues to promote the adoption of trustworthy AI.[23]

Republic of Korea

The Republic of Korea is among the top five countries in all four GovTech focus areas and the global leader in citizen engagement (figure 4.13). The Ministry of the Interior and Safety website is the entry point for Korea's vision and strategy for digital transformation.[24] A rich set of plans is available for download: the e-government 2020 Action Plan, Intelligent Government Basic Plan, and Digital Government Innovation Promotion Plan. These plans have institutionalized the pursuit of a whole-of-government approach, specifying the strategy for transitioning to intelligent information technologies such as AI, big data analytics, cloud, open platforms, IoT, and online-to-offline services.[25] The government also has plans for machine learning and blockchain, with pilot projects under way, together with a national 5-G strategy.

The Korean government is committed to citizen participation, consistent with its membership in the Open Government Initiative since 2011. The national participatory budget website offers opportunities for citizen engagement (figure 4.14). Policies and guidelines on government enterprise architecture, data classification, and standardization have been established and enforced over the years.[26] An open-data portal provides up-to-date downloadable data in various formats, including CSV, XML, and JSON.

FIGURE 4.13

GovTech Maturity Index and component scores for the Republic of Korea, 2020

Source: World Bank data.
Note: CEI = Citizen Engagement Index. CGSI = Core Government Systems Index. GTEI = GovTech Enablers Index. GTMI = GovTech Maturity Index. PSDI = Public Service Delivery Index.

FIGURE 4.14

GovTech good-practice cases from the Republic of Korea

a. Ministry of the Interior and Safety

b. eGovFrame portal

Sources: For the Ministry of the Interior and Safety, https://www.mois.go.kr/eng/a01/engMain.do. For the eGovFrame portal, https://www.egovframe.go.kr/eng/sub.do?menuNo=31.

Singapore

In Singapore the Government Technology Agency (GovTech Singapore) is responsible for implementing national digital government strategies and services using a whole-of-government approach (figure 4.15). In 2014 Singapore launched the Smart Nation initiative, with digital government as an integral part.[27] In 2018 the Digital Government Blueprint was developed to leverage data better, harness new technologies, and drive broader efforts to build a digital economy and digital society.

Singapore has a one-stop-shop government portal (Gov.sg) that provides access to specialized portals for e-services, open data, e-participation, and public procurement (figure 4.16).[28] Digital platforms allow citizens to plan and monitor their social security savings or report issues with government services. Singapore is using predictive systems and services in the health sector, tax administration, business registry, smart city applications, and more.

Singapore is a global leader in the GovTech ecosystem and broadband access. The Personal Data Protection Act and cybersecurity legislation were approved in 2012, and the Government Data Office was established in 2018. Despite these opportunities, many elderly Singaporeans cannot use the internet and are digitally marginalized.

The Smart Nation website presents the details of strategic national projects, including Core Operations Development Environment and eXchange (CODEX), national digital identity, the Smart Nation sensor platform, e-payments, and mobile apps. Another new platform is Open Certs, a blockchain-based application offering an easy and reliable way to issue and validate tamper-resistant academic certificates.[29]

FIGURE 4.15

GovTech Maturity Index and component scores for Singapore, 2020
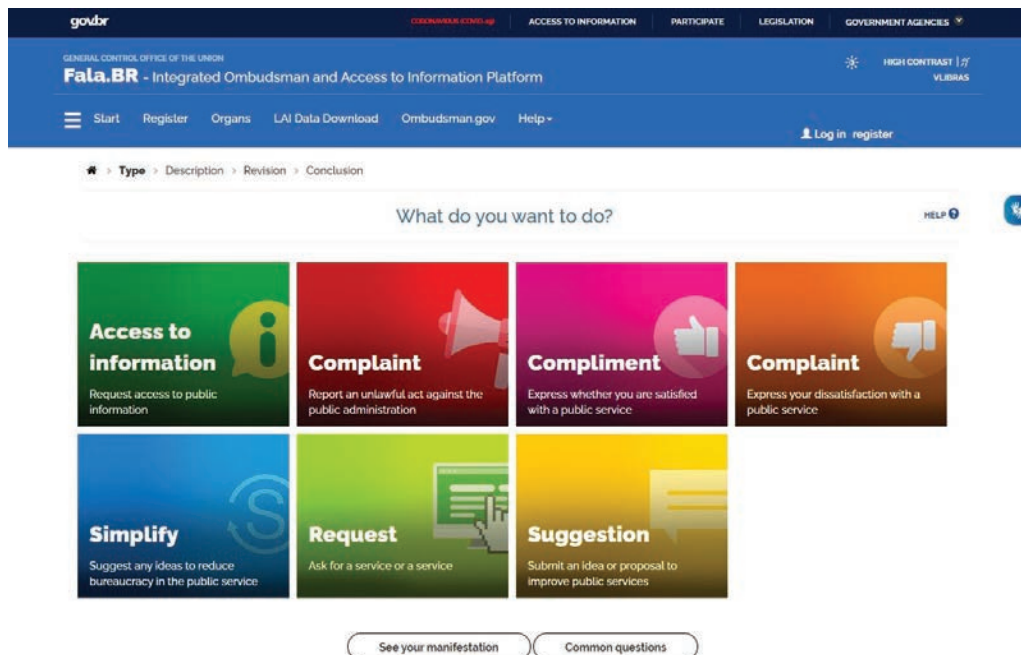

Source: World Bank data.
Note: CEI = Citizen Engagement Index. CGSI = Core Government Systems Index. GTEI = GovTech Enablers Index. GTMI = GovTech Maturity Index. PSDI = Public Service Delivery Index.

GovTech good-practice cases from Singapore

a. TechNews

b. Smart Nation

Sources: For TechNews, https://www.tech.gov.sg/. For Smart Nation, https://www.smartnation.gov.sg/.

South Africa

South Africa is a leader in digital transformation in the Sub-Saharan Africa region, particularly in core government systems, citizen engagement, and enablers (figure 4.17). The State Information Technology Agency (SITA) website presents the country's 2020–25 digital transformation strategy, which emphasizes four key elements: engaging citizens, empowering employees, transforming services, and creating shared platforms, in addition to optimizing operations (figure 4.18). SITA's GovTech site provides a platform for sharing knowledge concerning lessons, solutions, and ideas.[30]

A new e-government portal was launched in 2020 to improve access to online services for citizens, businesses, and government entities. Also, in 2001, the Centre for Public Service Innovation was established to develop digital skills and promote innovation for improved service delivery in collaboration with civil society organizations and the private sector.[31] The Centre for Public Service Innovation's Multi-Media Innovation Centre is open to all public sector entities, and public employees are invited to use it to explore innovative practices or for training.

The Department of Public Service and Administration launched the Batho Pele (People First) Program in 1997 to transform public service delivery based on eight principles: consultation, service standards, redress, access, courtesy, information, transparency, and value for money.[32] This approach has been adjusted over the years, with the addition of the Know Your Service Rights campaign and other initiatives to promote Batho Pele within the public service. The annual national Batho Pele excellence awards recognize public servants who are selfless, dedicated, committed, and go the extra mile in serving citizens.

FIGURE 4.17

GovTech Maturity Index and component scores for South Africa, 2020

Source: World Bank data.
Note: CEI = Citizen Engagement Index. CGSI = Core Government Systems Index. GTEI = GovTech Enablers Index. GTMI = GovTech Maturity Index. PSDI = Public Service Delivery Index.

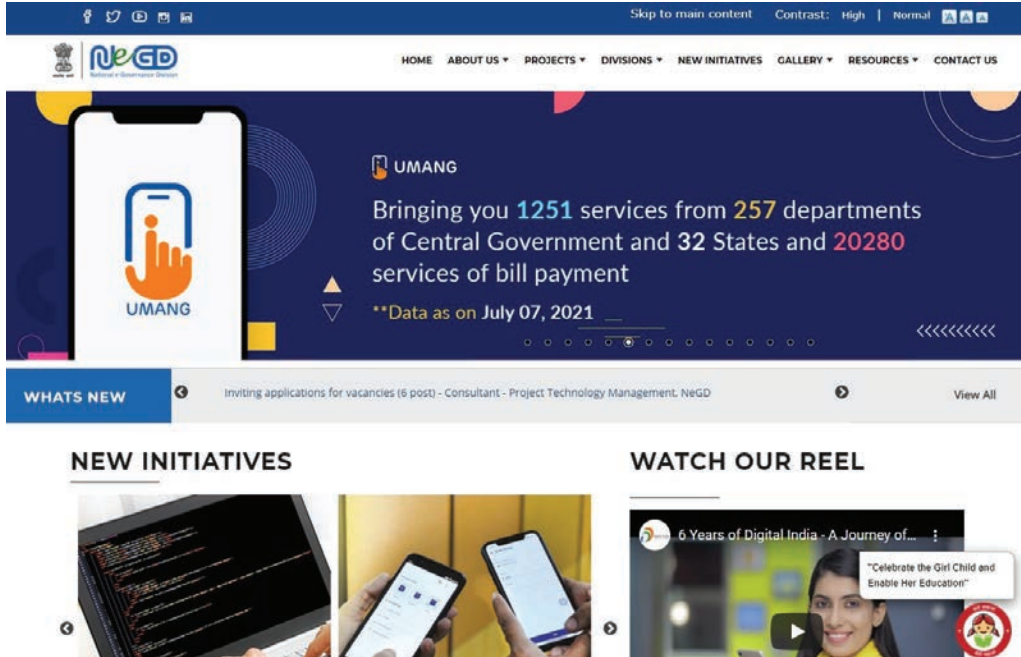**GovTech good-practice cases from South Africa**

a. State Information Technology Agency (SITA)

b. SITA e-services

Sources: For SITA, http://www.sita.co.za/. For SITA e-services, https://www.eservices.gov.za/tonkana/citizen/eservices.jsf.

Switzerland

The Swiss government runs one of the most advanced economies in public sector digital transformation (figure 4.19). The Federal Council and the Federal Office for Communications coordinate the operationalization of the Swiss digital agenda (figure 4.20).[33] Increased use of virtual interfaces for public service delivery is one of its primary focus areas. The eID Act was put in place in 2019 to ensure secure identification in the use of public online services. Switzerland is pursuing a whole-of-government approach through its digital strategy, which is an umbrella strategy complemented by sectoral strategies.

The e-government website provides rich information on projects as well as the downloadable digital strategy together with related publications.[34] The ability to translate the website into German, Italian, French, or English makes it user-friendly across these languages. The digital strategy also emphasizes equal opportunity through a universal service that embodies special services for the disabled, including voice access to directory services and sign-language relay services for persons with hearing challenges.

The Swiss Digital Initiative was launched in 2015 to strengthen trust in digital technologies and the actors involved in ongoing digital transformation. The initiative launched the first Swiss Global Digital Summit in September 2019 to promote constructive discussions on the topic of ethics and fairness in the age of digital transformation. Swiss Digital Days 2020—the first fully hybrid national event—was organized in November 2020, with the participation of 80,000 visitors from more than 100 partners.[35] The Swiss Digital Initiative is promoting GovTech activities together with relevant state and nonstate actors.

FIGURE 4.19

GovTech Maturity Index and component scores for Switzerland, 2020

Source: World Bank data.
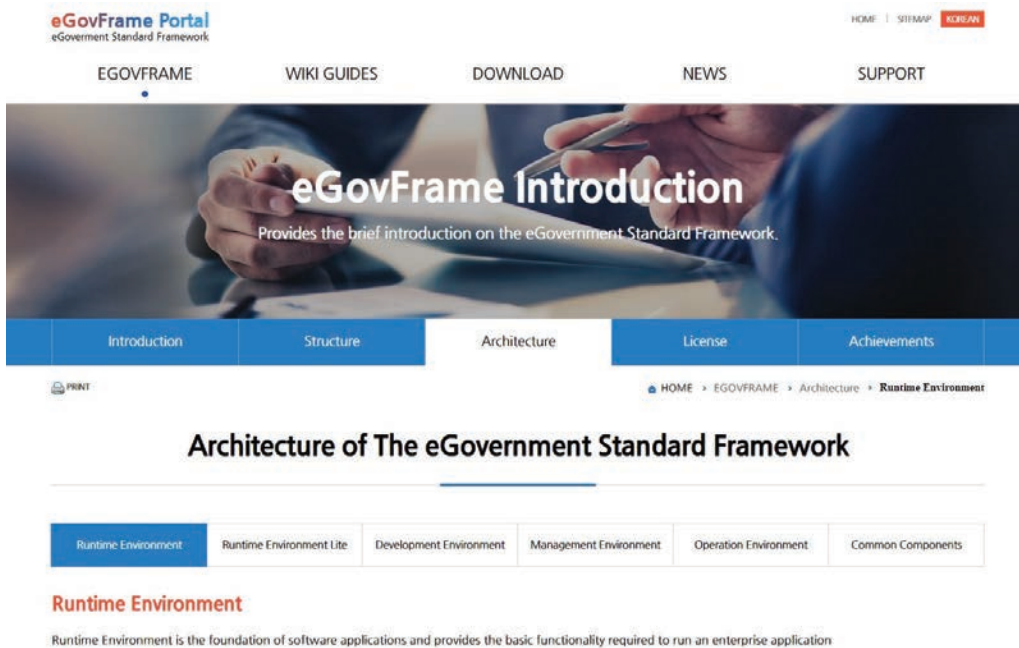*Note:* CEI = Citizen Engagement Index. CGSI = Core Government Systems Index. GTEI = GovTech Enablers Index. GTMI = GovTech Maturity Index. PSDI = Public Service Delivery Index.

GovTech good-practice cases from Switzerland

a. Swiss Authorities Online

b. e-government

Sources: For Swiss Authorities Online, https://www.ch.ch/en/. For the e-government website, https://www.egovernment.ch/en/.

United Arab Emirates

The United Arab Emirates is one of the most mature countries in citizen-centric online public services in the Middle East and North Africa region (figure 4.21). The Digital Emirates website provides information about digital government strategies, including the Strategy for the Fourth Industrial Revolution, Strategy for Artificial Intelligence, National Innovation Strategy, and Emirates Blockchain Strategy 2021.[36]

The government uses a digital government maturity model as a unified reference to assess its own digital maturity. The United Arab Emirates also publishes its citizen engagement performance and has a dedicated website, mSurvey, that allows the public to articulate their opinions easily and to provide feedback transparently on policies and various development issues.[37]

In 2021 the Dubai government is expected to go completely paperless, eliminating more than 1 billion pieces of paper used for government transactions every year. The digital national ID for all citizens, residents, and visitors allows users to access the services of local and federal government agencies and other service providers (figure 4.22).[38] Ongoing GovTech initiatives also include establishing the Emirates Council for Digital Well-being and transitioning to 5-G standards.

The Strategy for Digital Transactions 2021 aims to adopt advanced technologies and employ them to convert 50 percent of government transactions at the federal level to a blockchain platform by 2021.[39] The Dubai Blockchain Strategy is also expected to contribute to transforming Dubai into the first city to be fully managed by the blockchain platform.

FIGURE 4.21

GovTech Maturity Index and component scores for the United Arab Emirates, 2020

Source: World Bank data.
Note: CEI = Citizen Engagement Index. CGSI = Core Government Systems Index. GTEI = GovTech Enablers Index. GTMI = GovTech Maturity Index. PSDI = Public Service Delivery Index.

FIGURE 4.22

GovTech good-practice cases from the United Arab Emirates

a. Smart Dubai

b. UAE Pass

Sources: For Smart Dubai, https://www.smartdubai.ae/. For UAE Pass, https://selfcare.uaepass.ae/. UAE Pass is the digital national identification.

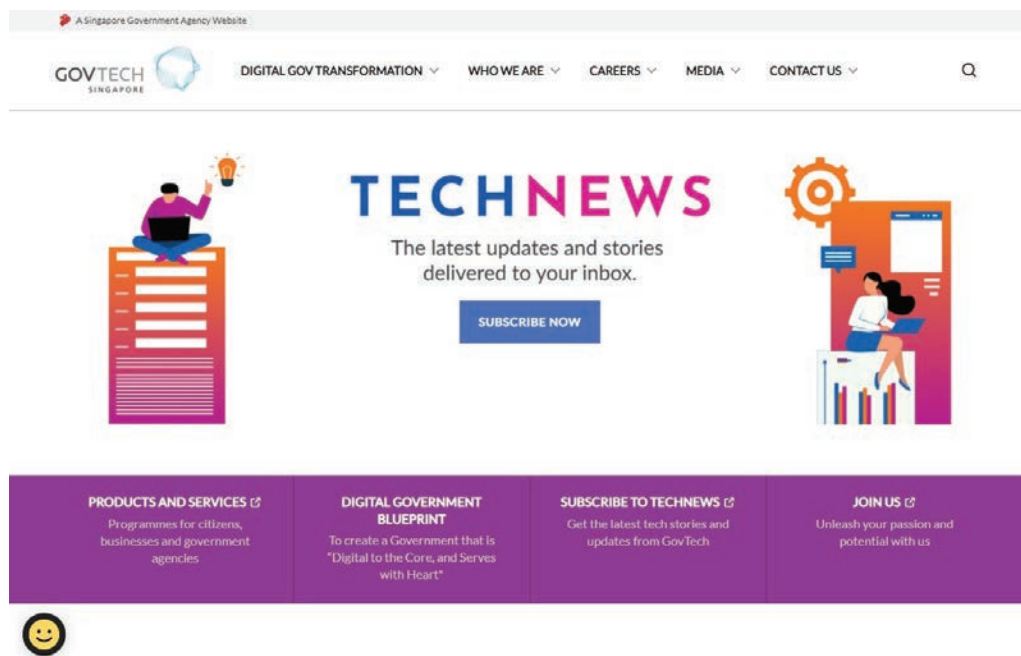**GovTech Maturity Index and component scores for Albania, 2020**
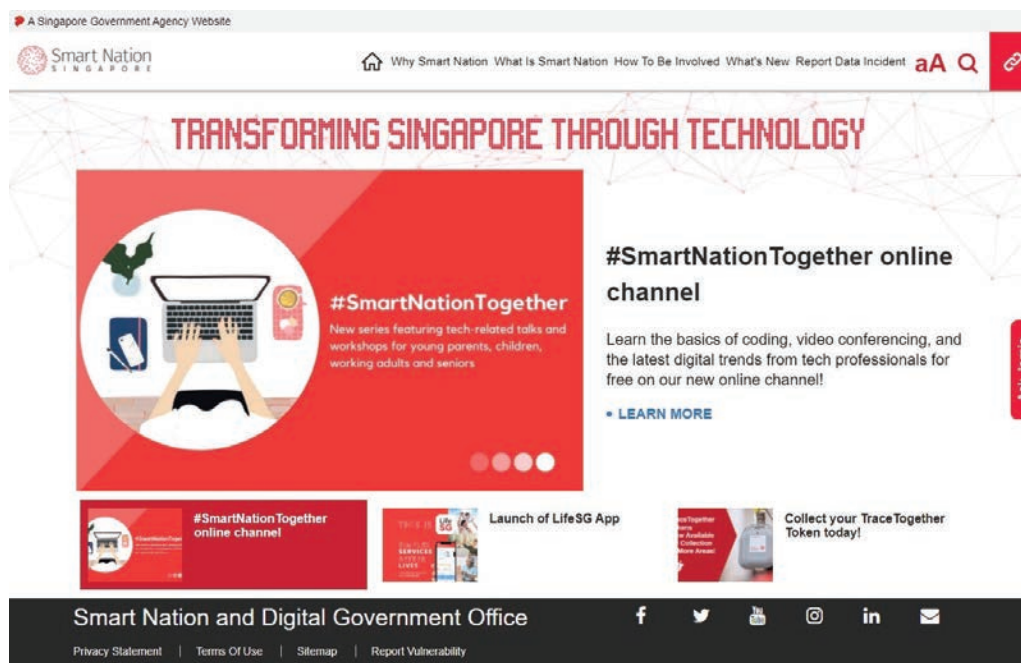

Source: World Bank data.
Note: CEI = Citizen Engagement Index. CGSI = Core Government Systems Index. GTEI = GovTech Enablers Index. GTMI = GovTech Maturity Index. PSDI = Public Service Delivery Index.

