Trends in IFMIS Modernization: Advanced Analytics & Interoperability

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IFMIS & Advanced Analytics

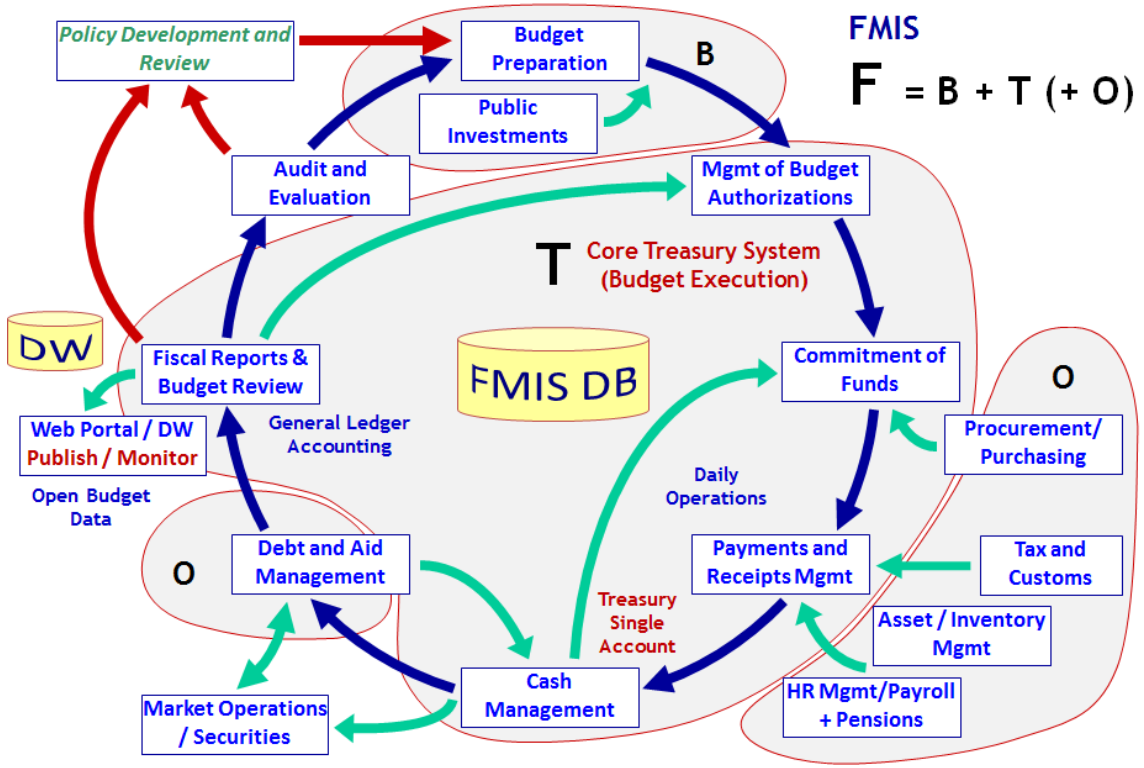
What is IFMIS ?

Core Financial Management Information Systems (FMIS) can be broadly defined as a set of automation solutions that enable governments to plan, execute and monitor the budget.

Core FMIS = OLTP

IFMIS = OLTP + OLAP

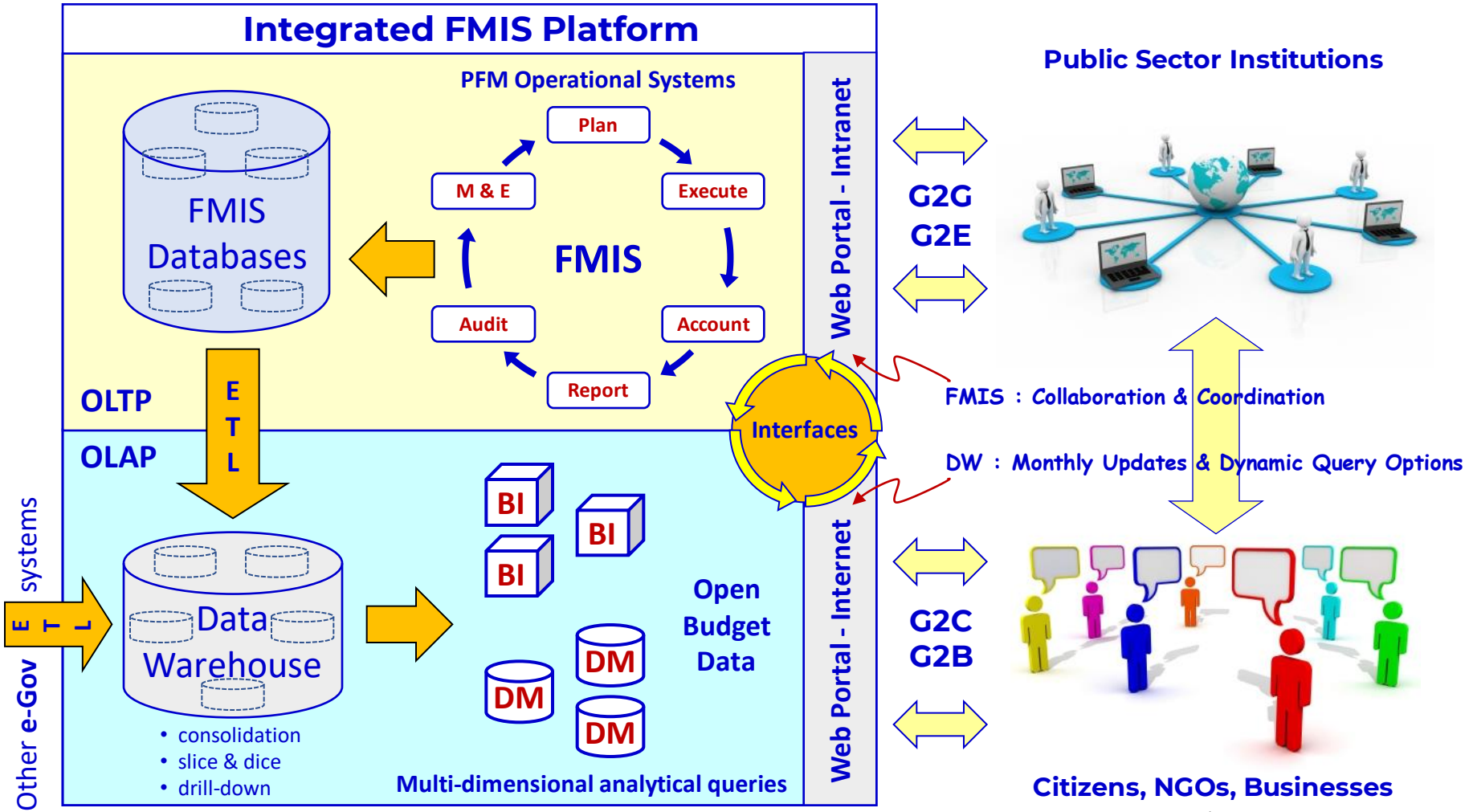
Core FMIS functional modules and interfaces



Integrated FMIS (or IFMIS) combine core FMIS modules (OLTP) with powerful Data Warehouse (DW) capabilities and multi-dimensional data analysis tools (OLAP) for effective planning, decision support, service delivery, and performance monitoring.

IFMIS = OLTP + OLAP

Goals > Sustainable public resource management + Effective public service delivery + Open and accountable government