GROUP B: SIGNIFICANT FOCUS ON GOVTECH

Albania

The National Agency for Information Society is leading the GovTech initiatives in Albania (figure 4.23). A new digital government strategy is expected to be launched in 2021 with a focus on universally accessible services, citizen engagement, and whole-of-government. The e-Albania portal is an integrated, online service delivery platform providing access to more than 750 mostly transactional (level 3 or 4) services for 1.6 million registered users (figure 4.24). The Agency for Integrated Service Delivery has established 9 citizen service centers and 10 service counters to expand access to services. In addition, the Albania We Want platform was launched to provide an open-interaction platform with citizens and businesses.[40] Citizens can provide feedback on public services, submit a complaint, share their ideas, and request information about government decisions and activities.

Bhutan

Bhutan falls in Group B on the GTMI and in 2020 moved up 23 positions in the United Nations (UN) e-Government Development Index (EGDI) ranking due to significant improvements in several GovTech foundations, including the expansion of internet access to most government offices, schools, and hospitals, expansion of online services, and expansion of digital skills development in the public sector (figure 4.25).[41]

The Department of Information Technology and Telecom is promoting the whole-of-government approach and managing shared platforms, including the e-GIF portal (figure 4.26). A government service bus based on an open-source WSO2 platform connects core government systems. The Ministry of

GovTech good-practice case from Albania

Source: For e-Albania, https://e-albania.al/.

GovTech Maturity Index and component scores for Bhutan, 2020

Source: World Bank data.
Note: CEI = Citizen Engagement Index. CGSI = Core Government Systems Index. GTEI = GovTech Enablers Index. GTMI = GovTech Maturity Index. PSDI = Public Service Delivery Index.

GovTech good-practice case from Bhutan

Source: For the Citizen Services portal, https://www.citizenservices.gov.bt/.

Finance initiated the integrated financial management information system and other system modernization projects to improve budget performance.[42]

Cabo Verde

Cabo Verde has gradually improved its core government systems, infrastructure, and digital skills with a focus on a whole-of-government approach (figure 4.27). The Information Society Operational Unit (NOSI) has created a state-owned government network to connect all public entities and provide access to a range of shared platforms and services, including email and government and municipal management applications (figure 4.28).[43]

Several public platforms have adopted common information and data exchange standards. The NOSI has also developed an integrated government resources planning system using the platform as a service model and Mkonekta (Serviçus Públicus na Bu Mô) mobile app for providing secure access to public services, including electronic payments.

Indonesia

Indonesia is in Group B on the GTMI and has moved up 19 positions in the UN 2020 EGDI ranking due to improvements in online services, e-participation, and GovTech enablers (figure 4.29). Strong institutional and legal foundations have been established through the 2018 Presidential Regulation on e-Government and the 2019 Regulation on Integrated Government Data Management.

GovTech Maturity Index and component scores for Cabo Verde, 2020
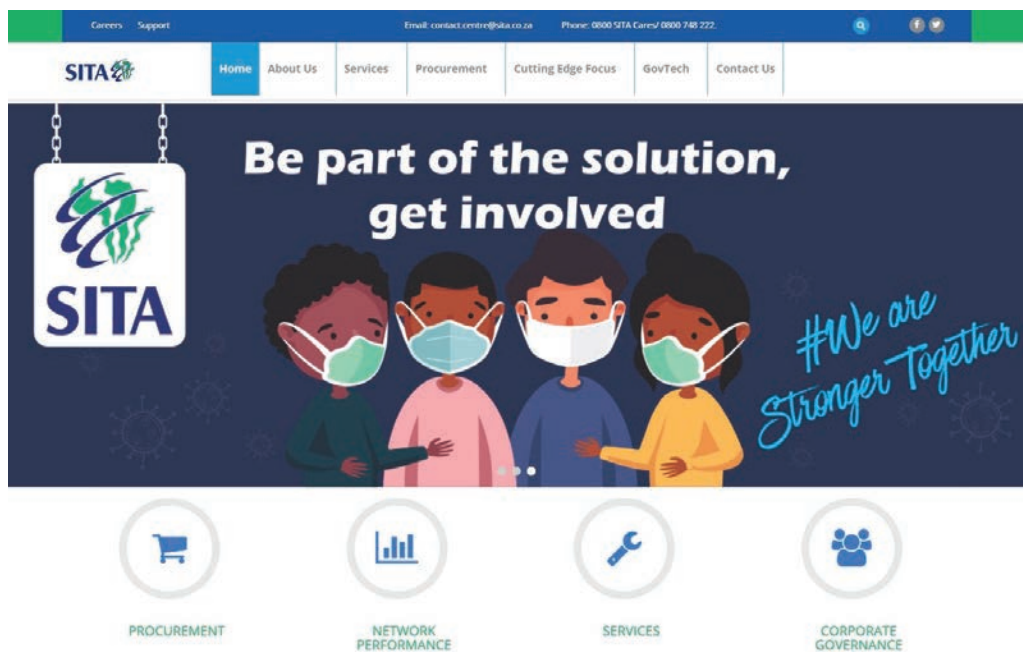

Source: World Bank data.
Note: CEI = Citizen Engagement Index. CGSI = Core Government Systems Index. GTEI = GovTech Enablers Index. GTMI = GovTech Maturity Index. PSDI = Public Service Delivery Index.
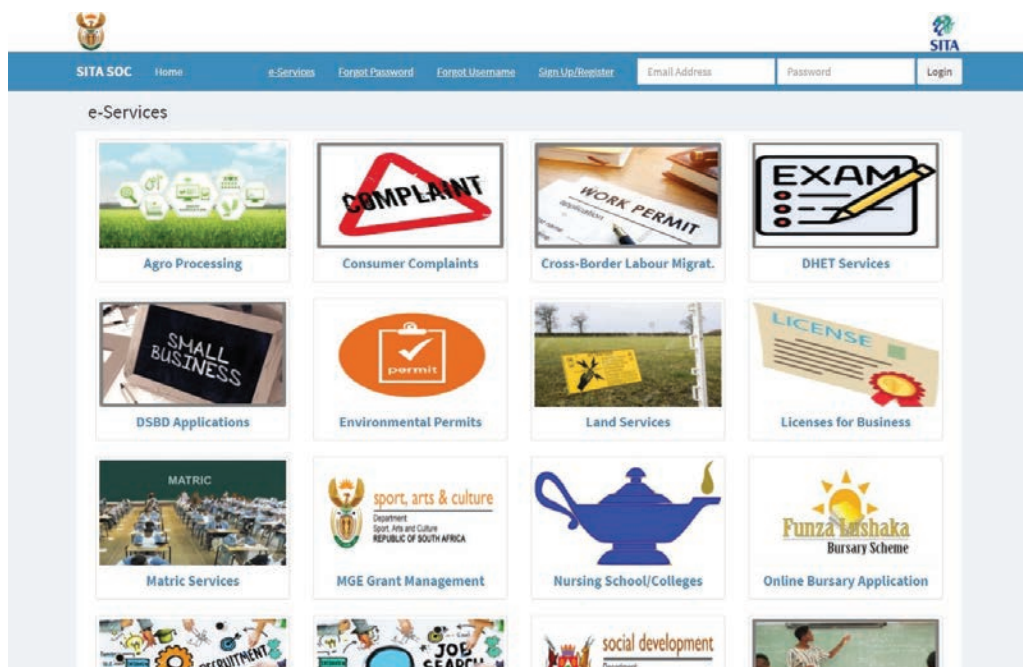
GovTech good-practice case from Cabo Verde

a. The Information Society Operational Unit (NOSI)

Source: For the Information Society Operational Unit (NOSI) website, https://www.nosi.cv/.

GovTech Maturity Index and component scores for Indonesia, 2020

Source: World Bank data.
Note: CEI = Citizen Engagement Index. CGSI = Core Government Systems Index. GTEI = GovTech Enablers Index. GTMI = GovTech Maturity Index. PSDI = Public Service Delivery Index.

GovTech good-practice case from Indonesia

Source: For the Ministry of Communication and Informatics website, https://layanan.kominfo.go.id/.

The policy formulation authority for data governance falls under the Ministry of Administrative and Bureaucratic Reform. The Ministry of Planning is responsible for planning and data governance. Access to online services is provided through the Ministry of Communications and Informatics and several other agency-specific portals (figure 4.30).[44]

Ongoing activities are focused on devising a new digital government strategy, creating a single public service portal, expanding connectivity, and developing digital skills.

Mauritius

Mauritius is a leading country in the Sub-Saharan Africa region, particularly in the area of public service delivery (figure 4.31). The Central Informatics Bureau website presents the country's digital government transformation strategy for 2018–22, which focuses on accelerating public sector digitization to enhance operational effectiveness and provide better service to citizens (figure 4.32). The Central Information Systems Division is responsible for supporting all government systems and maintaining shared platforms.[45]

Mauritius takes a partnership-oriented approach that allows flexibility in the adoption of digital technologies tailored to the needs of public institutions. State Informatics and the State Informatics Training Centre also support government cloud services and digital skills, respectively.[46]

Moldova

Moldova has mature online services and citizen engagement platforms (figure 4.33). The government is focused on enhancing existing systems and digital skills as well as implementing new models of service delivery. The MCloud was established as a private government cloud in 2014 to improve the
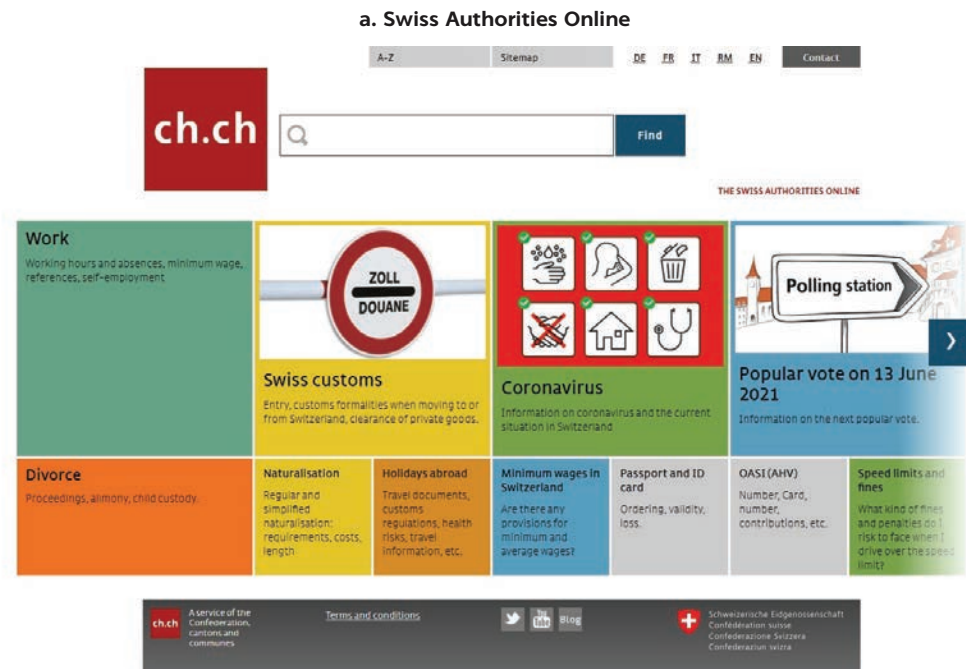
FIGURE 4.31

GovTech Maturity Index and component scores for Mauritius, 2020

Source: World Bank data.
Note: CEI = Citizen Engagement Index. CGSI = Core Government Systems Index. GTEI = GovTech Enablers Index. GTMI = GovTech Maturity Index. PSDI = Public Service Delivery Index.

GovTech good-practice case from Mauritius

Source: For the Digital Government Transformation Strategy, https://cib.govmu.org/.

GovTech Maturity Index and component scores for Moldova, 2020

Source: World Bank data.
Note: CEI = Citizen Engagement Index. CGSI = Core Government Systems Index. GTEI = GovTech Enablers Index. GTMI = GovTech Maturity Index. PSDI = Public Service Delivery Index.

interoperability of systems and reduce operating costs by consolidating more than 120 data centers and server rooms as part of the whole-of-government approach (figure 4.34).[47]

Currently, around 70 percent of public services are hosted on the cloud. Building on the open-source WSO2 platform, 53 public entities are connected to MConnect, which was used to manage more than 15 million data exchange transactions in 2020. Total savings to date are estimated at US$30 million since the deployment of MCloud.

Rwanda

Rwanda's Vision 2050 and Smart Rwanda Master Plan emphasize creating a knowledgeable society through the implementation of smart information and communication technology (ICT) strategies (figure 4.35). The Rwandan Information Society Authority is leading the digital transformation and adoption of frontier technologies in the public sector (figure 4.36). The Digital Transformation Department is focused on improving ICT infrastructure and digital skills.[48]

Despite limited resources, the country has made great strides in offering public services online, and most public officials use ICT and the internet extensively in their everyday work. The Irembo portal provides access to 89 online services via mobile devices or computers. The e-government platform supports two-way communication, not only for updating e-services but also for allowing individuals to request information and voice their concerns directly.[49]

FIGURE 4.34

GovTech good-practice case from Moldova

Source: For the Electronic Government Agency website, https://www.egov.md/.

GovTech Maturity Index and component scores for Rwanda, 2020

Source: World Bank data.
Note: CEI = Citizen Engagement Index. CGSI = Core Government Systems Index. GTEI = GovTech Enablers Index. GTMI = GovTech Maturity Index. PSDI = Public Service Delivery Index.
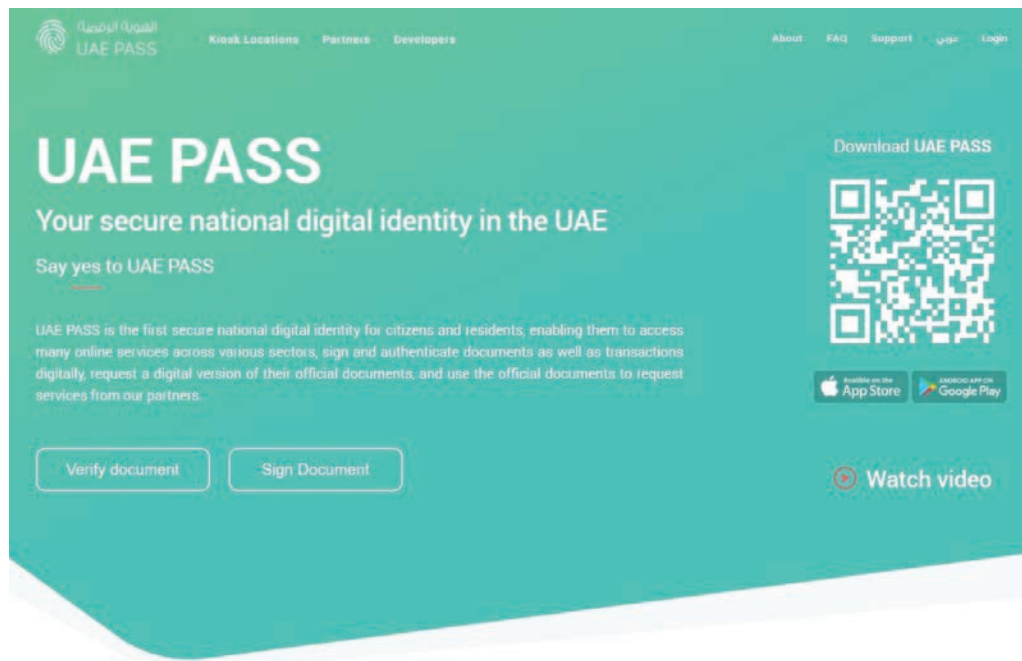
GovTech good-practice case from Rwanda

Source: Rwandan Information Society Authority website, https://www.risa.rw/.

Tunisia

In Tunisia the Ministry of Communication Technologies is leading GovTech initiatives with a focus on improving online services and enablers (figure 4.37). The national strategic plan, Digital Tunisia 2020, focuses on several areas, including transitioning to a transparent and agile e-administration at the service of the citizen and reducing the digital divide (figure 4.38).[50]

GovTech Maturity Index and component scores for Tunisia, 2020

Source: World Bank data.
Note: CEI = Citizen Engagement Index. CGSI = Core Government Systems Index. GTEI = GovTech Enablers Index. GTMI = GovTech Maturity Index. PSDI = Public Service Delivery Index.

GovTech good-practice case from Tunisia

Source: For the Tunisian Government portal, http://fr.tunisie.gov.tn/.

Additionally, the Smart Tunisia Program was launched (based on a public-private partnership) to create 50,000 jobs in the digital sector. The Tunisian government portal provides access to more than 460 mainly informational online services.[51] The Ministry of Communication Technology website includes a multifunctional citizen participation section offering a variety of options, such as online submission of complaints, ideation forum, and access to open data and government documents.

Vietnam

Vietnam's Office of the Government is leading the country's GovTech initiatives. Substantial progress has been made in several GovTech focus areas since 2016 (figure 4.39). The national public service portal was launched in 2019 and currently provides 2,700 online services for citizens and businesses to more than 417,000 registered users (figure 4.40).[52] The Office of the Government reports the savings due to online services of 84 ministries and agencies in 63 localities and the details of other system modernization projects. Also, the e-Cabinet system has been in use since June 2019.

The Ministry of Information and Communication has launched a one-stop center for e-government services to facilitate citizen feedback (complaints, petitions, or support); the government's responses are posted online for all questions and feedback.[53]

FIGURE 4.39
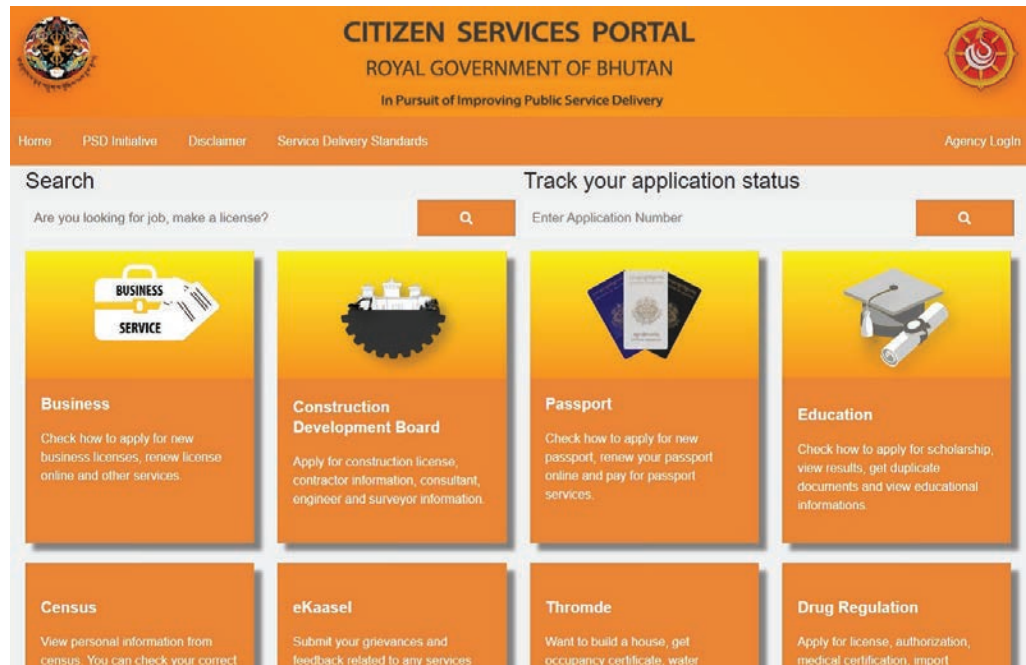
GovTech Maturity Index and component scores for Vietnam, 2020

Source: World Bank data.
Note: CEI = Citizen Engagement Index. CGSI = Core Government Systems Index. GTEI = GovTech Enablers Index. GTMI = GovTech Maturity Index. PSDI = Public Service Delivery Index.

FIGURE 4.40

GovTech good-practice case from Vietnam

Source: For the National Public Service portal, https://dichvucong.gov.vn/.

GROUP C: SOME FOCUS ON GOVTECH

Madagascar

Madagascar falls in Group C on the GTMI, and significant opportunities exist to improve all four aspects of GovTech (figure 4.41). There is high-level government commitment to public sector digital transformation. The Digital Governance Unit was created in 2019 to implement the national digital governance strategy, based on an agile and user-centric design approach (figure 4.42). The Digital Governance and Identification Management System Project (Prodigy) was launched in September 2020 to strengthen civil registration and identity management systems, streamline and digitize key public services, and improve the government's capacity to deliver online services.[54] Considering the high cost of mobile internet connectivity, the project is focused on improving multimodal service delivery to target people with limited literacy and the most basic phones.

Togo

In Togo the Ministry of Digital Economy and Digital Transformation is championing numerous GovTech initiatives (figures 4.43 and 4.44). The national digital planning strategy for 2018–22 set out an ambitious digital development plan with a focus on regulatory, institutional, and organizational measures, including the Law on Cybersecurity. Togo's Computer Emergency Response Team (CERT.tg) was launched in February 2021.[55]

GovTech Maturity Index and component scores for Madagascar, 2020

Source: World Bank data.
Note: CEI = Citizen Engagement Index. CGSI = Core Government Systems Index. GTEI = GovTech Enablers Index. GTMI = GovTech Maturity Index. PSDI = Public Service Delivery Index.

GovTech good-practice case from Madagascar

Source: For the Digital Governance Unit blog, https://digital.gov.mg/.

FIGURE 4.43

GovTech Maturity Index and component scores for Togo, 2020

Source: World Bank data.
Note: CEI = Citizen Engagement Index. CGSI = Core Government Systems Index. GTEI = GovTech Enablers Index. GTMI = GovTech Maturity Index. PSDI = Public Service Delivery Index.
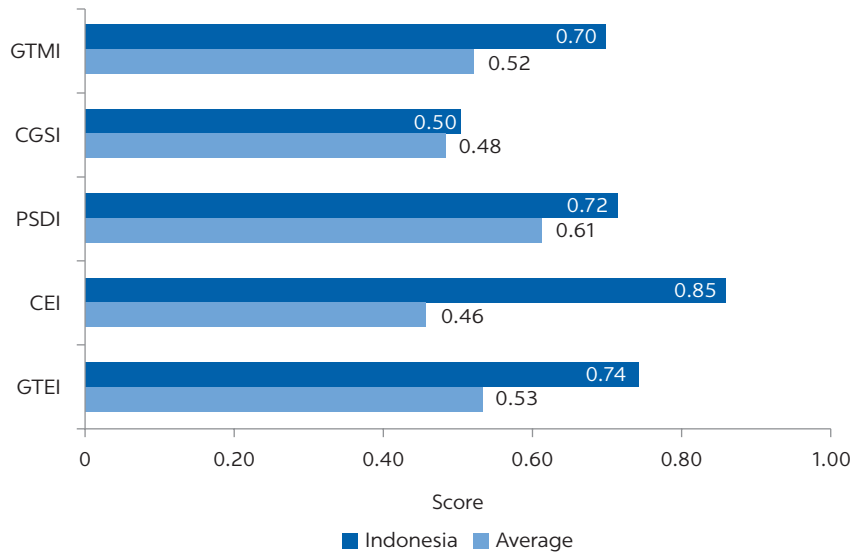
FIGURE 4.44

GovTech good-practice case from Togo

Source: For the Ministry of Digital Economy and Digital Transformation website, https://numerique.gouv.tg/.

The government is implementing GovTech solutions to modernize the public sector and improve service delivery in different sectors, including education and agriculture. The government portal includes links to the presidency and the ministry websites. A public service portal provides access to information and forms.[56] Ongoing activities also include establishing a fiber-optic network connecting all 565 public buildings in Lomé and creating a network operations center.

EMERGING GOOD PRACTICES: SOMALIA

It is also important to highlight the good practices that are emerging in some difficult settings like Somalia. According to the latest World Bank update, there are 39 fragile and conflict-affected situations around the world—18 in Group C and 21 in Group D.[57]

In Somalia the financial management information systems of the federal government and five member states are all cloud-based solutions; since 2015, two web-based applications have been used to support daily operations in six locations. Monthly budget results of the federal government are posted in open-data format on the cloud, and member states regularly post their monthly budget reports on their respective ministry of finance websites. In 2019 four member states cost-effectively launched and operationalized their cloud-based human resource management information and payroll systems.

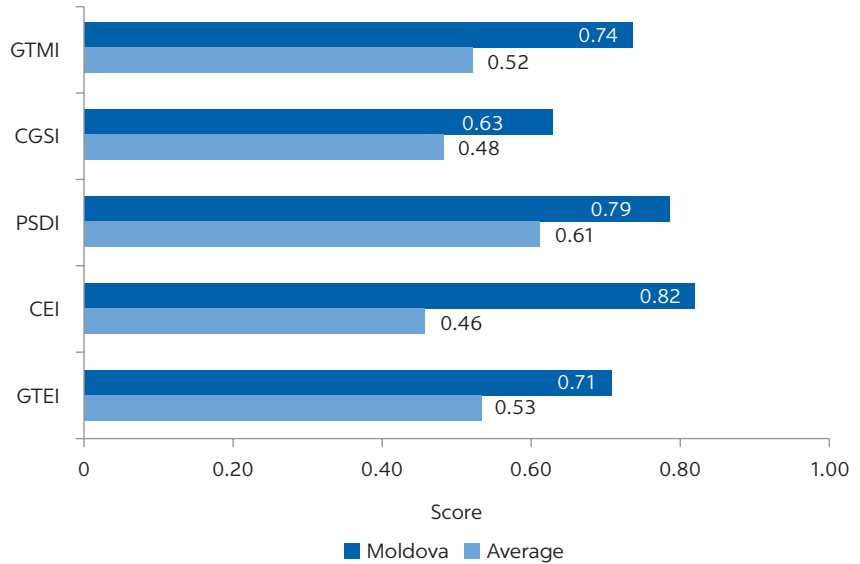The federal government and other member states are currently developing similar cloud-based systems to improve their core government systems. These systems operate as disconnected platforms, and data exchange is not yet automated. Additionally, the federal government and member states have several ongoing projects to support other key actions of the digital agenda, including the development of a digital ID system for improving civil registration and online services. All of these platforms were developed with substantial support from development partners, and the government is currently focused on strengthening institutional capacity and preparing the foundations for transitioning to the next level of public sector digital transformation within five years.

NOTES

1. Well-known good-practice cases, such as Denmark, Estonia, the United Kingdom, and the United States, are documented in the latest European Union, Organisation for Economic Co-operation Development, and United Nations reports. They are not included here to avoid repetition and provide more room for less-known country cases.
2. For the Digital Country portal, see https://www.argentina.gob.ar/jefatura/innovacion -publica/gobierno-abierto-y-pais-digital/paisdigital. For the Secretariat of Modernization website, see https://www.entrerios.gov.ar/modernizacion/.
3. For Servicios Digitales, see https://www.argentina.gob.ar/jefatura/innovacion-publica /gobierno-abierto-y-pais-digital/serviciosdigitales. For technological solutions for public administration, see https://www.argentina.gob.ar/jefatura/innovacion-publica/gobierno -abierto-y-pais-digital/paisdigital/soluciones-tecnologicas-para-la-administracion -publica. For WiFi Digital Country, see https://www.argentina.gob.ar/jefatura/innovacion -publica/gobierno-abierto-y-pais-digital/wifi. For the virtual learning platform, see https://cursos.innovacion.gob.ar.
4. For Consulta Pública, see https://consultapublica.argentina.gob.ar. For Punto Digital, see https://www.argentina.gob.ar/jefatura/innovacion-publica/gobierno-abierto-y-pais-digital /paisdigital/puntos. For miArgentina, see https://www.argentina.gob.ar/miargentina.

5. For LABgobar, see https://www.argentina.gob.ar/jefatura/innovacion-publica /laboratoriodegobierno.

6. For the Digital Transformation Agency, see https://www.dta.gov.au. For the Services Australia website, see https://www.servicesaustralia.go.au/. For the Australian Data and Digital Council, see https://pmc.gov.au/public-data/data-and-digital-ministers-meeting.

7. To access the myGov portal, see https://my.gov.au/. For the cloud, see https://cloud.gov.au/. For the Gov.au Observatory, see https://www.dta.gov.au/our-projects/govau-observatory. To learn more about the Cloud Marketplace, see https://www.buyict.gov.au/ sp?id=buyer&kb=KB0010616.

8. For the government's AI road map, see https://data61.csiro.au/en/Our-Research/Our-Work /AI-Roadmap. For the government's work on a new digital identity, see https://www.dta .gov.au/our-projects/digital-identity.

9. For GovLab Austria, https://www.govlabaustria.gv.at. For Digital Austria, see https://www .digitalaustria.gv.at/.

10. For the government portal, see https://www.oesterreich.gv.at. For more on the portal and the digital app, see https://www.bmdw.gv.at/en/Topics/Digitalisation/In-administration /Platform-oesterreich-gv-at.html.

11. For the BRZ website, see https://www.brz.gv.at/en/.

12. For the digital government strategy, see https://www.gov.br/governodigital/pt-br /EGD2020.

13. For Brazil's digital servicers website, see https://www.gov.br/governodigital/pt-br /transformacao-digital/lista-servicos-digitais.

14. For Brazil's interoperability standards, see https://www.gov.br/governodigital/pt-br /governanca-de-dados/padroes-de-interoperabilidade. For Brazil's public software portal, see https://softwarepublico.gov.br/social/search/software_infos. For Fala.BRT, see https:// falabr.cgu.gov.br/publico/Manifestacao/SelecionarTipoManifestacao.aspx.

15. For Brazil's digital government strategies, see https://www.gov.br/governodigital/pt-br /EGD2020/centrado-no-cidadao. For GovTech Brazil 2021, see https://govtechbrasil.org .br/. For Brazil Lab, see https://brazillab.org.br/olab.

16. For the ministry's website, see https://www.mintic.gov.co/portal/inicio/.

17. For the digital government portal, see https://gobiernodigital.mintic.gov.co/portal, which provides access to the following: GOV.CO (https://www.gov.co/home), digital single windows (https://www.gov.co/home/ventanillas-unicas), Data Sandbox Digital Space (https:// gobiernodigital.mintic.gov.co/portal/Iniciativas/Espacio-colaborativo-Data-Sandbox/), free software (https://gobiernodigital.mintic.gov.co/portal/Iniciativas/Software-libre/), the Center for Digital Public Information Center (https://gobiernodigital.mintic.gov.co /portal/Iniciativas/Centro-de-Innovacion-Publica-Digital), and more.

18. For the Urna de Cristal website, see https://www.urnadecristal.gov.co. For digital centers, see https://www.mintic.gov.co/micrositios/centros_digitales/768/w3-channel.html.

19. For the GOV.CO website, see https://gobiernodigital.mintic.gov.co/portal/Iniciativas /GOV-CO-Territorial/.

20. For the Digital Government Index, see https://gobiernodigital.mintic.gov.co/portal /Mediciones.

21. For Digital India, see https://www.digitalindia.gov.in. See also https://negd.gov.in and https://services.india.gov.in. For India's GovTech initiatives, see https://www.digitalindia .gov.in/infrastructure. For Aadhar, see https://uidai.gov.in.

22. For India's National Government Services portal, see https://services.india.gov.in. For MyGov, see https://www.mygov.in. For UMANG, see https://web.umang.gov.in/landing/. For DigiLocker, see https://digilocker.gov.in.

23. For the Centre of Excellence for IoT and AI in India, see https://www.coe-iot.com. see also https://www.digitalindia.gov.in. For the Accessible India campaign, see http:// accessibleindia.gov.in/content. For the Global Partnership on Artificial Intelligence, see https://gpai.ai.

24. For Korea's vision and strategy, see https://www.mois.go.kr/frt/sub/a06/b04/egovVision/ screen.do. See also https://www.mois.go.kr/eng/a01/engMain.do. For the National Information Resources Service, see https://www.nirs.go.kr/eng/index.jsp.

25. In Korea, the digital government innovation plan emphasizes online-to-offline services to citizens by combining virtual and physical spaces through hyperconnected devices, such as IoT, cloud computing, big data analytics, mobile devices, and other intelligent technologies. In the Gov 3.0 environment, Korean officials do not wait at the office for citizens needing

administrative services; instead, they use sophisticated digital devices to provide the requisite services.

26. For Korea's participatory budget website, see https://www.mybudget.go.kr. For the National Information Society Agency website, see https://eng.nia.or.kr/site/nia_eng/main.do. For the architecture of the e-government standard framework, see https://www.egovframe.go.kr/eng/sub.do?menuNo=31.

27. For the TechNews website, see https://www.tech.gov.sg. For Singapore's Smart Nation initiative, see https://www.smartnation.gov.sg.

28. For Citizen Connect, see https://www.citizenconnectcentre.gov.sg. For open data, see https://data.gov.sg. For e-participation, see https://www.reach.gov.sg. For public procurement, see https://www.gebiz.gov.sg.

29. For the Smart Nation website, see https://www.smartnation.gov.sg/. For strategic national projects, see https://www.smartnation.gov.sg/what-is-smart-nation/initiatives/Strategic-National-Projects. For Open Certs, see https://www.smartnation.gov.sg/what-is-smart-nation/initiatives/Digital-Government-Services/opencerts.

30. For SITA's egovernment website, see http://www.sita.co.za/content/e-government. For SITA's GovTec website, see https://v2.itweb.co.za/event/govtech/conference-2015/?page=about.

31. For SITA's e-government portal, see https://www.eservices.gov.za/tonkana/services/home.jsf. For the Centre for Public Service Innovation, see https://www.cpsi.co.za.

32. For the Batho Pele website, see https://www.dsd.gov.za/index.php/about/batho-pele.

33. For the Swiss Authorities Online website, see https://www.ch.ch/en/. For the Swiss digital agenda, see https://www.egovernment.ch/.

34. For the digital strategy and related publications, see https://www.efd.admin.ch/efd/en/home/digitalisierung/swiss-digital-initiative.html.

35. For the Swiss Digital Initiative, see https://digitalswitzerland.com/sdi/. For information on the Swiss Global Digital Summit, see https://digitalswitzerland.com/2019/09/12/the-digital-world-needs-more-ethical-standards-launch-of-the-swiss-digital-initiative-in-geneva/. For information on Swiss Digital Days 2020, see https://digitaltag.swiss/en/programm/.

36. For the Connected Government website, see https://u.ae/en/information-and-services/g2g-service. For the Smart Dubai website, see https://www.smartdubai.ae. For the Emirates Digital website, see https://u.ae/ar-ae/about-the-uae/digital-uae.

37. For mSurvey, see https://u.ae/en/information-and-services/g2g-services/msurvey.

38. For more on paperless transactions, see https://www.smartdubai.ae/initiatives/paperless. For more on the digital ID, see https://selfcare.uaepass.ae.

39. For the use of blockchain, see https://u.ae/ar-AE/about-the-uae/digital-uae/blockchain-in-the-uae-government.

40. For the National Agency for Information Society website, see https://akshi.gov.al. For the e-Albania portal, see https://e-albania.al/. For the Agency for Integrated Service Delivery website, see https://www.adisa.gov.al. For the Albania We Want platform, see https://www.shqiperiaqeduam.al/.

41. For the Citizen Services portal, see https://www.citizenservices.gov.bt.

42. For the Department of Information Technology and Telecom website, see https://dit.gov.bit. For the e-GIF portal, see https://egf.dit.gov.bit. For the Ministry of Finance website, see https://mof.gov.bt.

43. For the NOSI website, see https://www.nosi.cv/.

44. For the Ministry of Administrative and Bureaucratic Reform website, see https://www.menpan.go.id/site/. For the Ministry of Planning website, see https://www.bappenas.go.id/id. For the Ministry of Communications and Informatics website, see https:// www.kominfo.go.id.

45. For the Central Informatics Bureau website, see https: //cib.govmu.org. For the Central Information Systems Division website, see https://cisd.govmu.org/.

46. For the State Informatics website, see https://sil.mu/. For the State Informatics Training Centre, see http://www.utm.ac.mu/index.php/en/utm-about-us/about-utm.

47. For Moldova's public service portal, see https://servicii.gov.md. For the MCloud website, see https://egov.md/en/projects/m-cloud.

48. For the Rwandan Information Society Authority website, see https://www.risa.rw/. For the Digital Transformation Directorate General website, see https://www.minict.gov.rw/programs/digital-transformation-directorate-general.