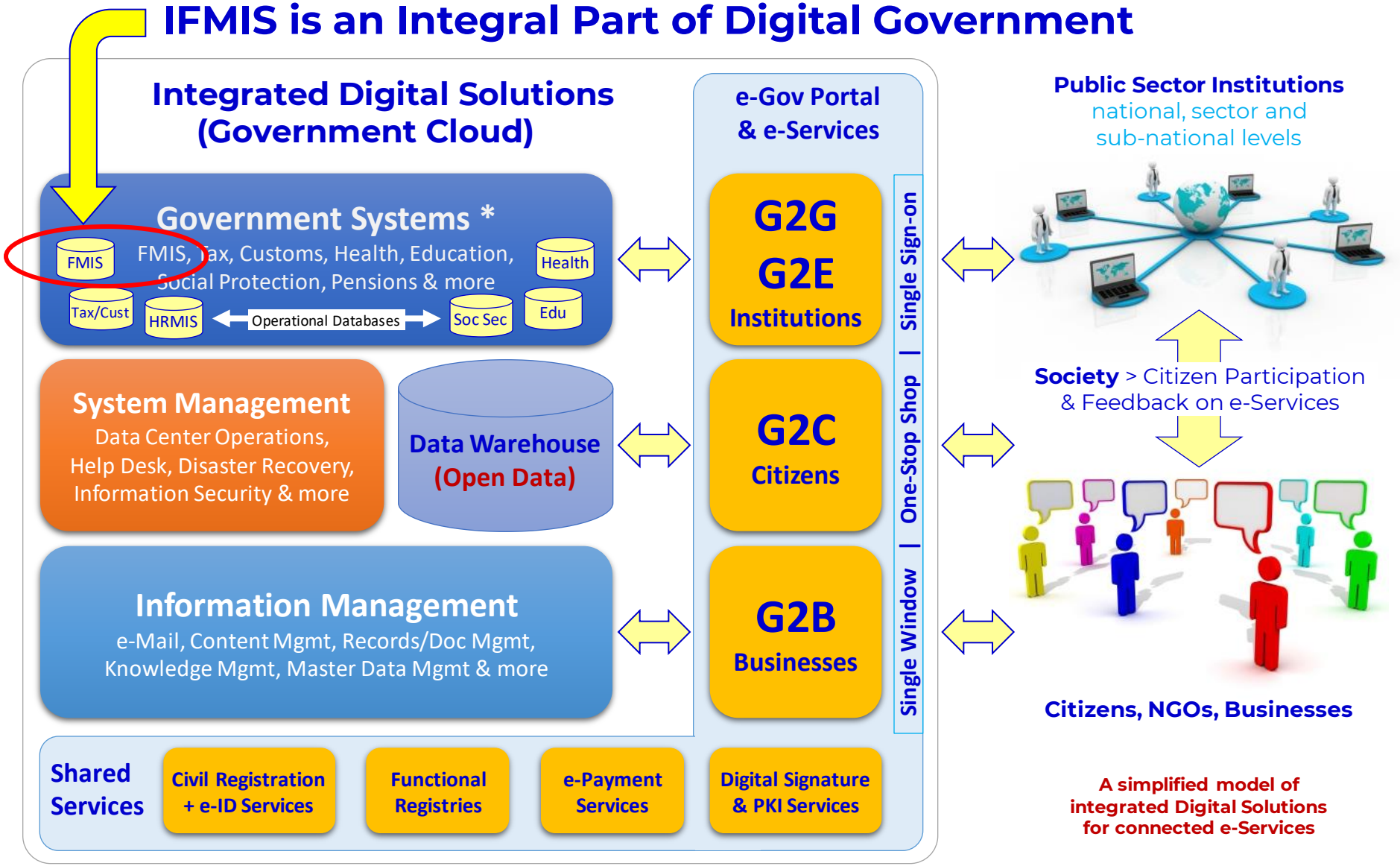


Images: jscreationzs / FreeDigitalPhotos.net

OLTP : Online Transaction Processing **OLAP** : Online Analytical Processing **DW:** Data Warehouse **ETL** : Extract, Transform, Load **BI** : Business Intelligence **DM** : Data Mining

What is IFMIS ?

IFMIS is an Integral Part of Digital Government



A simplified model of integrated Digital Solutions for connected e-Services

* Government Systems cover the integration (interconnectivity & interoperability) of sector applications, back-office systems, as well as the improvement of institutions, capacity, regulations, processes, information management, and more (National Enterprise Architecture, e-Gov Interoperability Framework, Single Window, and One-Stop-Shops).