49. For the Irembo portal, see https://rdb.irembo.gov.rw/rolportal. For the e-government platform, see https://www.gov.rw/services.
50. For Tunisia's Ministry of Communication Technologies website, see https://www.mtc.gov.tn/index.php?id=14. For the Tunisian government portal, see fr.tunisie.gov.tn. For Digital Tunisia 2020, see https://www.mtc.gov.tn/index.php?id=14.
51. For Tunisia's government portal, see https://fr.tunisie.gov.tn/.
52. For Vietnam's Office of the Government website, see http://vpcp.chinhphu.vn/. For the national public service portal, see https://dichvucong.gov.vn/.
53. For the One-Stop Center for e-Government Services website, see https://egov.mic.gov.vn/.
54. For the Digital Governance Unit, see https://digital.gov.mg/. For more on Prodigy, see https://www.worldbank.org/en/news/press-release/2020/09/30/world-bank-supports-madagascars-digital-transformation-and-identity-management-system-upgrades.
55. For the ministry's GovTech initiatives, see https://numerique.gouv.tg/. For Protecting the Togolese Cyberspace website, see https://cert.tg/en/cert-en/.
56. For the government portal, see https://togo.gouv.tg/. For the public service portal, see https://service-public.gouv.tg/.
57. For the 2021 list of fragile and conflict-affected situations around the world, see https://thedocs.worldbank.org/en/doc/888211594267968803-0090022020/original/FCSListFY21.pdf.

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UN (United Nations). 2020. *E-Government Survey 2020: Digital Government in the Decade of Action for Sustainable Development*. New York: UN, Department of Economic and Social Affairs. https://www.un.org/development/desa/publications/publication/20-20-united-nations-e-government-survey.

5 **Conclusions**

Advances in digital technologies and the transition to a data-driven public sector can radically change the way governments operate and interact with citizens. GovTech has great potential to improve core government systems, citizen-centric services, and citizen engagement and to deliver on the promises of the digital age. However, turning the promise of digital solutions and data into tangible, measurable, and consistent outcomes remains a challenge in most countries.

Governments must adapt to changing societal demands that stem from digital advancements as well as the coronavirus pandemic. The GovTech Maturity Index (GTMI) was developed to measure the key aspects of four focus areas of the new frontier of digital transformation and to inform decisions on priority actions for public sector modernization.

> Interest in GovTech initiatives is growing around the world. Government entities leading the GovTech agenda exist in 80 economies out of 198 reviewed, and mature digital government and good practices are highly visible in 43 economies.

Within the last two decades, 174 economies have launched digital government or GovTech initiatives and strategies to address country-specific challenges. Within the last five years, about 120 countries have developed new digital government strategies that are substantially different from earlier e-government initiatives. New strategy documents are more focused on the GovTech agenda and promote a whole-of-government approach to public sector modernization as well as improved accessibility to online services, multifunctional citizen participation platforms, and a sustainable GovTech ecosystem.

KEY FINDINGS

Focus on GovTech

Despite increasing investments in information and communication technology (ICT) infrastructure and the availability of GovTech institutions and strategy or policy documents, the maturity of GovTech foundations is lower than expected

in most countries. All countries generally score higher in the area of core government systems, online services, and GovTech enablers than in digital citizen engagement or CivicTech. Despite good progress in most regions, digital divides persist between and within regions.

Visibility of results

Few governments record or report transparently their investments in GovTech initiatives, results achieved, or challenges faced. Therefore, it is difficult to monitor the progress made in most GovTech initiatives and to highlight good practices based on the information available on the web.[1]

Core government systems

Most countries have already developed core government systems (back- and front-office solutions), online service and open-data portals, and countrywide ICT infrastructure supporting central and local government operations. However, these systems are usually fragmented and disconnected, and data exchange is point-to-point, not automated and secured using web services or application programming interfaces (APIs) based on well-defined protocols.

Shared platforms and standards

Many countries are interested in developing shared digital government platforms such as cloud-based solutions, mobile apps, and a government service bus to support the operational and service delivery requirements of public entities. Despite a minimal focus on government enterprise architecture, which appears to be more difficult to develop and implement in a large number of countries, there is substantial interest in developing government gateways or a service bus, interoperability frameworks, and cloud platforms as some of the key components of government enterprise architecture.

Online services

Integrated national portals are available in many countries to support online service delivery, mostly one-way information flow from the government to citizens or businesses. Two-way information flow, universally accessible user-centric transactional services supported by mobile apps, and quality of service metrics are visible in a small number of countries, mainly in Groups A and B.

Digital citizen engagement

Governments and civil society organizations have launched various technology solutions to improve digital citizen engagement, but it is difficult to find information about the impact of these tools and service quality standards or responsiveness. Also, multifunctional citizen participation portals that provide capabilities to submit a petition, publish citizen's inputs, allow the provision of anonymous feedback, or post the government's response are visible only in a relatively small group of countries.

GovTech enablers

Most of the digital government strategies and action plans approved within the last five years include establishing enabling and safeguarding institutions to support the GovTech agenda, with more focus on a whole-of-government approach, data-driven public sector, digital skills development, and innovation labs. Public-private partnerships to draw on private sector skills, innovations, and investments to address public sector challenges are visible in a small group of countries. Also, there is growing concern about cybersecurity and data privacy risks.

Identification for development

According to the World Bank Identification for Development (ID4D) data set, about 1 billion people do not have official proof of identity, although 186 economies have mandatory birth registration systems and 180 economies issue a national identification (ID) to all citizens. Additional efforts are needed to expand the issuance of a unique national ID at birth and to strengthen civil registration and identification systems, especially in Sub-Saharan Africa and South Asia.

Disruptive technologies

Several high- and middle-income countries have recognized and harnessed the potential of new and disruptive technologies. National strategies or plans for artificial intelligence, blockchain, Internet of Things, drones, and other emerging technologies are evident. Some GovTech leaders are already using artificial intelligence and chatbots to reduce administrative burden, strengthen oversight functions, and improve service quality.

> The findings and good-practice cases presented in this study demonstrate that the GovTech focus areas identified by the World Bank Group are highly relevant to the public sector digital transformation agenda in most countries.

KEY MESSAGES

- Commitment at high government levels and allocation of necessary resources are crucial for the sustainability of GovTech initiatives. Beyond strong political will and adequate resource allocation, active cooperation and coordination across institutional arrangements and among key actors are critical to achieving improved outcomes (World Bank 2017, 2021). Dedicated GovTech entities and strong governance mechanisms are essential to advance the whole-of-government approach and improve GovTech maturity.
- Large-scale GovTech challenges are more evident in Sub-Saharan Africa and South Asia, and these regions need to allocate more resources to address digital divide, infrastructure, and governance issues than other regions. The GTMI can assist in identifying priority actions in these regions and in specific countries.

- Countries could focus more on improving the interconnectivity and interoperability of existing systems and portals, benefiting from government cloud, service bus, and APIs, as cost-effective shared platforms in future GovTech initiatives.
- Next-generation online service portals could expand transactional services to save time, reduce costs, and improve the quality of services. Also, as highlighted in the United Nations Online Service Index findings, more than 1 billion people live with some form of disability, and 80 percent of them reside in the low- and middle-income world. Universally accessible user-centric services should be launched to reach vulnerable sections of the population and reduce the digital divide.
- GovTech initiatives could focus more on multifunctional citizen participation platforms through effective CivicTech solutions to deepen the citizen-government relationship, improve accountability, and build public trust in government.
- Further investments in developing digital skills and promoting innovation in the public sector are crucial to supporting the transition to a data-driven culture and strengthening technical skills, particularly in low-income countries.
- Governments could promote the use of open data by individuals and firms to create economic value addition through public data platforms. While sharing and reusing public and personal data both inside and outside government, governments should mitigate the increasing risks to cybersecurity, data protection, and privacy.
- The *World Development Report 2021: Data for Better Lives* highlights the importance of data governance, which is highly relevant to the GovTech agenda (World Bank 2021). The report offers five high-level recommendations: (a) forge a new social contract for data, (b) increase the use and reuse of data to realize greater value, (c) create more equitable access to the benefits of data, (d) foster trust through safeguards that protect people from the harm of data misuse, and (e) pave the way for an integrated national data system.
- Governments could strengthen citizen trust in data-driven societies and promote GovTech more effectively by adopting solid legal frameworks and establishing strong data protection agencies. Privacy concerns are an integral part of an open-data environment, and an assurance of protection would foster trust in the open-data systems.
- Interconnectivity between traditional and "new" data is necessary to advance digital transformation. The integration of traditional and new (digital) data can accelerate and strengthen service delivery, particularly for the historically underserved and marginalized populations. Traditional data, including censuses, household surveys, civil registration and vital statistics, and other administrative data remain fundamental to the progress of GovTech.
- Governments could promote the development of local GovTech ecosystems by supporting local entrepreneurs and start-ups to develop new products and services and by providing incentives to draw on private sector skills, innovation, and investments to address public sector challenges.
- The use of frontier and disruptive digital technologies can greatly improve core government operations and online service delivery. Governments could use disruptive technologies to simplify and shorten the provision of online services at lower cost, improve the efficiency of core government systems (including e-procurement), increase transparency, and reduce corruption.

- Future GovTech initiatives could also consider six dimensions of a fully digital government: (a) digital by design, (b) data-driven public sector, (c) government as a platform, (d) open by default, (e) user-driven, and (f) proactiveness. These important aspects are defined in detail in the OECD Digital Government Policy Framework published in October 2020 (OECD 2020).

The coronavirus pandemic has highlighted how critical GovTech solutions can be in difficult times to ensure the continuity of core government operations, provide secure remote access to online services, and support vulnerable people and businesses. Governments should allocate the necessary resources to improve GovTech maturity during the COVID-19 recovery and resilience phase and adapt to the "new normal" through effective partnerships with all stakeholders.

NOTE

1. From time to time, governments may change the web links included in the GovTech global data set. Hence, some of the web links may not be working after a while. As a good practice, governments may wish to use dedicated websites with stable web links (uniform resource locators [URLs]) for critical GovTech systems, services, strategy documents, and important initiatives and to direct users to the new site whenever the web link of a specific website has changed.

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Explanation of GovTech Indicators

To measure the maturity level of GovTech focus areas, 48 key indicators were defined (32 new and 16 updated data fields). These key indicators are presented in table A.1, with a brief explanation about the measurement method, points given, and evidence of observed characteristics.

TABLE A.1 **Key GovTech indicators**

NUMBER	INDICATOR	WHAT IS MEASURED	HOW IT IS MEASURED	SOURCE	DATA FIELDS
CORE GOVERNMENT SYSTEMS INDEX (CGSI)					
1	Government cloud	Is there a government cloud available for all government entities?	0 = No	GT 2020	New
			1 = Planned or cloud strategy developed		
			2 = Yes (in use)		
2	Government enterprise architecture	Is there a government enterprise architecture?	0 = No	GT 2020	New
			1 = In draft or planned		
			2 = Partially implemented		
			3 = Yes (in use)		
3	Government interoperability framework (GIF) or government service bus (GSB)	Is there a GSB (government gateway) or GIF in place?	0 = No	GT 2020	New
			1 = Planned or in progress		
			2 = Yes (not mandatory)		
			3 = Yes (mandatory for all government institutions)		
4	Financial management information system (FMIS)	Is there an operational FMIS to support central government public financial management functions?	0 = No	GT 2020	Updated
			1 = Implementation or upgrade in progress		
			2 = Pilot implementation or reduced scope		
			3 = Fully operational		

(continued)

TABLE A.1., *continued*

NUMBER	INDICATOR	WHAT IS MEASURED	HOW IT IS MEASURED	SOURCE	DATA FIELDS
5	Treasury single account (TSA) for automating government payments	Is there a TSA linked with the FMIS to automate payments and bank reconciliation?	0 = No 1 = Implementation or upgrade in progress 2 = Partially operational 3 = Fully operational (centralized TSA)	GT 2020	Updated
6	Tax management system	Is there an operational tax management system?	0 = No 1 = Planned 2 = Implementation in progress 3 = Operational	GT 2020	Updated
7	Customs system	Is there an operational customs system?	0 = No 1 = Planned 2 = Implementation in progress 3 = Operational	GT 2020	Updated
8	Human resource management information system (HRMIS)	Is there an operational HRMIS with an online service portal?	0 = No 1 = Planned 2 = Implementation in progress 3 = Operational	GT 2020	Updated
9	Payroll system	Is there an operational payroll system linked with a human resource management information system?	0 = No 1 = Planned 2 = Implementation in progress 3 = Operational	GT 2020	Updated
10	e-procurement system	Is there an e-procurement portal supporting public procurement—recurrent budget plus investments?	0 = No 1 = Yes, only tender or contract information 2 = Yes, including bidding documents and contract awards 3 = Yes, including interfaces with government systems	GT 2020	Updated
11	Debt management system	Is there an operational debt management system for foreign and domestic debt?	0 = No 1 = Planned 2 = Implementation in progress 3 = Operational	GT 2020	Updated
12	Public investment management system	Is there an operational public investment management system?	0 = No 1 = Planned 2 = Implementation in progress 3 = Operational	GT 2020	New

TABLE A.1., *continued*

NUMBER	INDICATOR	WHAT IS MEASURED	HOW IT IS MEASURED	SOURCE	DATA FIELDS
13	Open-source software in public sector	Is there a government open-source software policy or action plan for the public sector?	0 = No 1 = Yes, proposed 2 = Yes, advisory or research and development 3 = Yes, mandatory	GT 2020	New
14	United Nations (UN) Telecommunication Infrastructure Index (TII)	The TII is composed of four indicators: · Estimated Internet users per 100 inhabitants · Number of mobile subscribers per 100 inhabitants · Active mobile broadband subscriptions · Number of fixed broadband subscriptions per 100 inhabitants	0 to 1	UN 2020	New
15	Disruptive technologies	Does the government have a specific national strategy on new or disruptive technologies (for example, artificial intelligence, blockchain)?	0 = No 1 = In draft or planned 2 = Yes (approved)	GT 2020	New
Public Service Delivery Index (PSDI)					
16	UN Online Service Index (2020)	The UN Online Service Index is a composite normalized score derived from answers to an online service questionnaire. The 2020 Online Service Questionnaire consists of a list of 148 questions (yes/no).	0 to 1	UN 2020	New
	OSI: Information available	Is there any "information about" something such as laws, policies, legislation, or expenditures?	0 = No 1 = Yes		
	OSI: Existence of a feature	Is there any evidence on the "existence of" a feature such as social networking tools?	0 = No 1 = Yes		
	OSI: Ability to do something	Is it possible to do something on the website (that is, run a transaction)?	0 = No 1 = Yes		
17	Online public service delivery portal	Is there a national online public service portal for citizens, business-es, and government entities?	0 = No 1 = Yes, level 1 or 2 Mostly information or forms; some online transactions (G2C, G2B) 2 = Yes, level 3 or 4 Mostly transactional (G2C, G2B, G2G), including single sign-on	GT 2020	Updated

(continued)

TABLE A.1., *continued*

NUMBER	INDICATOR	WHAT IS MEASURED	HOW IT IS MEASURED	SOURCE	DATA FIELDS
18	Tax online service portal	Is there an operational tax system online service portal?	0 = No information on services	GT 2020	Updated
			1 = Information services or forms		
			2 = Transactional services		
			3 = Connected services (single window)		
19	e-filing	Is there an operational e-filing service portal for citizens and businesses, including e-payment options?	0 = No	GT 2020	Updated
			1 = Provide information only		
			2 = Online e-filing services		
			3 = Online e-filing and payments		
20	e-payment	Is there an online e-payment portal providing support for various e-services?	0 = No	GT 2020	Updated
			1 = Yes, fragmented systems; multiple platforms		
			2 = Yes, centralized shared platform		
21	Customs online service portal	Is there an operational customs system online service portal?	0 = No information on services	GT 2020	Updated
			1 = Information services or forms		
			2 = Transactional services		
			3 = Connected services (single window)		
Citizen Engagement Index (CEI)					
Inclusive participation					
22	UN e-Participation Index (2020)	Government use of online services in providing information to its citizens or "e-information sharing," interacting with stakeholders or "e-consultation," and engaging in decision-making processes or "e-decision-making"	0 to 1	UN 2020	New
	e-information	Enabling participation by providing citizens with public information and access to information without or on demand	0 to 1		
	e-consultation	Engaging citizens in contributions to and deliberation on public policies and services	0 to 1		
	e-decision-making	Empowering citizens through codesign of policy options and coproduction of service components or delivery modalities	0 to 1		
23	Open-government portal	Is there an open-government portal?	0 = No	GT 2020	New
			1 = Yes		

(continued)

TABLE A.1., *continued*

NUMBER	INDICATOR	WHAT IS MEASURED	HOW IT IS MEASURED	SOURCE	DATA FIELDS
24	Open-data portal	Is there an open-data portal?	0 = No 1 = Yes (information only) 2 = Yes (providing access to open data)	GT 2020	New
	Participation and feedback				
25	National website for citizen participation	Is there a national platform that allows citizens to participate in policy decision-making?	0 = No 1 = Yes	GT 2020	New
26		Is it for a petition?	0 = No 1 = Yes		New
27		Are citizens' inputs publicly available on the platform?	0 = No 1 = Yes		New
28		Does the platform allow citizens to provide feedback anonymously?	0 = No 1 = Yes		New
29		Is government response publicly available on the platform?	0 = No 1 = Yes		New
30	National website for citizen and business feedback	Are there government platforms such as a website or app that allow citizens or businesses to provide feedback—compliments, complaints, suggestions, information requests—directly to the government on its service delivery and performance?	0 = No 1 = Yes	GT 2020	New
31	Public information	Does the government make the service standards such as response time and procedure available to the public? .	0 = No 1 = Yes		New
32	Universal accessibility	Are these platforms universally accessible, or do they provide support for users with disabilities—for example, e-services and availability of voice commands?	0 = No 1 = Yes		New
	Government responsiveness				
33	Government responsiveness	Does the government publish its engagement statistics and performance regularly?	0 = No 1 = Yes	GT 2020	New
	GovTech Enablers Index (GTEI)				
34	GovTech institutions	Is there a government body focused on GovTech—digital transformation, whole-of-government, services, and so on?	0 = No 1 = Yes	GT 2020	New
35	Data governance institutions	Is there a government entity in charge of data governance or data management?	0 = No 1 = Planned or in progress 2 = Yes (established)	GT 2020	New

(continued)

TABLE A.1., *continued*

NUMBER	INDICATOR	WHAT IS MEASURED	HOW IT IS MEASURED	SOURCE	DATA FIELDS
36	Digital government or GovTech strategy	Is there a specific national GovTech or digital transformation strategy?	0 = No 1 = Planned or in progress 2 = Yes (< = 2014) 3 = Yes (> = 2015)	GT 2020	New
37	Whole-of-government	Is there a whole-of-government approach to implement data governance?	0 = No 1 = Planned or in progress 2 = Yes (institutionalized)	GT 2020	New
38	Right-to-information laws	Are there national laws, statutes, or regulations—for example, right to information, access to information—to make data and information available to the public online or digitally?	0 = No 1 = Draft or consultations in progress 2 = Yes (effective)	GT 2020	New
39	Data protection or privacy laws	Is there a data protection or privacy law?	0 = No 1 = Draft or consultations in progress 2 = Yes (effective)	GT 2020	New
40	Data protection agency	Is there a data protection authority?	0 = No 1 = Not established yet (visible in law) 2 = Yes	GT 2020	New
41	National identification (ID)	Is there a foundational unique national ID system in place?	0 = No 1 = Yes	ID4D 2018	Updated
42	Digital ID	Is there a digital ID that can be used for identification and services?	0 = No 1 = Yes	ID4D 2018	Updated
43	Digital signature	Is there a digital signature regulation and public key infrastructure in place to support government operations and service delivery?	0 = No digital signature 1 = Regulation approved; no infrastructure yet (public key infrastructure, certificate authority) 2 = Regulations and infrastructure in place, not used yet or in progress 3 = Operational, used in practice for operations and e-services	GT 2020	Updated
44	Cybersecurity	Is there a cybersecurity emergency response team?	0 = No 1 = Planned 2 = Yes (established)	GT 2020	New
45	UN Human Capital Index (HCI)	The HCI has four components: a. Adult literacy rate b. Combined primary, secondary, and tertiary gross enrollment ratio c. Expected years of schooling d. Average years of schooling	0 to 1	UN 2020	New

TABLE A.1., *continued*

NUMBER	INDICATOR	WHAT IS MEASURED	HOW IT IS MEASURED	SOURCE	DATA FIELDS
46	Digital skills in the public sector	Is there a government strategy or program to improve the digital skills or data literacy of public employees?	0 = No 1 = Planned or in progress 2 = Yes	GT 2020	New
47	Digital skills and innovation	Is there a training program to improve digital skills or data literacy and innovation in the public sector?	0 = No 1 = Yes	GT 2020	New
48	Public sector innovation	Is there a government entity or strategy focused on public sector innovation—innovation hubs, private sector investments, and so on?	0 = No 1 = Planned or in progress 2 = Yes	GT 2020	New

Source: World Bank staff compilation based on information in World Bank 2018, 2021; United Nations 2020.
Note: GT 2020 = World Bank Group, GovTech Data Set (198 economies) (2020 data). UN 2020 = 2020 UN e-Government Survey (193 countries). ID4D 2018 = Identification for Development (ID4D) data set (198 economies). New = new data field included in the latest version of the GT 2020. Updated = updated data field in the GT 2020 imported from previous versions. G2B = government to business. G2C = government to citizen. G2G = government to government.