Images: jscreationzs / FreeDigitalPhotos.net

OLAP & Business Intelligence

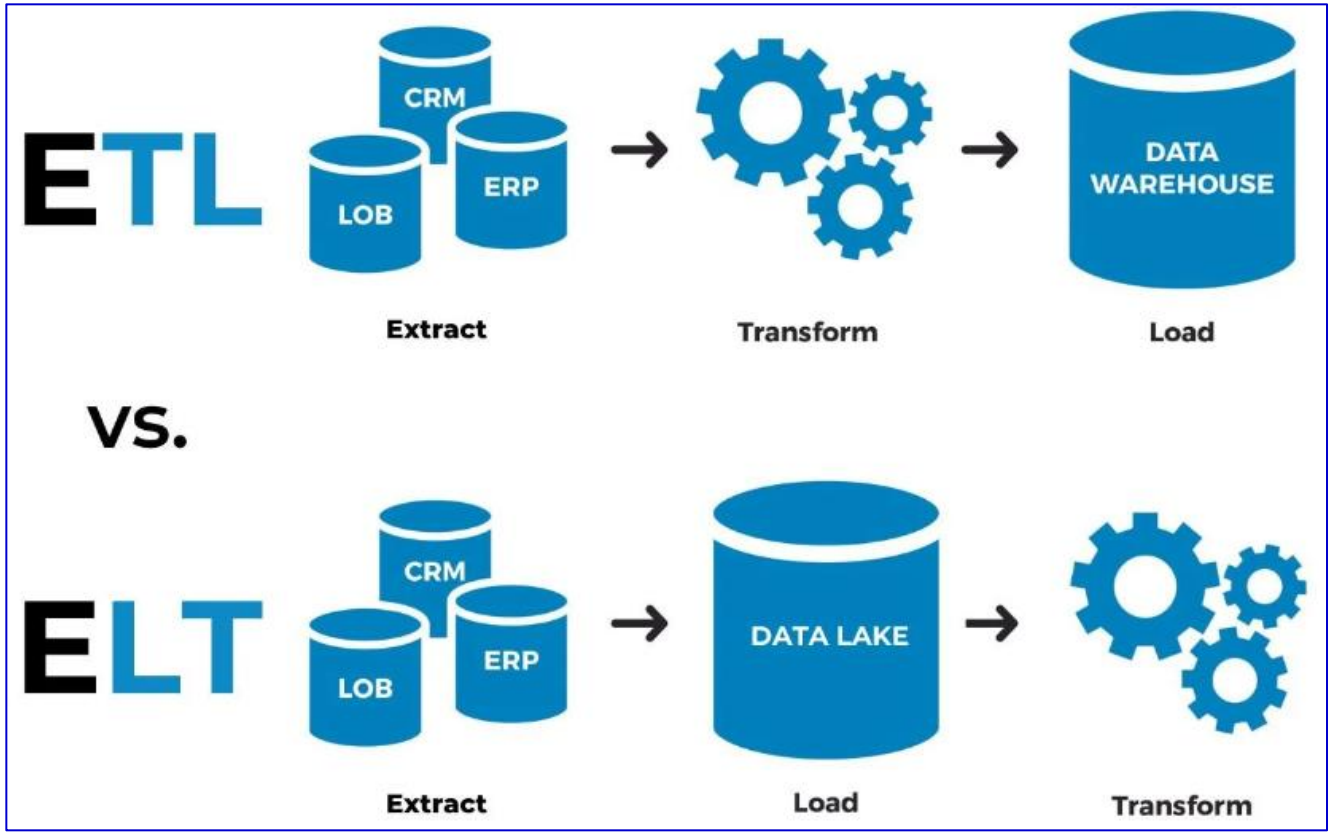
Business Intelligence (BI) refers to the technologies and strategies involved in collecting and analyzing data from internal and external systems to provide a detailed view of budget performance.

Using reports, dashboards and query tools, historical data can be analyzed, and custom reports can be generated. BI is a powerful tool providing real-time access to data to support decision-making.

Online Analytical Processing (OLAP) is technology for performing high-speed complex queries or multidimensional analysis on large volumes of data in a data warehouse, data lake or other data repository.

OLAP is used in BI, decision support, and a variety of forecasting and reporting applications.

Source: Microsoft



ETL (Extract, Transform and Load) has been the most used methodology for carrying out data integration processes since the 1970s. However, new demands in terms of volume, velocity and variety in data management have led to the emergence of a new approach to the traditional ETL process: ELT

IFMIS & Advanced Analytics

Advanced Analytics (AA) uses Data Science beyond traditional business intelligence (BI) methods, to make predictions or generate recommendations.

AA techniques include machine learning, pattern matching, forecasting, visualization, semantic analysis, simulation, sentiment analysis, deep learning/neural networks, and more.

Business Intelligence vs. Advanced Analytics

	Business Intelligence	Advanced Analytics
Answers the questions:	▪ What happened? ▪ When? ▪ Who? ▪ How many?	▪ Why did it happen? ▪ Will it happen again? ▪ What will happen if we change X? ▪ What else does the data tell us that we never thought to ask?
Includes:	▪ Reporting (KPIs, metrics) ▪ Automated monitoring and alerting (thresholds) ▪ Dashboards ▪ Scorecards ▪ OLAP (cubes, slice and dice, drilling) ▪ Ad hoc query ▪ Operational and real-time BI	▪ Statistical or quantitative analysis ▪ Data mining ▪ Predictive modeling ▪ Multivariate testing ▪ Big data analytics ▪ Text analytics

BI is focused on historical data to identify what has happened and why. It's a reactive, rearview mirror approach.
AA takes a proactive, forward-looking approach that extrapolates data to forecast what could happen and how various actions might alter an outcome.

Source: TechTarget

Using GTMI to track IFMIS trends & interoperability

GovTech
Putting people first

What is GTMI?

GovTech Maturity Index (GTMI)
measures the state of four GovTech focus areas
in 198 economies
using 48 key indicators
to inform operations, research & analytics

Core Government Systems Index (CGSI)
17 indicators

Public Service Delivery Index (PSDI)
9 indicators

Digital Citizen Engagement Index (DCEI)
6 indicators

GovTech Enablers Index (GTEI)
16 indicators

Target users: Government officials, World Bank teams, and practitioners involved in digital transformation

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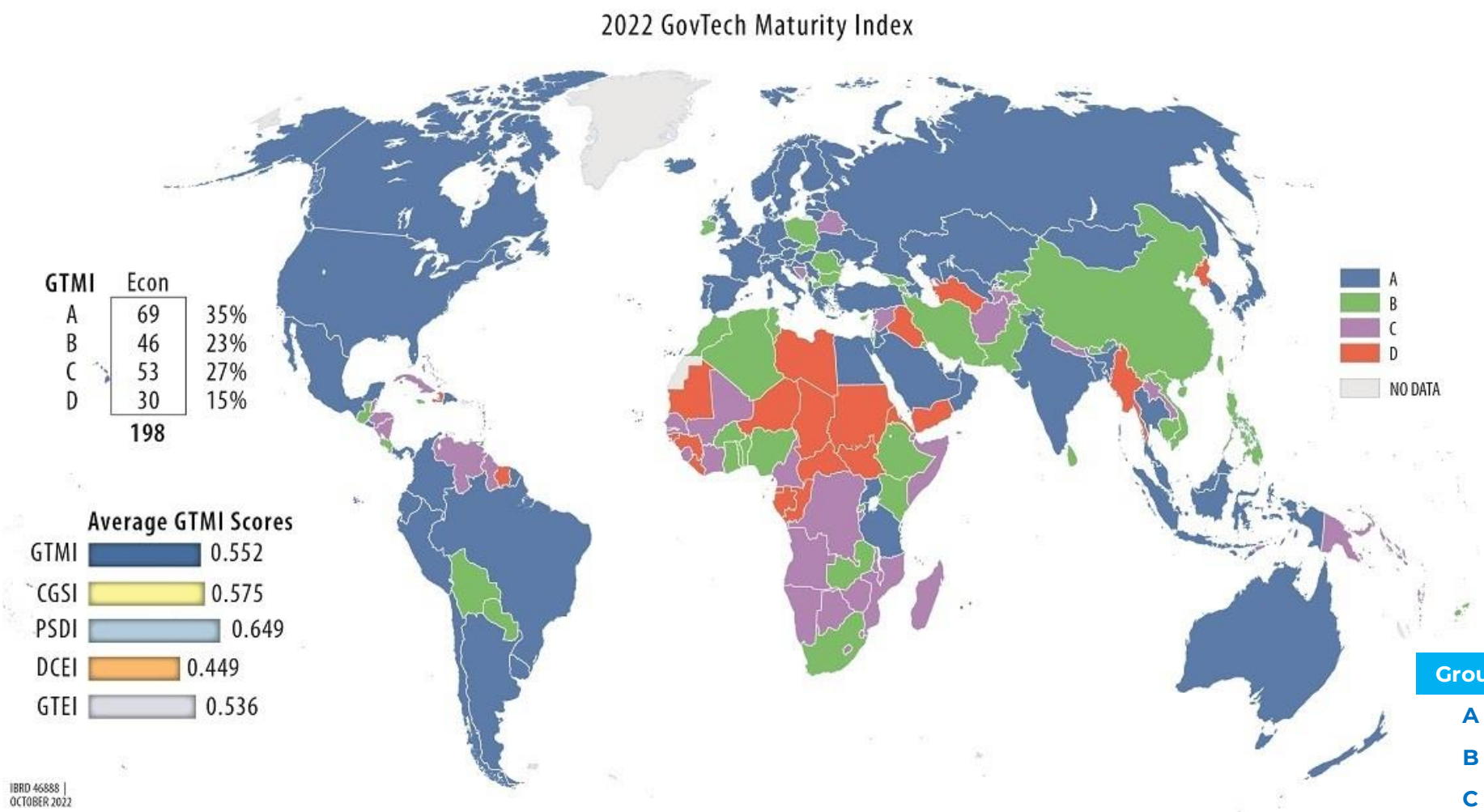
2022 GTMI: International Outlook