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The GovTech Data Set and Selected Indicators

The GovTech data set is composed of six main components, as described in figure B.1. The data set is an extended version of a global data set on government systems and services, originally developed in 2014 and updated every two years during the preparation of several World Bank studies and flagship reports: *World Development Report 2016: Digital Dividends;* 2018 World Bank Group Digital Adoption Index; 2020 GovTech Maturity Index; and *World Development Report 2021: Data for Better Lives*.[1] The GovTech data set contains a rich set of data covering important aspects of digital government and GovTech initiatives in 198 economies.

- *International outlook*. The GovTech data set includes key indicators measuring various dimensions in 198 economies, including all 188 of the World Bank member countries plus some of the large economies—from the European Union, Organisation for Economic Co-operation and Development (OECD), and Asia-Pacific Economic Cooperation—to present a broader spectrum of the GovTech agenda. Income-level distributions of key indicators are presented for 198 economies. This approach has been used consistently in all global data sets created by the Governance Global Practice since 2014.
- *Regional outlook*. The "region" field included in the GovTech data set can be used to filter and present various dimensions for 168 World Bank client countries that are receiving advisory and financial support to implement public sector modernization activities, without including high-income countries and large economies. All regional distributions of key indicators are presented for 168 client countries.

In this study, key indicators and GovTech Maturity Index (GTMI) scores are presented both for 198 economies and for 168 World Bank client countries (table B.1) in order to compare two different perspectives (international- or income-level and regional distributions).

The GTMI is calculated based on 48 key indicators defined in four categories:

- *I-1 to I-15:* Core government system indicators
- *I-16 to I-21:* Public service delivery indicators
- *I-22 to I-33:* Citizen engagement indicators
- *I-34 to I-48:* GovTech enablers.

As presented in figure B.1, the GovTech data set includes several sections to display the raw data collected using all key indicators in separate columns, together with additional information related to each indicator such as a web link

FIGURE B.1

Description of the GovTech data set (198 economies)

Basic data	• Name of economy + Income level + Population + GNI • Relevant data fields: Columns B:I in the "DGSS" tab
Core government systems indicators	• 15 key indicators: I-1 to I-15 • Relevant data fields: Columns LD:LR in the "DGSS" tab
Public service delivery indicators	• 6 composite indicators: I-16 to I-21 • Relevant data fields: Columns LS:LX in the "DGSS" tab
Citizen engagement indicators	• 12 key indicators: I-22 to I-33 • Relevant data fields: Columns LY:MJ in the "DGSS" tab
GovTech enablers indicators	• 15 key indicators: I-34 to I-48 • Relevant data fields: Columns MK:MY in the "DGSS" tab
GovTech Maturity Index scores and groups	• Calculation of subindexes based on weights (expert opinion) • GTMI scores and groups: Columns KW:LC in the "DGSS" tab

Source: World Bank data.
Note: GTMI = GovTech Maturity Index. GNI = gross national income.

to the relevant website of the institution or published strategy document, year of establishment or publication, operational status of systems, and level of online services. The "metadata" tab explains the details of all data fields, and the header row of the "DGSS" tab also embeds comments or notes in each column header to explain all indicators and the meaning of specific points or other attributes.

The GovTech data set has several other tabs, including automatically updated graphs, maps, and tables to visualize data—all graphs and tables are linked to specific fields in the "DGSS" tab. The "DGSS_Stats" tab includes the trend lines and graphical presentation of all key indicators. Income-level and regional distributions of 48 key GTMI indicators are presented, together with the GTMI by groups. The "GT_Stats" tab presents the diffusion of digital government or GovTech initiatives as well as the relationships between the GTMI and various digital government indexes. The "GTI" tab includes the GTMI world map, presenting four groups, GTMI calculations, and details of the GTMI and subindexes for all 198 economies, together with the findings on four subindexes for relevant indicators, split by country groups. The "other" tab includes new digital government or GovTech indexes (OECD, Development Bank of Latin America) published in 2020 and their comparison with the GTMI. The "contents" tab provides an overview of the contents for additional information on all tabs.

Income-level distribution presents the results for all 198 economies, whereas regional distribution presents the status in 168 World Bank client countries. All key indicators and the GTMI scores or groups are presented similarly.

The following sections present detailed findings on the following 12 key indicators related to less-known aspects of GovTech focus areas:

- *I-1*. Government cloud platforms
- *I-2*. Government enterprise architecture (GEA) framework
- *I-3*. Government interoperability framework (GIF) or government service bus (GSB)
- *I-13*. Open-source software policies in the public sector
- *I-15*. National strategy on disruptive technologies

TABLE B.1 **List of 198 economies, including 168 World Bank Group client countries, by income level and region**

ECONOMY	INCOME	REGION	ECONOMY	INCOME	REGION	ECONOMY	INCOME	REGION
Afghanistan	LIC	SAR	Greece	HIC	—	Norway	HIC	—
Albania	UMIC	ECA	Grenada	UMIC	LCR	Oman	HIC	MNA
Algeria	LMIC	MNA	Guatemala	UMIC	LCR	Pakistan	LMIC	SAR
Andorra	HIC	—	Guinea	LIC	AFR	Palau	HIC	EAP
Angola	LMIC	AFR	Guinea-Bissau	LIC	AFR	Panama	HIC	LCR
Antigua and Barbuda	HIC	LCR	Guyana	UMIC	LCR	Papua New Guinea	LMIC	EAP
Argentina	UMIC	LCR	Haiti	LIC	LCR	Paraguay	UMIC	LCR
Armenia	UMIC	ECA	Honduras	LMIC	LCR	Peru	UMIC	LCR
Australia	HIC	—	Hong Kong SAR, China	HIC	EAP	Philippines	LMIC	EAP
Austria	HIC	—	Hungary	HIC	ECA	Poland	HIC	ECA
Azerbaijan	UMIC	ECA	Iceland	HIC	—	Portugal	HIC	—
Bahamas, The	HIC	LCR	India	LMIC	SAR	Qatar	HIC	MNA
Bahrain	HIC	MNA	Indonesia	UMIC	EAP	Romania	HIC	ECA
Bangladesh	LMIC	SAR	Iran, Islamic Rep.	UMIC	MNA	Russian Federation	UMIC	ECA
Barbados	HIC	LCR	Iraq	UMIC	MNA	Rwanda	LIC	AFR
Belarus	UMIC	ECA	Ireland	HIC	—	Samoa	UMIC	EAP
Belgium	HIC	—	Israel	HIC	MNA	San Marino	HIC	—
Belize	UMIC	LCR	Italy	HIC	—	São Tomé and Príncipe	LMIC	AFR
Benin	LMIC	AFR	Jamaica	UMIC	LCR	Saudi Arabia	HIC	MNA
Bhutan	LMIC	SAR	Japan	HIC	EAP	Senegal	LMIC	AFR
Bolivia	LMIC	LCR	Jordan	UMIC	MNA	Serbia	UMIC	ECA
Bosnia and Herzegovina	UMIC	ECA	Kazakhstan	UMIC	ECA	Seychelles	HIC	AFR
Botswana	UMIC	AFR	Kenya	LMIC	AFR	Sierra Leone	LIC	AFR
Brazil	UMIC	LCR	Kiribati	LMIC	EAP	Singapore	HIC	EAP
Brunei Darussalam	HIC	—	Korea, Dem. People's Rep.	LIC	—	Slovak Republic	HIC	ECA
Bulgaria	UMIC	ECA	Korea, Rep.	HIC	EAP	Slovenia	HIC	ECA
Burkina Faso	LIC	AFR	Kosovo	UMIC	ECA	Solomon Islands	LMIC	EAP
Burundi	LIC	AFR	Kuwait	HIC	MNA	Somalia	LIC	AFR
Cabo Verde	LMIC	AFR	Kyrgyz Republic	LMIC	ECA	South Africa	UMIC	AFR
Cambodia	LMIC	EAP	Lao PDR	LMIC	EAP	South Sudan	LIC	AFR
Cameroon	LMIC	AFR	Latvia	HIC	ECA	Spain	HIC	—
Canada	HIC	—	Lebanon	UMIC	MNA	Sri Lanka	LMIC	SAR
Central African Republic	LIC	AFR	Lesotho	LMIC	AFR	St. Kitts and Nevis	HIC	LCR
Chad	LIC	AFR	Liberia	LIC	AFR	St. Lucia	UMIC	LCR

(continued)

TABLE B.1., *continued*

ECONOMY	INCOME	REGION	ECONOMY	INCOME	REGION	ECONOMY	INCOME	REGION
Chile	HIC	LCR	Libya	UMIC	MNA	St. Vincent and the Grenadines	UMIC	LCR
China	UMIC	EAP	Liechtenstein	HIC	—	Sudan	LIC	AFR
Colombia	UMIC	LCR	Lithuania	HIC	ECA	Suriname	UMIC	LCR
Comoros	LMIC	AFR	Luxembourg	HIC	—	Sweden	HIC	—
Congo, Dem. Rep.	LIC	AFR	Macao SAR, China	HIC	EAP	Switzerland	HIC	—
Congo, Rep.	LMIC	AFR	Madagascar	LIC	AFR	Syrian Arab Republic	LIC	MNA
Costa Rica	UMIC	LCR	Malawi	LIC	AFR	Taiwan, China	HIC	EAP
Côte d'Ivoire	LMIC	AFR	Malaysia	UMIC	EAP	Tajikistan	LIC	ECA
Croatia	HIC	ECA	Maldives	UMIC	SAR	Tanzania	LMIC	AFR
Cuba	UMIC	—	Mali	LIC	AFR	Thailand	UMIC	EAP
Cyprus	HIC	—	Malta	HIC	MNA	Timor-Leste	LMIC	EAP
Czech Republic	HIC	ECA	Marshall Islands	UMIC	EAP	Togo	LIC	AFR
Denmark	HIC	—	Mauritania	LMIC	AFR	Tonga	UMIC	EAP
Djibouti	LMIC	MNA	Mauritius	HIC	AFR	Trinidad and Tobago	HIC	LCR
Dominica	UMIC	LCR	Mexico	UMIC	LCR	Tunisia	LMIC	MNA
Dominican Republic	UMIC	LCR	Micronesia, Fed. Sts.	LMIC	EAP	Turkey	UMIC	ECA
Ecuador	UMIC	LCR	Moldova	LMIC	ECA	Turkmenistan	UMIC	ECA
Egypt, Arab Rep.	LMIC	MNA	Monaco	HIC	—	Tuvalu	UMIC	EAP
El Salvador	LMIC	LCR	Mongolia	LMIC	EAP	Uganda	LIC	AFR
Equatorial Guinea	UMIC	AFR	Montenegro	UMIC	ECA	Ukraine	LMIC	ECA
Eritrea	LIC	AFR	Morocco	LMIC	MNA	United Arab Emirates	HIC	MNA
Estonia	HIC	ECA	Mozambique	LIC	AFR	United Kingdom	HIC	—
Eswatini	LMIC	AFR	Myanmar	LMIC	EAP	United States	HIC	—
Ethiopia	LIC	AFR	Namibia	UMIC	AFR	Uruguay	HIC	LCR
Fiji	UMIC	EAP	Nauru	HIC	EAP	Uzbekistan	LMIC	ECA
Finland	HIC	—	Nepal	LMIC	SAR	Vanuatu	LMIC	EAP
France	HIC	—	Netherlands	HIC	—	Venezuela, RB	UMIC	LCR
Gabon	UMIC	AFR	New Zealand	HIC	—	Vietnam	LMIC	EAP
Gambia, The	LIC	AFR	Nicaragua	LMIC	LCR	West Bank and Gaza	LMIC	MNA
Georgia	UMIC	ECA	Niger	LIC	AFR	Yemen, Rep.	LIC	MNA
Germany	HIC	—	Nigeria	LMIC	AFR	Zambia	LMIC	AFR
Ghana	LMIC	AFR	North Macedonia	UMIC	ECA	Zimbabwe	LMIC	AFR

Source: World Bank staff.
Note: Regional groupings are as follows: AFR = Sub-Saharan Africa. EAP = East Asia and Pacific. ECA = Europe and Central Asia. LCR = Latin America and the Caribbean. MNA = Middle East and North Africa. SAR = South Asia. Income groupings are as follows: HIC = high-income countries. UMIC = upper-middle-income countries. LMIC = lower-middle-income countries. LIC = low-income countries.

- *I-17*. Online public service delivery portals (level of services)
- *I-25*. National website for citizen participation
- *I-34*. GovTech institutions
- *I-36*. Data governance institutions
- *I-37*. Whole-of-government approach, as a part of the national digital government strategy
- *I-47*. Public or academic programs for digital skills and innovation
- *I-48*. Public entity or strategy focused on public sector innovation.

KEY INDICATORS

Indicator I-1. Is there a government cloud available for all government entities?

Indicator I-1 measures the availability of a government cloud—public, private, hybrid—that provides various shared services such as infrastructure as a service, platform as a service, and software as a service for government entities (table B.2).

Of the 60 countries that have an operational government cloud platform, 35 are high-income countries, 11 are upper-middle-income countries, 13 are lower-middle-income countries, and 1 is a low-income country. Of the 46 countries that have an approved government cloud strategy or are establishing their cloud platforms, 17 are high-income countries and 16 are upper-middle-income countries. Figure B.2, panel a, shows that about half of the governments—92 out of 198 (46 percent)—do not yet focus on creating a government cloud, and most of these are low- or middle-income countries. Most of the fragile states do not have government cloud platforms, but some of these countries use public-private cloud platforms to run some of their core government systems. In Somalia both financial management information and human resource management information systems are running on regional cloud platforms to support daily operations.

Regarding regional distribution, East Asia and Pacific and Europe and Central Asia are leading, with nine countries that have operational government cloud platforms, as shown in figure B4.2, panel b. There are 39 ongoing activities in the regions to establish a government cloud—either a cloud-first or cloud-only policy has been approved or a government cloud is being established. Most of the governments in Sub-Saharan Africa, 36 out of 48 (75 percent), do not yet focus on a government cloud.

TABLE B.2 Indicator I-1: Is there a government cloud available for all government entities?

		ECONOMIES		REGIONS	
POINTS	RESPONSE	NUMBER	%	NUMBER	%
2	Yes. An operational government cloud is in use	60	31	42	25
1	In progress. A cloud strategy or implementation is in progress	46	23	39	23
0	No. There is no government cloud strategy or platform yet	92	46	87	52

Source: World Bank data.

Distribution of scores for indicator I-1, by income and region

a. Income-level distribution   b. Regional distribution

Source: World Bank data.
Note: HIC = high-income countries. UMIC = upper-middle-income countries. LMIC = lower-middle-income countries.
LIC = low-income countries. AFR = Sub-Saharan Africa. EAP = East Asia and Pacific. ECA = Europe and Central Asia.
LCR = Latin America and the Caribbean. MNA = Middle East and North Africa. SAR = South Asia.

Indicator I-2. Is there a government enterprise architecture?

Indicator I-2 presents the status of government enterprise architecture,[2] if any (table B.3). Implementation of the GEA is difficult especially in the public sector, and good practices in the adoption of this approach to support the whole-of-government approach are limited.

Most of the existing GEA solutions—29 out of 45 (64 percent)—are visible in high-income countries, as presented in figure B.3, panel a. Additionally, 16 countries at all income levels are developing their GEA frameworks. A large group of governments, 137 out of 198 (69 percent), do not focus on GEA, which provides a common framework for integrating strategic, business, and technology management as part of public sector modernization.

In all regions, a few countries are using a GEA framework effectively, as illustrated in figure B.3, panel b. For example, the framework is adopted and in use in Bhutan, Brazil, India, and the Republic of Korea; it is developed but not fully used in 23 other countries. Most of the governments in Sub-Saharan Africa, 40 out of 48 (83 percent), are not yet focused on GEA. This low level of maturity and interest may stem from the fact that the GEA is both abstract and complex. Despite all of the challenges and limited use in the public sector, several solutions are popular, especially in the private sector. The Open Group Architecture Framework (TOGAF) is one of the most frequently used frameworks for enterprise architecture in the public and private sectors, providing an approach for designing, planning, implementing, and governing an enterprise digital architecture.[3]

Indicator I-3. Is there a government interoperability framework or service bus?

Indicator I-3 measures the state of the government interoperability framework[4] and of the government service bus as a part of shared government platforms (table B.4). These platforms are integral components of the data and technology

TABLE B.3 **Indicator I-2: Is there a government enterprise architecture (GEA)?**

POINTS	RESPONSE	ECONOMIES		REGIONS	
		NUMBER	%	NUMBER	%
3	Yes. GEA is in use broadly	6	3	4	2
2	Partially implemented	39	20	23	14
1	In draft or planned	16	8	15	9
0	No. There is no GEA yet	137	69	126	75

Source: World Bank data.

FIGURE B.3

Distribution of scores for indicator I-2, by income and region

a. Income-level distribution

b. Regional distribution

Source: World Bank data.
Note: HIC = high-income countries. UMIC = upper-middle-income countries. LMIC = lower-middle-income countries. LIC = low-income countries. AFR = Sub-Saharan Africa. EAP = East Asia and Pacific. ECA = Europe and Central Asia. LCR = Latin America and the Caribbean. MNA = Middle East and North Africa. SAR = South Asia.