*There are 154 established Digital Government/GovTech entities around the world, and **good practices are highly visible in 69 economies** out of 198.*



2020 GTMI is based on remotely collected data

2022 version is mainly based on online survey data provided by government officials

Based on the GTMI component scores, each economy is grouped into one of four categories (A to D)

Group	Score	GTMI
A	0.75-1.00	Very High > GT Leaders
B	0.50-0.74	High > Significant Focus
C	0.25-0.49	Medium > Some Focus
D	0.00-0.24	Low > Minimal Focus

GTMI showcases a country's overall advancement in digital transformation.

GTMI is not intended to create a ranking or assess a country's readiness for or performance of GovTech.

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GTMI Key Indicators

Ind	GTMI Key indicators	Points	Weight
	Core Government Systems Index (CGSI)		
I-1	Is there a cloud platform available for all government entities?	0 - 2	W1
I-2	Is there a government enterprise architecture framework?	0 - 2	W1
I-3	Is there a government interoperability framework?	0 - 2	W1
I-4	Is there a government service bus platform?	0 - 2	W1
I-5	Is there an operational FMIS in place to support core PFM functions?	0 - 2	W3
I-6	Is there a TSA supported by FMIS to automate payments and bank reconciliations?	0 - 2	W3
I-7	Is there a Tax Management Information System in place?	0 - 2	W3
I-8	Is there a Customs Management Information System in place?	0 - 2	W3
I-9	Is there a Human Resources Mgmt Information System with self-service portal?	0 - 2	W3
I-10	Is there a Payroll System (MIS) linked with HRMIS?	0 - 2	W3
I-11	Is there a Social Insurance system providing pensions and other SI programs?	0 - 2	W1
I-12	Is there an e-Procurement portal?	0 - 2	W2
I-13	Is there a Debt Management System in place? (Foreign and Domestic debt)?	0 - 2	W3
I-14	Is there a Public Investment Management System (PIMS) in place?	0 - 2	W2
I-15	Is there a gov Open-Source Software (OSS) policy/action plan for public sector?	0 - 2	W2
I-16	UN Telecommunication Infrastructure Index (TII)	0 - 1	E1
I-17	Does gov have a national strategy on disruptive / innovative technologies?	0 - 2	W2
	Public Service Delivery Index (PSDI)		
I-18	UN Online Service Index (OSI)	0 - 1	E1
I-19	Is there an online public service portal? (Also called "One-Stop Shop" or similar)	0 - 2	W2