TABLE B.4 **Indicator I-3: Is there a government interoperability framework (GIF) or a government service bus (GSB)?**

POINTS	RESPONSE	ECONOMIES		REGIONS	
		NUMBER	%	NUMBER	%
3	Yes. Mandatory for all government institutions	4	2	2	1
2	Yes. Not mandatory	67	34	48	29
1	Planned or in progress	23	11	20	12
0	No	104	53	98	58

Source: World Bank data.

architecture domains of the GEA framework, which are relatively easier to implement than applications and business architecture.

There is growing interest in using GIF/GSB platforms to set the standards and automate secure data exchange between mutually interacting

Distribution of scores for indicator I-3, by income and region

a. Income-level distribution | b. Regional distribution

Source: World Bank data.
Note: HIC = high-income countries. UMIC = upper-middle-income countries. LMIC = lower-middle-income countries. LIC = low-income countries. AFR = Sub-Saharan Africa. EAP = East Asia and Pacific. ECA = Europe and Central Asia. LCR = Latin America and the Caribbean. MNA = Middle East and North Africa. SAR = South Asia.

government systems. Most of the existing GIF/GSB solutions—38 out of 71 (53 percent)—are visible in high-income countries, and the remaining platforms are mainly in middle-income countries (figure B.4, panel a). Few fragile states have GIF/GSB solutions.

Regarding regional distribution, Europe and Central Asia, Latin America and the Caribbean, and Middle East and North Africa are leading, with more than 10 countries having operational GIF/GSB platforms, as shown in figure B.4, panel b. Despite several ongoing activities to establish GIF/GSB platforms in all regions, more than half of governments, 98 out of 168 (58 percent), are not yet focused on creating such shared platforms.

Indicator I-13. Is there a government open-source software policy for the public sector?

Indicator I-13 measures the adoption of open-source software (OSS) policies by the government, based on an updated data set originally produced by the Center for Strategic and International Studies (table B.5).[5]

The adoption of OSS policies in the public sector is generally low. Most countries that have approved OSS policies—43 out of 75 (57 percent)—are in high-income countries; the remaining 32 middle-income countries have mainly advisory policies, as shown in figure B.5, panel a. Four countries—Brazil, Italy, the Netherlands, and Sweden—have mandatory OSS policies, and a large group of countries have one or more advisory policy documents promoting the use of OSS in the public sector. No fragile state has an approved OSS policy.

The pattern of regional distribution is similar, as illustrated in figure B.5, panel b. East Asia and Pacific, Europe and Central Asia, and Latin America and the Caribbean lead, with more than 41 out of 54 OSS policies adopted. Of the 109 governments (65 percent) with no OSS policy, most are in Sub-Saharan Africa.

TABLE B.5 Indicator I-13: Is there a government open-source software (OSS) policy for the public sector?

POINTS	RESPONSE	ECONOMIES		REGIONS	
		NUMBER	%	NUMBER	%
3	Yes. OSS policy is mandatory	4	2	1	1
2	Yes. OSS policy is advisory or for research and development needs	71	36	53	32
1	Yes. OSS policy is proposed	5	3	5	3
0	No	118	60	109	65

Source: World Bank data.

FIGURE B.5

Distribution of scores for indicator I-13, by income and region

a. Income-level distribution

b. Regional distribution

Source: World Bank data.
Note: HIC = high-income countries. UMIC = upper-middle-income countries. LMIC = lower-middle-income countries.
LIC = low-income countries. AFR = Sub-Saharan Africa. EAP = East Asia and Pacific. ECA = Europe and Central Asia.
LCR = Latin America and the Caribbean. MNA = Middle East and North Africa. SAR = South Asia.

Indicator I-15. Is there a national strategy for new or disruptive technologies?

Indicator I-15 measures the state of adoption of national strategy documents focused on the effective use of disruptive technologies in the public sector (table B.6).

About 64 percent (34 out of 53) of existing national strategies on disruptive technologies have been approved by the high-income countries; the rest are distributed among 13 upper-middle-income countries, 4 lower-middle-income countries, and 2 low-income countries (figure B.6, panel a). Disruptive technology strategy documents produced within the last decade have focused on artificial intelligence (AI) and machine learning—56 out of 79 (71 percent). Sixteen, mostly high-income, countries have more than one disruptive technology strategy—for example, a strategy for blockchain, Internet of Things (IoT), and drones. Most of the lower-middle-income and low-income countries do not yet focus on using disruptive technologies in the public sector.

TABLE B.6 Indicator I-15: Is there a national strategy for new or disruptive technologies?

POINTS	RESPONSE	ECONOMIES		REGIONS	
		NUMBER	%	NUMBER	%
2	Yes	53	27	34	20
1	In draft or planned	26	13	22	13
0	No	119	60	112	67

Source: World Bank data.

FIGURE B.6

Distribution of scores for indicator I-15, by income and region

Source: World Bank data.
Note: HIC = high-income countries. UMIC = upper-middle-income countries. LMIC = lower-middle-income countries. LIC = low-income countries. AFR = Sub-Saharan Africa. EAP = East Asia and Pacific. ECA = Europe and Central Asia. LCR = Latin America and the Caribbean. MNA = Middle East and North Africa. SAR = South Asia.

Most of the national disruptive technology strategies (96 percent) were adopted within the last five years. The adoption of such strategies is typically low in the public sector in most regions, as shown in figure B.6, panel b. Europe and Central Asia is the most active region, with 9 approved and 11 draft AI strategies; Sub-Saharan Africa, East Asia and Pacific, Latin America and the Caribbean, and Middle East and North Africa follow, with 24 approved strategies in total. In Sub-Saharan Africa, disruptive technology strategies have recently been approved in Benin, Mauritius, Rwanda, Sierra Leone, and South Africa. The focus on disruptive technology strategies is minimal in the South Asia region.

AI and chatbots are reducing the administrative burden on service providers by providing virtual assistance to online and mobile users. One example is the Alex chatbot developed by the Australian Taxation Office to address general taxation inquiries from citizens. Facebook chatbots are also supporting service delivery in Madagascar and the Philippines. These chatbots provide information and expand the reach for citizen feedback to monitor the implementation of decentralized service delivery, as is happening through the Madagascar Public Sector Performance Project.[6]

Indicator I-17. Is there an online public service portal for citizens and businesses?

Indicator I-17 measures the presence of online service delivery portals and the level of services provided by the governments.

A majority of the economies—152 out of 198 (77 percent)—have dedicated online public service delivery portals, and most of these—105 out of 152 (69 percent)—support level 3 or 4 transactional services (table B.7).[7] Of the 46 governments (23 percent) that have no online service portal, most are low-income countries or lower-middle-income countries (see figure B.7, panel a). Most of the fragile states do not yet have service delivery portals.

The pattern of regional distribution is similar, as shown in figure B.7, panel b. Most of the countries—123 out of 168 (73 percent)—have online public service delivery portals, and 78 governments (46 percent) provide level 3 or 4 services. Of the 45 governments (27 percent) with no online service portal, most are in the Sub-Saharan Africa region.

TABLE B.7 Indicator I-17: Is there an online public service portal for citizens and businesses?

		ECONOMIES		REGIONS	
POINTS	RESPONSE	NUMBER	%	NUMBER	%
2	Yes (level 3 or 4). Mostly transactional (G2C, G2B, G2G) including single sign-on and other advanced features	**105**	53	**78**	46
1	Yes (level 1 or 2). Mostly information or forms. Some online transactions (G2C, G2B)	**47**	24	**45**	27
0	No. There is no online public service portal yet	**46**	23	**45**	27

Source: World Bank data.
Note: G2B = government to business. G2C = government to citizen. G2G = government to government.

FIGURE B.7

Distribution of scores for indicator I-17, by income and region

Source: World Bank data.
Note: HIC = high-income countries. UMIC = upper-middle-income countries. LMIC = lower-middle-income countries. LIC = low-income countries. AFR = Sub-Saharan Africa. EAP = East Asia and Pacific. ECA = Europe and Central Asia. LCR = Latin America and the Caribbean. MNA = Middle East and North Africa. SAR = South Asia.

Indicator I-25. Is there a national portal for citizen participation in policy decision-making?

While there are many different approaches to citizen engagement and participation in the policy process, enabling online tools is one way to extend citizen reach and promote engagement. Indicator I-25 measures the presence of multifunctional citizen participation platforms (table B.8).

Figure B.8, panel a shows that about half of the countries in high-income and upper-middle-income countries—60 out of 119—have multifunctional national portals for citizen participation. Such platforms are not available in most low-income countries. Of the 82 countries with a citizen participation platform, 49 governments provide options to submit petitions, 56 publish citizens' input online, 32 allow citizens to provide feedback anonymously, and 37 respond to citizens' questions.

A relatively small group of countries in the World Bank Group regions—60 out of 168 (36 percent)—have a citizen participation portal, as illustrated in figure B.8, panel b. Europe and Central Asia (15), Latin America and the Caribbean (13), East Asia and Pacific (12), and Middle East and North Africa (10) lead, with online portals providing various options for citizen participation. Only 6 countries out of 48 in the Sub-Saharan Africa region have a citizen participation platform.

TABLE B.8 Indicator I-25: Is there a national portal for citizen participation in policy decision-making?

		ECONOMIES		REGIONS	
POINTS	RESPONSE	NUMBER	%	NUMBER	%
1	Yes	82	41	60	36
0	No	116	59	108	64

Source: World Bank data.

FIGURE B.8

Distribution of scores for indicator I-25, by income and region

a. Income-level distribution

b. Regional distribution

Source: World Bank data.
Note: HIC = high-income countries. UMIC = upper-middle-income countries. LMIC = lower-middle-income countries. LIC = low-income countries. AFR = Sub-Saharan Africa. EAP = East Asia and Pacific. ECA = Europe and Central Asia. LCR = Latin America and the Caribbean. MNA = Middle East and North Africa. SAR = South Asia.

Indicator I-34. Is there a government body focused on GovTech (digital government transformation)?

GovTech has been growing globally over the last five years, and more countries are adopting a centralized approach to managing the digital transformation. Indicator I-34 measures the presence of GovTech institutions established to lead digital transformation in the public sector (table B.9).

Of the 80 countries with a GovTech institution in charge of public sector modernization, 41 are high-income countries, 21 are upper-middle-income countries, 17 are lower-middle-income countries, and 1 is a low-income country (figure B.9, panel a). Around 86 percent of these institutions were established within the last six years to implement new digital transformation action plans. Among these, 27 GovTech institutions are under the president's or prime minister's administration as a central government agency, 15 are connected to the ministry of ICT, and others are either autonomous or connected to another public entity. Mature GovTech institutions are focused on several key aspects of the digital government agenda, including policy or strategy, e-government or e-services, private sector partnership, digital skills, and use of disruptive technologies in the public sector. Most of the fragile states do not yet have a GovTech institution.

Regarding regional distribution, 20 out of 60 GovTech institutions (33 percent) were established in the Europe and Central Asia region; the East Asia and

TABLE B.9 **Indicator I-34: Is there a government body focused on GovTech (digital government transformation)?**

POINTS	RESPONSES	ECONOMIES		REGIONS	
		NUMBER	%	NUMBER	%
1	Yes. There is a GovTech institution established	**80**	40	**60**	36
0	No	**118**	60	**108**	64

Source: World Bank data.

FIGURE B.9

Distribution of scores for indicator I-34, by income and region

Source: World Bank data.
Note: HIC = high-income countries. UMIC = upper-middle-income countries. LMIC = lower-middle-income countries. LIC = low-income countries. AFR = Sub-Saharan Africa. EAP = East Asia and Pacific. ECA = Europe and Central Asia. LCR = Latin America and the Caribbean. MNA = Middle East and North Africa. SAR = South Asia.

Pacific (12), Latin America and the Caribbean (11), Middle East and North Africa (9) and South Asia (5) regions follow, as shown in figure B.9, panel b. Most of the governments in Sub-Saharan Africa do not yet focus on GovTech institutions.

Indicator I-35. Is there a government entity in charge of data governance or data management?

Data governance and management institutions are a growing trend, reflecting the challenges of data protection and privacy and the potential to use data for digital entrepreneurship, contributing to development of the digital economy. Indicator I-35 measures the presence of dedicated data governance entities in the public sector (table B.10).

About 70 percent of existing data governance institutions are in high-income countries (34 out of 49); 10 upper-middle-income countries and 5 lower-middle-income countries follow, as shown in figure B.10, panel a. In 12 countries, either the establishment of new data governance bodies is in progress or there are plans to establish them. Of the 61 data governance institutions established or in progress, 27 are separate or autonomous institutions, whereas 34 are part of another government entity. Of these institutions, 50 support a holistic data governance approach, with a central body supporting all entities, and the remaining 11 support multilevel data governance—a central or federal agency provides guidelines, but data governance is implemented

TABLE B.10 Indicator I-35: Is there a government entity in charge of data governance or data management?

POINTS	RESPONSE	ECONOMIES		REGIONS	
		NUMBER	%	NUMBER	%
2	Yes. Established by law	49	25	31	18
1	Planned or in progress	12	6	8	5
0	No	137	69	129	77

Source: World Bank data.

FIGURE B.10

Distribution of scores for indicator I-35, by income and region

a. Income-level distribution

b. Regional distribution

Source: World Bank data.
Note: HIC = high-income countries. UMIC = upper-middle-income countries. LMIC = lower-middle-income countries. LIC = low-income countries. AFR = Sub-Saharan Africa. EAP = East Asia and Pacific. ECA = Europe and Central Asia. LCR = Latin America and the Caribbean. MNA = Middle East and North Africa. SAR = South Asia.

separately by each nation or state. Nearly 60 percent of these institutions were established within the last six years.

Regarding regional distribution, a relatively small group of countries, 31 out of 168 (18 percent), have dedicated data governance institutions (see figure B.10, panel b). The East Asia and Pacific region has the largest number of data governance institutions with 10; the Europe and Central Asia (7), Latin America and the Caribbean (6), and Middle East and North Africa (5) regions follow. Another 8 institutions are expected to be established soon in four regions: Europe and Central Asia, Sub-Saharan Africa, Latin America and the Caribbean, and Middle East and North Africa. Only 2 out of 48 countries in Sub-Saharan Africa are in the process of establishing a new institution for data governance.

Indicator I-47. Is there an academic or public program to improve digital skills or data literacy and innovation in the public sector?

Countries are recognizing the need to upskill their civil servants and increasing the focus on enhancing digital skills in the public sector. Indicator I-47 measures the presence of specific programs available to improve digital skills and innovation in the public sector (table B.11).

Worldwide, 107 programs are available for improving digital skills and data literacy in the public sector. Nearly half of these programs are in high-income countries, and the remaining are in middle-income countries (figure B.11,

TABLE B.11 Indicator I-47: Is there an academic or public program to improve digital skills or data literacy and innovation in the public sector?

POINTS	RESPONSE	ECONOMIES		REGIONS	
		NUMBER	%	NUMBER	%
1	Yes	107	54	81	48
0	No	91	46	87	52

Source: World Bank data.

FIGURE B.11

Distribution of scores for indicator I-47, by income and region

a. Income-level distribution

b. Regional distribution

HIC ■ UMIC ■ LMIC ■ LIC

HIC ■ UMIC ■ LMIC ■ LIC ■ LMIC ■ LIC

Source: World Bank data.
Note: HIC = high-income countries. UMIC = upper-middle-income countries. LMIC = lower-middle-income countries. LIC = low-income countries. AFR = Sub-Saharan Africa. EAP = East Asia and Pacific. ECA = Europe and Central Asia. LCR = Latin America and the Caribbean. MNA = Middle East and North Africa. SAR = South Asia.

panel a). Only 6 out of 29 low-income countries (20 percent) have specific programs focused on improving digital skills. Most of these programs, 100 out of 107 (93 percent), were launched by public entities; GovTech programs of academic and civil society organization exist in several countries, including Canada, Colombia, India, Jordan, Spain, South Africa, and the United States. About 70 percent of the programs were initiated within the last five years.

Regarding regional distribution, Europe and Central Asia and Latin America and the Caribbean are leading, with 20 and 19 countries, respectively, having specific public sector training programs to enhance digital skills; East Asia and Pacific, Middle East and North Africa, and South Asia follow (figure B.11, panel b). Despite the presence of relevant programs in 15 countries, most governments in the Sub-Saharan Africa region—33 out of 48 (69 percent)—invest little in the development of digital skills in the public sector. In addition to these government-led programs, development partners also provide free massive open online courses—for example, Atingi and Apolitical's GovTech course to enhance digital skills and data literacy in the public sector.[8]

Indicator I-48. Is there a government entity or strategy focused on public sector innovation?

There is growing interest in establishing public sector innovation labs or public entities supporting innovation and digital skills in collaboration with the private sector. Indicator I-48 measures the presence of government entities with a mandate to improve public sector innovation (table B.12).

Of the 90 countries with a dedicated unit or GovLab for public sector innovation, 45 are high-income countries, 21 are upper-middle-income countries, 20 are lower-middle-income countries, and 5 are low-income countries, as presented in figure B.12, panel a. There are 9 other ongoing initiatives to establish such units in 9 countries. Many of these initiatives, 64 out of 100 (64 percent), are focused on supporting innovation and improving digital skills in the public sector. About 55 percent of these initiatives were launched within the last five years.

Europe and Central Asia and Latin America and the Caribbean are leading, with 20 and 18 countries, respectively, having GovLab initiatives or strategy documents supporting the enhancement of digital skills and innovation in the public sector; East Asia and Pacific, Middle East and North Africa, and South Asia follow, as illustrated in figure B.12, panel b. Despite the presence of relevant initiatives in 13 countries, most governments in the Sub-Saharan Africa region—35 out of 48 (73 percent)—do not focus on public sector innovation.
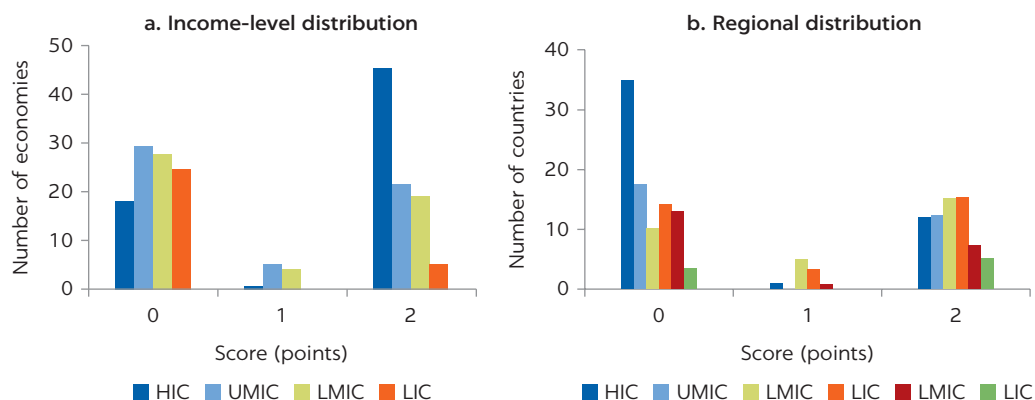
TABLE B.12 Indicator I-48: Is there a government entity or strategy focused on public sector innovation?