I-20	Is there a Tax online service portal?	0 - 2	W2
I-21	Is e-Filing available for tax and/or customs declarations?	0 - 2	W2
I-22	Are e-Payment services available?	0 - 2	W2
I-23	Is there a Customs online service portal (Single Window)?	0 - 2	W2
I-24	Is there a Social Insurance/Pension online service portal?	0 - 2	W2
I-25	Is there a Job portal?	0 - 2	W2
I-26	Is there a digital ID that enables remote authentication for (online service access	0 / 1	E2
	Digital Citizen Engagement Index (DCEI)		
I-27	UN E-Participation Index (EPI)	0 - 1	E1
I-28	Is there an Open Government web site / portal?	0 / 1	W2
I-29	Is there an Open Data portal?	0 / 1	W2
I-30	Are there national platforms for citizens to participate in policy decision-making?	0 / 1	W1
I-31	Are there gov platforms for citizens to provide feedback on service delivery?	0 / 1	W1
I-32	Does the gov publish its citizen engagement statistics and performance regularly?	0 / 1	W2
	GovTech Enablers Index (GTEI)		
I-33	Is there a gov entity focused on GovTech (digital transform, whole-of-gov?	0 - 2	W1
I-34	Is there a dedicated gov entity in charge of data governance or data mgmt?	0 - 2	W1
I-35	Is there a GovTech / digital transformation strategy?	0 - 3	W3
I-36	Is there a whole-of-government approach to public sector digital transformation?	0 - 2	W1
I-37	Are there RTI laws to make data/info available to the public online or digitally?	0 - 2	W3
I-38	Is there a data protection / privacy law?	0 - 2	W3
I-39	Is there a data protection authority?	0 - 2	W3
I-40	Is there a national ID (or similar foundational ID) system?	0 / 1	E2
I-41	Are records in the national ID system stored in a digitized (electronic) format?	0 / 1	E2
I-42	Is there a digital signature regulation and PKI to support service delivery?	0 - 3	W3
I-43	ITU Global Cybersecurity Index (GCI)	0 - 1	E1
I-44	UN Human Capital Index (HCI)	0 - 1	E1
I-45	Is there a gov strategy / program to improve digital skills in the public sector?	0 - 2	W1
I-46	Is there a strategy and/or program to improve public sector innovation?	0 - 2	W1
I-47	Is there a government entity focused on public sector innovation?	0 - 2	W1
I-48	Is there a gov policy to support GovTech startups and private sector investments?	0 / 1	W2

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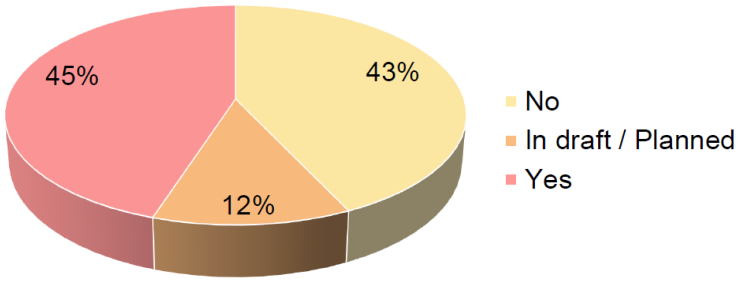
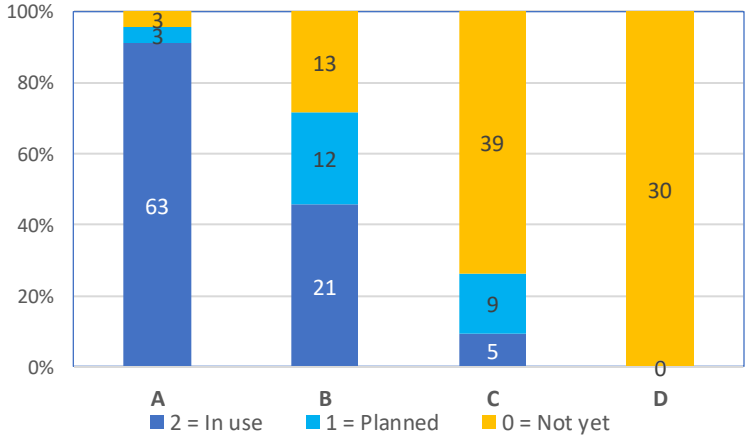
GTMI Trends > Interoperability