POINTS	RESPONSE	ECONOMIES		REGIONS	
		NUMBER	%	NUMBER	%
2	Yes	90	46	66	40
1	Planned or in progress	10	5	10	5
0	No	98	49	92	55

Source: World Bank data.

FIGURE B.12

Distribution of scores for indicator I-48, by income and region

Source: World Bank data.
Note: HIC = high-income countries. UMIC = upper-middle-income countries. LMIC = lower-middle-income countries.
LIC = low-income countries. AFR = Sub-Saharan Africa. EAP = East Asia and Pacific. ECA = Europe and Central Asia.
LCR = Latin America and the Caribbean. MNA = Middle East and North Africa. SAR = South Asia.

NOTES

1. For the *World Development Report 2016: Digital Dividends*, see https://www.worldbank.org/en/publication/wdr2016. For the Digital Adoption Index, see https://www.worldbank.org/en/publication/wdr2016/Digital-Adoption-Index. For the GovTech Maturity Index, see https://www.worldbank.org/en/programs/govtech/gtmi. For the GovTech data set, see https://datacatalog.worldbank.org/search/dataset/0037889/GovTech-Dataset. For the *World Development Report 2021: Data for Better Lives*, see https://www.worldbank.org/en/publication/wdr2021.

2. The Open Group Architecture Framework (TOGAF) defines *government enterprise architecture* as "a whole of government approach to support government ecosystems by transcending boundaries for delivering services in a coordinated, efficient, and equitable manner." TOGAF supports all four components of enterprise architecture: business (or business process) architecture, applications architecture, data architecture, and technology architecture. See https://blog.opengroup.org/2018/05/15/government-enterprise-architecture-beyond-business-as-usual-for-better-outcomes/.

3. For the TOGAF website, see https://www.opengroup.org/togaf.

4. A *government interoperability framework* is a document that specifies a set of common elements such as vocabularies, concepts, principles, policies, guidelines, recommendations, standards, and practices for agencies that work together for the joint delivery of human-centric joined-up public services (Lisboa and Soares 2014). A *government service bus* is a secure and integrated platform for automating data exchange between mutually interacting software applications in a service-oriented architecture based on well-defined protocols. See https://en.wikipedia.org/wiki/Enterprise_service_bus.

5. The Government Open Source Policies data set was originally developed in 2010 (Lewis 2010). It has been expanded by including new policy documents adopted by the government within the last decade.

6. For more on the Madagascar project, see https://documents1.worldbank.org/curated/en/678101603328051531/pdf/Disclosable-Version-of-the-ISR-Public-Sector-Performance-Project-P150116-Sequence-No-09.pdf.

7. The United Nations proposes a four-stage model of e-service maturity ranging from level 1 (emerging) to level 4 (connected) (UN 2014).

8. For Atingi, see https://www.atingi.org. For Apolitical's GovTech course, see https://apolitical.co/fieldguides/building-govtech-and-digital-government-skill.

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Comparison with Other GovTech Indexes

This appendix compares the GovTech Maturity Index (GTMI) with other relevant GovTech indexes to demonstrate the consistency of findings and observations.

RELATIONSHIP WITH THE UNITED NATIONS E-GOVERNMENT DEVELOPMENT INDEX

Since all three components of the United Nations (UN) e-Government Development Index (EGDI)[1] and e-Participation Index (EPI) are highly relevant to the GovTech domain, they were used to calculate the composite GTMI in addition to 42 indicators defined by the World Bank team and included in the GovTech data set. The scatter diagram of the GTMI and the EGDI reveals a positive correlation between these scores, as expected (figure C.1).

Due to the importance of the EGDI and EPI, specific weights were assigned to each of these indexes while calculating the GTMI and its four components. Table C.1 demonstrates that the grouping of countries based on the additional 42 key GovTech indicators defined for this study is largely consistent with the EGDI groups, despite some differences.

The EGDI measures the readiness and capacity of national institutions to use information and communication technologies (ICTs) to deliver public services based on comprehensive survey results and rich data sets. According to the EGDI, 126 out of 193 countries (65 percent) have high or very high scores and offer specific digital services for youth, women, older people, persons with disabilities, migrants, and the poor, contributing to efforts aimed at leaving no one behind. Similarly, more governments are using online platforms for public procurement and recruitment of civil servants—80 percent of countries publish government vacancies online. The GTMI scores for some of these countries are lower than the EGDI scores. These differences are due to their relatively lower level of maturity in specific GovTech focus areas, including whole-of-government approach, citizen-centric and universally accessible services, and citizen engagement.

As shown in table C.1, 57 countries have very high EGDI scores, 37 of which are among the GovTech leaders (Group A) based on their GTMI scores. Some of these countries have lower GTMI scores (18 in Group B and 2 in Group C), since their focus on four GovTech focus areas is weaker than

Comparison of the GovTech Maturity Index with the United Nations e-Government Development Index

$$y = 0.5736x^2 + 0.3175x + 0.0966$$
$$R^2 = 0.7193$$

Source: World Bank data (193 economies).
Note: GTMI = GovTech Maturity Index. EGDI = e-Government Development Index.

TABLE C.1 Comparison of the GovTech Maturity Index with the United Nations e-Government Development Index, by number of countries in each group

EGDI SCORE	COUNTRY	A	B	C	D
0.75–1.00	57	37	18	2	0
0.50–0.74	69	5	34	27	3
0.25–0.49	59	0	6	31	22
0.00–0.24	8	0	0	0	8
Total	**193**	42	58	60	33

Source: World Bank data.
Note: GTMI = GovTech Maturity Index. EGDI = e-Government Development Index.

that of other countries. Similarly, 69 countries have high EGDI scores (Group B), and more than half of these—39 out of 69 countries (57 percent)—have relatively high GovTech scores (Groups A or B). The remaining 30 countries have lower GTMI scores: 27 in Group C and 3 in Group D. The main reason

for these patterns is the focus on new GTMI indicators that measure lesser-known aspects of public sector digital transformation not measured by the EGDI and other indexes.

Also, 67 countries have medium or low EGDI scores (Groups C and D), and about half of these countries—37 out of 67 (55 percent)—have made some investments in GovTech focus areas to enable them to receive medium or higher GTMI scores. Despite this, the remaining 30 countries have low GTMI scores, indicating that they have little or no interest in the GovTech agenda. This finding demonstrates that the GTMI measures more specific dimensions of the GovTech agenda than the EGDI and that more countries in Groups C and D—93 out of 193 (47 percent)—do not focus enough on GovTech enablers and other focus areas.

The overall conclusion of the comparison of the GTMI with the 2020 EGDI is that the GTMI can be useful for monitoring the maturity of digital transformation in four focus areas.

COMPARISON WITH THE OECD DIGITAL GOVERNMENT INDEX

The Organisation for Economic Co-operation and Development (OECD) Digital Government Index (DGI) was published in October 2020 to measure the maturity of digital government in 33 countries, including 29 OECD member countries and 4 nonmember countries: Argentina, Brazil, Panama, and Uruguay, with a focus on six key aspects: digital by design, data-driven public sector, government as a platform, open by default, user-driven approach, and proactiveness. Since these dimensions are highly relevant to the GovTech agenda, figure C.2 compares the DGI and the GTMI.

FIGURE C.2

Comparison of the GovTech Maturity Index with the OECD Digital Government Index

$$y = 0.3218x^2 + 0.0002x + 0.7518$$
$$R^2 = 0.1837$$

Source: World Bank data (33 countries).
Note: GTMI = GovTech Maturity Index. OECD = Organisation for Economic Co-operation and Development. DGI = Digital Government Index.

TABLE C.2 Comparison of the GovTech Maturity Index with the OECD Digital Government Index, by number of countries in each group

DGI SCORE	COUNTRY	A	B	C	D
0.75–1.00	0	0	0	0	0
0.50–0.74	17	17	0	0	0
0.25–0.49	16	11	5	0	0
0.00–0.24	0	0	0	0	0
Total	**33**	28	5	0	0

Source: World Bank data.
Note: GTMI = GovTech Maturity Index. OECD = Organisation for Economic Co-operation and Development.

As shown in table C.2, 17 countries have high scores on all six dimensions of the DGI, and their GTMI scores are comparable (17 in Group A). Similarly, 16 countries have high scores on some of the DGI dimensions, and their GTMI scores are also high (11 in Group A and 5 in Group B). This finding indicates that the OECD's DGI and new GTMI consistently capture most of the good practices in the GovTech domain, with comparable indicators.

COMPARISON WITH THE CAF GOVTECH INDEX

The GovTech Index 2020 published by the Development Bank of Latin America (CAF) in June 2020 also measures the degree of maturity of GovTech ecosystems, the dynamism of tech-for-good start-up markets, and the degree of innovation of public institutions. A comparison of the CAF GovTech Index (CGTI) and the GTMI is presented in figure C.3.

The CGTI consists of 28 indicators across seven dimensions. Most of these indicators (24) were taken from existing data sets, but some (4 new indicators) were calculated by the CAF, as explained in the CGTI methodology. Specific weights were used in the CGTI based on the opinions of local experts, similar to the GTMI approach.

As shown in table C.3, seven countries, all in Group A, have relatively high scores on all seven dimensions of the CGTI, and their GTMI scores are comparable. Similarly, eight countries have high scores on some of the CGTI dimensions and also high GTMI scores—two in Group A and six in Group B. Only one country has relatively lower scores on all dimensions of the CGTI, but higher scores on the GTMI. The CGTI indicators are more focused on indicators for the innovation environment, start-ups, and broader digital government, while the GTMI is more focused on four focus areas. Hence, most of the 16 countries included in the CGTI survey have higher GTMI scores due to differences in the selected indicators. This comparison indicates that the CGTI and the GTMI are complementary, yielding comparable results.

The indicators defined for this study produce consistent results when compared to relevant indicators used in other indexes and also highlight less-known dimensions related to GovTech initiatives, complementing existing surveys and data sets.

FIGURE C.3

Comparison of the GovTech Maturity Index with the CAF GovTech Index

Source: World Bank data (16 countries).
Note: GTMI = GovTech Maturity Index. CAF = Development Bank of Latin America. CGTI = CAF GovTech Index.

TABLE C.3 **Comparison of the GovTech Maturity Index with the CAF GovTech Index, by number of countries in each group**

CGTI SCORE	COUNTRY	A	B	C	D
0.75–1.00	0	0	0	0	0
0.50–0.74	7	7	0	0	0
0.25–0.49	8	2	6	0	0
0.00–0.24	1	0	0	1	0
Total	**16**	9	6	1	0

Source: World Bank data.
Note: GTMI = GovTech Maturity Index. CGTI = Development Bank of Latin America (CAF) GovTech Index.

INDICATORS SHOWING THE IMPACT OF GOVTECH ON BROADER ASPECTS OF GOVERNANCE

GovTech initiatives provide governments with opportunities to improve public services, get better value-for-money, and curb corruption. Several governance indicators can be compared with the GTMI to obtain a better sense of the potential impact of GovTech on broader aspects of governance. This section presents the relationship of the GTMI with the Corruption Perceptions Index (CPI) and two of the Worldwide Governance Indicators (WGI).

Figure C.4 compares the GTMI with the CPI.[2] The top 17 countries with the lowest level of perceived corruption (CPI >= 75) have relatively high GTMI scores: 16 in Group A and 1 in Group B).

A higher maturity level of GovTech initiatives correlates positively with improved perceptions of corruption.

Comparison of the GovTech Maturity Index with the Corruption Perceptions Index

Source: World Bank data (180 economies).
Note: GTMI = GovTech Maturity Index. CPI = Corruption Perceptions Index.

The Worldwide Governance Indicators[3] include several relevant dimensions that could be used to calculate the GTMI. After a detailed review of the underlying data sets, it was noted that the sources used for calculating various components did not cover most of the 198 economies historically. Hence, the WGI was not used to calculate the GTMI. Instead, the GTMI scores were compared with the indicators for government effectiveness, control of corruption, and voice and accountability.

The WGI government effectiveness indicator is based on the data collected from more than 30 sources covering 196 countries about the perceived quality of public services, coupled with the commitment of governments to policies geared toward improving the quality of service delivery. The scatter diagram comparing the GTMI and the government effectiveness indicator shows a positive correlation across 196 economies (figure C.5).

This finding indicates that governments with a higher level of commitment to improving the quality of public services have relatively higher GTMI scores, consistent with their focus on four areas linked to public sector modernization.

The WGI control of corruption indicator quantifies the perceptions of the degree to which public power is exercised for private gain. The scatter diagram comparing the GTMI and the WGI control of corruption indicator shows a

positive association across 196 economies (figure C.6). This implies that advancement in digital transformation can improve the capability of governments to control corruption and promote inclusive prosperity.

The WGI voice and accountability indicator presents the degree to which citizens can participate in electing their government, together with their degree of freedom of expression and association. The relationship between the GTMI and the WGI voice and accountability indicator shows a positive correlation across 198 economies (figure C.7).

The pattern for the relationship of the voice and accountability indicator with the GTMI is similar to that for the WGI control of corruption indicator. Most of the 18 countries with high scores on voice and accountability (between 1.25 and 2.5) also have high scores on GovTech: 15 in Group A, 2 in Group B, and 1 in Group C.

Improvements in public sector digital transformation can promote inclusive governance by providing greater opportunities for citizens not only to elect governments periodically, but also to voice their concerns or participate in major decisions that are important to them.

FIGURE C.5

Comparison of the GovTech Maturity Index with the WGI government effectiveness indicator

$$y = 0.8573x^2 + 2.0715x - 1.4263$$
$$R^2 = 0.5399$$

Source: World Bank data (196 economies).
Note: GTMI = GovTech Maturity Index. WGI = Worldwide Governance Indicator.

Comparison of the GovTech Maturity Index with the WGI control of corruption indicator

$$y = 2.1542x^2 + 0.0795x + 0.8246$$
$$R^2 = 0.3525$$

Source: World Bank data (196 economies).
Note: GTMI = GovTech Maturity Index. WGI = Worldwide Governance Indicator.

Comparison of the GovTech Maturity Index with the WGI voice and accountability indicator

$$y = 1.6618x^2 + 0.0742x - 0.6192$$
$$R^2 = 0.2113$$

Source: World Bank data (198 economies).
Note: GTMI = GovTech Maturity Index. WGI = Worldwide Governance Indicator.

NOTES

1. The 2020 EGDI measures the scope and quality of online services, the status of telecommunication infrastructure, and existing human capacity in 193 UN member states. The UN EPI is a supplementary index that extends the EGDI by focusing on government's use of online services to provide information to citizens (e-information sharing), interact with stakeholders (e-consultation), and engage in decision-making processes (e-decision-making).

2. The CPI is a composite index—a combination of 13 surveys and assessments of corruption, collected by a variety of reputable institutions. It scores countries based on how corrupt a country's public sector is perceived by experts and business executives. Each of the sources included in the CPI is standardized to allow for aggregation into the CPI score. The standardization converts all of the data points to a scale of 0–100, where 0 represents the highest level of perceived corruption and 100 represents the lowest level of perceived corruption in 180 countries. See https://www.transparency.org/en/cpi/2020/index/nzl.

3. The WGI reports aggregate and individual governance indicators for more than 200 countries and territories over the period 1996–2019 for six dimensions of governance: (a) voice and accountability, (b) political stability and absence of violence, (c) government effectiveness, (d) regulatory quality, (e) rule of law, and (f) control of corruption. These indicators are not available for all 200 economies included in the WGI data set. The indicators for governance effectiveness and control of corruption are available for 196 out of 198 economies included in the GovTech data set; the indicator for voice and accountability is available for all 198 economies. See https://info.worldbank.org/governance/wgi/.

Weight Calculations

To construct the GovTech Maturity Index (GTMI) and make it policy-relevant, six primary steps were followed.[1] The first step involved defining the phenomenon being measured—GovTech—which encompasses four focus areas. The second step was to determine the primary purposes and objectives of the index. This decision informed the decision to construct mostly actionable indicators to help policy makers not only to identify gaps but also to act on them. Considering the purpose of the index also helped to determine the unit of analysis for collecting data as well as for reporting the results. The third step entailed identifying a set of desirable characteristics that the index should exhibit: (a) simplicity in understanding and description, (b) coherence and conformity with the measured phenomenon, (c) fitness for purpose and ultimate use, (d) rigor or technical soundness, and (e) actionability.[2] The fourth step was to consider the conceptual domains of the index and determine areas with relatively greater importance. The fifth step was to choose the indicators and method of aggregation. In the fifth step, a weighted average approach was selected (with differential weights at the indicator level) to construct subindexes for the four GovTech focus areas, which were aggregated further into a GTMI as a simple average.

The sixth and final step noted the invariance axioms that the index should satisfy to meet its objectives over time and assure consistency. The GTMI satisfies four main axioms. First, the index satisfies monotonicity, meaning that, all else being equal, an increase in the score of one indicator increases the overall score of the index. Second, the index satisfies subgroup decomposability, implying that it can be decomposed into subgroups for further analysis. Third, the index satisfies the replication axiom, such that if a set of indicator scores is formed by replicating the existing set and order of scores an arbitrary number of times, the GTMI score remains the same. Fourth, the index is non-negative and equal to zero if and only if all indicators record zero scores.

To find the best fit for calculating the four key component indexes used in GTMI calculations, the following options were considered:

- *GT0 (no weights)*. Simple arithmetic average of four component index scores—Core Government Systems Index (CGSI), Public Service Delivery Index (PSDI), Citizen Engagement Index (CEI), and GovTech Enablers Index (GTEI)—without any weight calculation.
- *GTE (with weights based on expert opinion)*. Average of the four weighted component index scores using specific weights identified by experts involved

in digital government or GovTech projects for selected key indicators that are not measured in well-known surveys or indexes.

- *GTC (with weights based on correlation analysis with standardized scores).*[3] Average of the four weighted component scores using correlation analysis applied to all key indicators.
- *GTF (with weights based on factor analysis with standardized scores).* Arithmetic average of the four weighted component scores using factor analysis applied to all key indicators.

GT0 and GTE options are explained in chapter 2. The details of GTC and GTF are explained in this appendix. These options were considered to allocate differential weights to indicators depending on the degree to which they explain any variation among the indicators or are associated with changes in the composite GTMI across countries. A key advantage of these approaches is that weights can be generated endogenously or computed from the data themselves; as such, the weights would differ depending on the variation or information in the available data.

GTC: CORRELATION ANALYSIS

Correlation analysis of the unweighted GovTech scores was performed (conditional on the raw data) using the standardized indicator Z-scores. First, a simple average of the GovTech Maturity Index was computed using raw scores from the data collection exercise. Subsequently, the raw scores for each indicator were standardized using the following formula:

$$z_{i1} = \frac{x_{i1} - \mu_1}{\sigma_1}. \tag{D.1}$$

Equation D.1 means that, to obtain the standardized score of indicator 1 for country i, denoted as z_{i1}, the mean value of indicator 1 (across all countries), μ_1, is subtracted from the raw score of indicator 1 for country i, x_{i1}, and then divided by the standard deviation of indicator 1 (across all countries), σ_1. The standardization places all indicators on equal footing or a common scale with the same mean (= 0) and variance (= 1). A critical practical implication of this transformation is that outlier values in the raw scores are accounted for and, therefore, do not unduly skew the results of the composite index.

The weight for indicator 1, for instance, is calculated using the following formula:

$$r_1 = \frac{\sum_{i=1}^{n}\left(z_{i1} - \overline{z_1}\right)\left(y_i - \overline{y}\right)}{\sqrt{\sum_{=1}^{n}\left(z_{i1} - \overline{z_1}\right)^2}\sqrt{\sum_{=1}^{n}\left(y_i - \overline{y}\right)^2}}, \tag{D.2}$$

where r_1 is the correlation coefficient or weight of indicator 1 (measures its degree of association with y), z_{i1} represents the standardized score of indicator 1 for country i, $\overline{z_1}$ is the mean of the standardized values of indicator 1 across countries, y_i denotes the score of the unweighted GTMI for country i, and $\overline{y}$ is the mean of the values of the unweighted GTMI across countries.

For example, correlating the standardized values of the e-service portal indicator (eSrv) with the unweighted GTMI across 198 economies in the

GovTech data set (using the command "correlate GTMI eSrv") in Stata produces the following correlation matrix:

```
.correlate GTI eSrv
(obs=198)
              │   GTI      eSrv
         ─────┼─────────────────
          GTI │ 1.0000
         eSrv │ 0.7482  1.0000
```

The GTMI is correlated one-to-one with itself, and likewise eSrv is correlated one-to-one with itself, but the degree of association between eSrv and GTMI is 0.75, which was used as the weight for the e-service portal indicator for all countries. The intuition is that the more closely associated an indicator is with the unweighted GTMI measure, after placing all indicators on a common scale, the more likely it is to explain variation in the composite index across countries and, therefore, the more weight it is assigned.

GTF: WEIGHTS CALCULATED BY FACTOR ANALYSIS (PRINCIPAL COMPONENTS METHOD)

Factor analysis estimates a model that explains the variation of a set of observed indicators by a set of fewer unobserved factors that are common to the observed indicators. In other words, it assumes that, for a set of indicator values for different individuals or countries, a set of unobserved variables called factors—fewer than the observed indicators—can explain the interrelationships among the observed indicators. This result is achieved by estimating the following model:

$$Z_{(NXV)} = F_{(NXf)}\, \alpha'_{(fxv)} + \varepsilon_{(NXV)}, \qquad (D.3)$$

where Z is a matrix representing the standardized indicator scores covering $N = 198$ economies and $V = 48$ indicators in this case. F represents the principal factors to be constructed that are retained, with α denoting the factor loadings. These loadings are coefficients that illustrate the degree of association between the unobserved factors and the observed indicators. The error term is denoted as ε.

Unlike a typical regression analysis where the independent variables are observed, the factors are not observed in this case. They are constructed through linear combinations of the indicator values:

$$\begin{aligned}
F_1 &= \alpha_{11}z_1 + \alpha_{12}z_2 + \ldots + \alpha_{1v}z_v \\
F_2 &= \alpha_{21}z_1 + \alpha_{22}z_2 + \ldots + \alpha_{2v}z_v \\
&\ldots \\
F_{(v)} &= \alpha_{v1}z_1 + \alpha_{v2}z_2 + \ldots + \alpha_{vv}z_v
\end{aligned} \qquad (D.3)$$

To create these factors, the set of factor loadings must be chosen. The factor loadings were chosen such that the factors are uncorrelated (orthogonal) with each other. Second, the first principal factor explains the maximum possible proportion of the variance of the set of indicator values, and the second principal factor subsequently captures the maximum of the remaining variance. This process continues until the final principal factor absorbs all of the remaining variance not accounted for by the preceding principal factors. The third condition for the choice of loadings is that, for each principal factor, the sum

of the squares of the loadings should equal 1, which is equal to the unit variance of the standardized scores.

The factors were first created to be equal to the number of indicators ($V = 48$), after which $P < V = 48$ factors that are *principal* to explaining the variation of the observed data were selected. The OECD handbook on the construction of composite indicators suggests retaining principal factors or components that (a) have associated eigenvalues > 1, (b) contribute individually to the explanation of overall variance by more than 10 percent, and (c) contribute cumulatively to the explanation of overall variance by more than 60 percent (OECD 2008). An eigenvalue measures the extent of the variance in the indicators that a factor explains. If a factor has an eigenvalue > 1, it explains more variance than a single indicator.

The *factor* command in Stata with the option *pcf* was used to estimate and subsequently rotate the factors and the loadings (with orthogonal varimax rotation) to obtain a simple structure of the unobserved factors and observed indicators. The weights were then computed as squared factor loadings normalized by the variance explained by the factor. This process is illustrated by the partial output in table D.2.

In the GTF analysis, seven factors were used that have eigenvalues > 1 and explain about 64 percent of the cumulative variance in the indicator scores, although the factors individually explain ≥ 6 percent of the overall variance (table D.1). Table D.2 presents a partial output of the weights corresponding to each indicator. For example, the weight for the government enterprise architecture (GEA) indicator was calculated by first identifying the maximum factor loading (0.712) and squaring it: $0.712^2 = 0.507$. The result was normalized by the variance explained by its factor: Factor 3 (3.979) in table D.1 to obtain the weight of 0.13.

TABLE D.1 Explained variance by each retained factor

FACTOR	VARIANCE	PROPORTION	CUMULATIVE
Factor1	8.798	0.183	0.183
Factor2	5.909	0.123	0.306
Factor3	3.979	0.083	0.389
Factor4	3.840	0.080	0.469
Factor5	2.848	0.059	0.529
Factor6	2.549	0.053	0.582
Factor7	2.548	0.053	0.635

Source: World Bank data.

TABLE D.2 Rotated factor loadings (pattern matrix): Selected indicators

VARIABLE	FACTOR1	FACTOR2	FACTOR3	FACTOR4	FACTOR5	FACTOR6	FACTOR7	MAX	MAX^2	WEIGHTS
GEA	0.324	0.202	**0.712**	0.073	0.108	0.042	−0.021	**0.712**	0.507	**0.13**
Tax	0.244	0.055	0.040	0.292	0.098	**0.673**	0.196	**0.673**	0.453	**0.18**
TaxS	0.330	0.211	0.307	0.302	−0.015	**0.594**	0.135	**0.594**	0.352	**0.14**
Cust	0.037	0.088	0.209	**0.556**	−0.065	0.350	0.552	**0.556**	0.309	**0.08**
HRM	0.190	0.114	0.033	**0.824**	0.173	0.057	0.018	**0.824**	0.680	**0.18**
Payr	0.135	0.061	0.050	**0.881**	0.139	0.085	0.028	**0.881**	0.776	**0.20**
PSI	0.385	0.237	0.413	0.105	**0.550**	0.112	0.095	**0.550**	0.303	**0.11**

Source: World Bank data.
Note: GEA = government enterprise architecture. Tax = tax management information system. TaxS = tax system. Cust = customs system. HRM = human resource management system. Payr = payroll system. PSI = public service index.

Details of the GTMI calculations with or without weights (total number of economies and average scores for each group) are shown in table D.3, panels a–f. GT0 represents the distribution of countries based on GTMI calculations with no weights. GTE option filters ongoing GovTech activities using some weights and resulting in fewer countries in Group C than the GT0 option. The GTC and GTF are based on weights from correlation and factor analyses using standardized scores. The GTC option results in a similar grouping of countries compared to the GTE, with some differences in countries in Groups C and D. The GTF option produces a distribution substantially different than other options, and the number of outliers increases.

After the comparison of results based on four different index construction options, it was realized that the scores and groupings generated using the GTF option (using weights based on factor analysis with standardized scores) were substantially different from those generated using the other options, creating an unrealistic mapping of GovTech focus areas. The GTE (using weights based on expert opinion) and GTC (using weights based on correlation analysis with standardized scores) options generated similar results. However, the GTC option created some unrealistic scores, especially for some countries in Groups A and D. The GT0 (no weights) option also produced similar results to the GTE option, but there were deviations in countries in Groups C and D. The GTE scores produced the best fit, since the weights assigned by experts captured the less-known aspects of GovTech focus areas more accurately than other options.

TABLE D.3 **Comparison of GovTech Maturity Index calculations using various options for weights**

A. GT0 (WITHOUT WEIGHTS)					B. GTE (WEIGHTS: EXPERT OPINION)				
GROUP	GT0	CGSI	PSDI	CEI	GTEI	GROUP	GTE	CGSI	PSDI	CEI	GTEI

GROUP	GT0	CGSI	PSDI	CEI	GTEI	GROUP	GTE	CGSI	PSDI	CEI	GTEI
A	**44**	60	76	26	65	A	**43**	34	73	52	56
B	**61**	96	58	42	53	B	**59**	57	63	31	45
C	**74**	27	48	33	49	C	**63**	77	43	42	56
D	**19**	15	16	97	31	D	**33**	30	19	73	41
Total	**198**	198	198	198	198	Total	**198**	198	198	198	198

| C. GTC (WEIGHTS: CORRELATION ANALYSIS) | | | | | D. GTF (WEIGHTS: FACTOR ANALYSIS) | | | | |

GROUP	GTC	CGSI	PSDI	CEI	GTEI	GROUP	GTF	CGSI	PSDI	CEI	GTEI
A	**42**	58	65	24	59	A	**45**	103	59	20	87
B	**62**	87	78	41	49	B	**75**	67	84	40	69
C	**71**	40	43	36	48	C	**66**	20	44	21	28
D	**23**	13	12	97	42	D	**12**	8	11	117	14
Total	**198**	198	198	198	198	Total	**198**	198	198	198	198

| E. COMPARISON OF GTMI CALCULATIONS | | | | | F. COMPARISON OF UNITED NATIONS EGDI AND GTE | | |

GROUP	EGDI	GT0	GTE	GTC	GTF	GROUP	EGDI	GTE
A	57	44	**43**	42	45	A	57	43
B	69	61	**59**	62	75	B	69	57
C	59	74	**63**	71	66	C	59	60
D	8	19	**33**	23	12	D	8	33
Total	193	198	**198**	198	198	Total	193	193

Source: World Bank data.
Note: CEI = Citizen Engagement Index. CGSI = Core Government Systems Index. GTEI = GovTech Enablers Index. GTMI = GovTech Maturity Index. PSDI = Public Service Delivery Index. Total number of economies in each group is shown for four GTMI calculation options and the United Nations e-Government Development Index (EGDI).

The GTMI scores were calculated using the weights based on expert opinion to reflect the relative degrees of importance of the selected indicators, as determined by the extant literature, observations during the data collection process and World Bank operational experience.

In comparison with the United Nations e-Government Development Index (EGDI), the primary GTE index (the GTMI computed using weights based on expert opinion) recorded relatively fewer countries in Groups A and B, but more countries in Groups C and D, as indicated in table D.3. This appears to be reasonable, since the EGDI measures a broader spectrum of e-government systems and services, whereas the GTMI measures the state of relatively new initiatives related to digital transformation, with a focus on more advanced capabilities and a whole-of-government approach to public sector modernization.

NOTES

1. Similar to the construction of the updated Statistical Capacity Index (also called the Statistical Performance Index), as explained in Cameron et al. (2019).
2. With regard to conformity with GovTech, the weighted average is linear in nature; as such, it does not describe nonlinear changes in GovTech status. Furthermore, it assumes that the indicators capture separate phenomena, although, in reality, some indicators may interact.
3. The Z-score standardization procedure was implemented for each component indicator to ensure that the overall GTMI was decided equally by the four component indexes—that is, each component index presents comparable variance after the Z-score standardization (similar to United Nations e-Government Development Index calculations).

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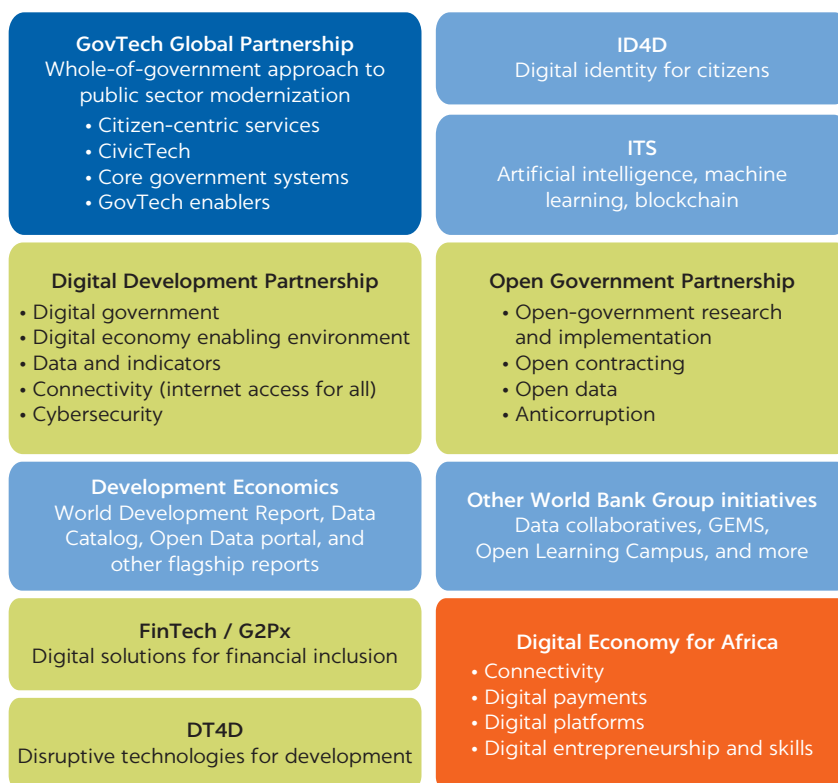
OTHER PROGRAMS FOCUSED ON GOVTECH

In addition to the GovTech initiative, other World Bank programs are focused on important aspects of the GovTech agenda, as presented in figure E.1.

The following are web links to the World Bank Group initiatives in the GovTech domain:

- Data Catalog: https://datacatalog.worldbank.org/search/dataset/0037889/GovTech-Dataset
- Data Collaboratives: https://datacollaboratives.org
- Development Data Partnership: https://datapartnership.org
- Development Economics: https://www.worldbank.org/en/about/unit/unit-dec
- Digital Development Partnership: https://www.worldbank.org/en/programs/digital-development-partnership#1
- Digital Economy for Africa: https://www.worldbank.org/en/programs/all-africa-digital-transformation
- Digitizing Government-to-Person Payments: https://www.worldbank.org/en/programs/g2px
- Disruptive Technologies for Development: https://collaboration.worldbank.org/content/usergenerated/asi/cloud/attachments/sites/collaboration-for-development/en/groups/urbanscapes/calendar/_jcr_content/content/primary/calendar/disruptive_technolog-MZpm/Victor%20Mulas.pdf
- Financial Technology: https://www.worldbank.org/en/topic/fintech

FIGURE E.1

World Bank programs focused on the GovTech agenda

GovTech Global Partnership
Whole-of-government approach to public sector modernization
- Citizen-centric services
- CivicTech
- Core government systems
- GovTech enablers

ID4D
Digital identity for citizens

ITS
Artificial intelligence, machine learning, blockchain

Digital Development Partnership
- Digital government
- Digital economy enabling environment
- Data and indicators
- Connectivity (internet access for all)
- Cybersecurity

Open Government Partnership
- Open-government research and implementation
- Open contracting
- Open data
- Anticorruption

Development Economics
World Development Report, Data Catalog, Open Data portal, and other flagship reports

Other World Bank Group initiatives
Data collaboratives, GEMS, Open Learning Campus, and more

FinTech / G2Px
Digital solutions for financial inclusion

Digital Economy for Africa
- Connectivity
- Digital payments
- Digital platforms
- Digital entrepreneurship and skills

DT4D
Disruptive technologies for development

Source: World Bank staff.
Note: DT4D = Disruptive Technologies for Development. FinTech = Financial Technology. GEMS = Geo-Enabling Initiative for Monitoring and Supervision. G2Px = Digitizing Government-to-Person Payments. ID4D = Identification for Development. ITS = Technology and Innovation Labs.

- Geo-Enabling Initiative for Monitoring and Supervision: https://www.worldbank.org/en/topic/fragilityconflictviolence/brief/geo-enabling-initiative-for-monitoring-and-supervision-gem; see also https://www.worldbank.org/en/news/feature/2019/11/11/using-pocket-science-to-monitor-and-supervise-operations-in-fragile-and-conflict-affected-settings
- Geospatial Data Access portal: https://www.worldbank.org/en/about/corporate-procurement/business-opportunities/administrative-procurement/geospatial-data-access
- GovTech Global Partnership: https://www.worldbank.org/en/programs/govtech
- Identification for Development: https://id4d.worldbank.org
- Open-Data portal: https://data.worldbank.org
- Open Government Partnership: https://www.opengovpartnership.org
- Open Learning Campus: https://olc.worldbank.org
- Technology and Innovation Labs: https://collaboration.worldbank.org/content/sites/collaboration-for-development/en/groups/the-smart-cities/calendar.event.html/meet_the_its_technol-gE6U.html.

Governments have been using technology to modernize the public sector for decades. The World Bank Group (WBG) has been a partner in this process, providing both financing and technical assistance to facilitate countries' digital transformation journeys since the 1980s.

The WBG launched the GovTech Initiative in 2019 to support the latest generation of these reforms. Over the past five years, developing countries have increasingly requested WBG support to design even more advanced digital transformation programs. These programs will help to increase government efficiency and improve the access to and the quality of service delivery, provide more government-to-citizen and government-to-business communications, enhance transparency and reduce corruption, improve governance and oversight, and modernize core government operations. The GovTech Initiative appropriately responds to this growing demand.

The GovTech Maturity Index (GTMI) measures the key aspects of four GovTech focus areas—supporting core government systems, enhancing service delivery, mainstreaming citizen engagement, and fostering GovTech enablers—and assists advisers and practitioners in the design of new digital transformation projects. Constructed for 198 economies using consistent data sources, the GTMI is the most comprehensive measure of digital transformation in the public sector.

Several similar indices and indicators are available in the public domain to measure aspects of digital government—including the United Nations e-Government Development Index, the WBG's Digital Adoption Index, and the Organisation for Economic Co-operation and Development (OECD) Digital Government Index. These indices, however, do not fully capture the aspects of emphasis in the GovTech approach—the whole-of-government approach and citizen centricity—as key when assessing the use of digital solutions for public sector modernization. The GTMI is not intended to be an assessment of readiness or performance; rather, it is intended to complement the existing tools and diagnostics by providing a baseline and a benchmark for GovTech maturity and by offering insights to those areas that have room for improvement.

The GTMI is designed to be used by practitioners, policy makers, and task teams involved in the design of digital transformation strategies and individual projects, as well as by those who seek to understand their own practices and learn from those of others.

GovTech
Putting people first

Federal Ministry
Republic of Austria
Finance

Ministry of Economy
and Finance
Republic of Korea

Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Swiss Confederation

Federal Department of Economic Affairs FDEA
State Secretariat for Economic Affairs SECO

WORLD BANK GROUP