#	2022 GTMI Indicators & Sub-indicators	Response options & Data format	Please select a country name
Economy	Country name	Korea, Rep.	Korea, Rep.
I-3	**Is there a government interoperability framework?**	0= No, 1= In draft / Planned, 2= Yes	2
I-3.1	Title of the GIF report	Text	Guidelines for public information system
I-3.2	GIF report / draft URL	URL	https://law.go.kr/행정기관%20및%공공
I-3.3	GIF was introduced / will be introduced in (year)	YYYY	2009
I-3.4	GIF operational status	0= Unknown, 1= Partially used, 2= Extensively used	2
I-3.5	GIF scope > Is there a shared GIF?	0= Unknown, 1= Fragmented (Separate Central/Local), 2= Shared Central+L	2
I-3.6	Is there a data quality framework?	0= No, 1= Yes	1
I-3.7	Is there a system to monitor the 'uptime' of government information syste	0= No, 1= Yes	1
I-3.8	Is there guidance for replacing legacy government information systems?	0= No, 1= Yes	1
I-3.9	Monitoring & publishing of GIF usage, compliance, benefits?	0= No, 1= Yes (internal, not published), 2= Yes (public, published)	2
I-3.9.1	If Yes > Supporting document (report / URL)	Enter URL (public link) or Attach relevant report	https://www.egovframe.go.kr/home/sub
I-4	**Is there a government service bus platform?**	0= No, 1= In draft / Planned, 2= Yes (platform in use)	2
I-4.1	Name of the Government Service Bus platform	Text	Public Information Sharing System
I-4.2	GSB platform URL	URL	https://share.go.kr/main_www_2018.jsp
I-4.3	GSB platform was launched / will be launched in (year)	YYYY	2002
I-4.4	GSB operational status	0= Unknown, 1= Partially used, 2= Extensively used	2
I-4.5	GSB scope > Is there a shared GSB platform?	0= Unknown, 1= Fragmented (Separate Central/Local), 2= Shared Central+L	2
I-4.6	Monitoring & publishing of GSB usage, security, savings?	0= No, 1= Yes (internal, not published), 2= Yes (public, published)	2
I-4.6.1	If Yes > Supporting document (report / URL)	Enter URL (public link) or Attach relevant report	https://share.go.kr/fa/fa010/newFa/infol

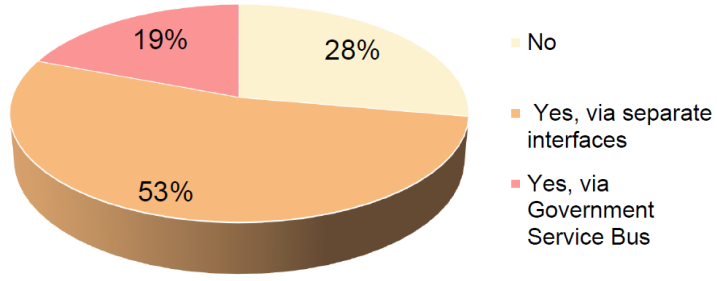
Is there a Government Service Bus Platform?



I-4 Interoperability Platform (Service Bus) - GTMI 2022



Does FMIS exchange data with other systems?



Trends in IFMIS Modernization

Trends and Challenges in Transition to IFMIS

Trends

- Growing focus on results: Program-Based Budgeting & Public Investment Mgmt.
- Integrating core FMIS with Data Warehouse and other government systems to improve data quality & value, and to expand the scope of transactions / TSA
- Rapid IFMIS modernization by combining traditional & agile approach
- Improving interoperability through web services / Application Program Interfaces (APIs) & shared Digital Public Infrastructure (DPI)
- Exploring the use of new/disruptive technologies (Big Data & AI/ML) for performance monitoring, decision support and savings

Challenges

Key challenges in transition to IFMIS are Adaptive (non-technical):

- Leadership & change management for transition to digital culture in the public sector
- Enforcing the use of IFMIS for daily recording of all budget transactions, and web publishing of results (for building trust)
- Improving the interoperability of IFMIS with other government systems.

Possible IFMIS Modules

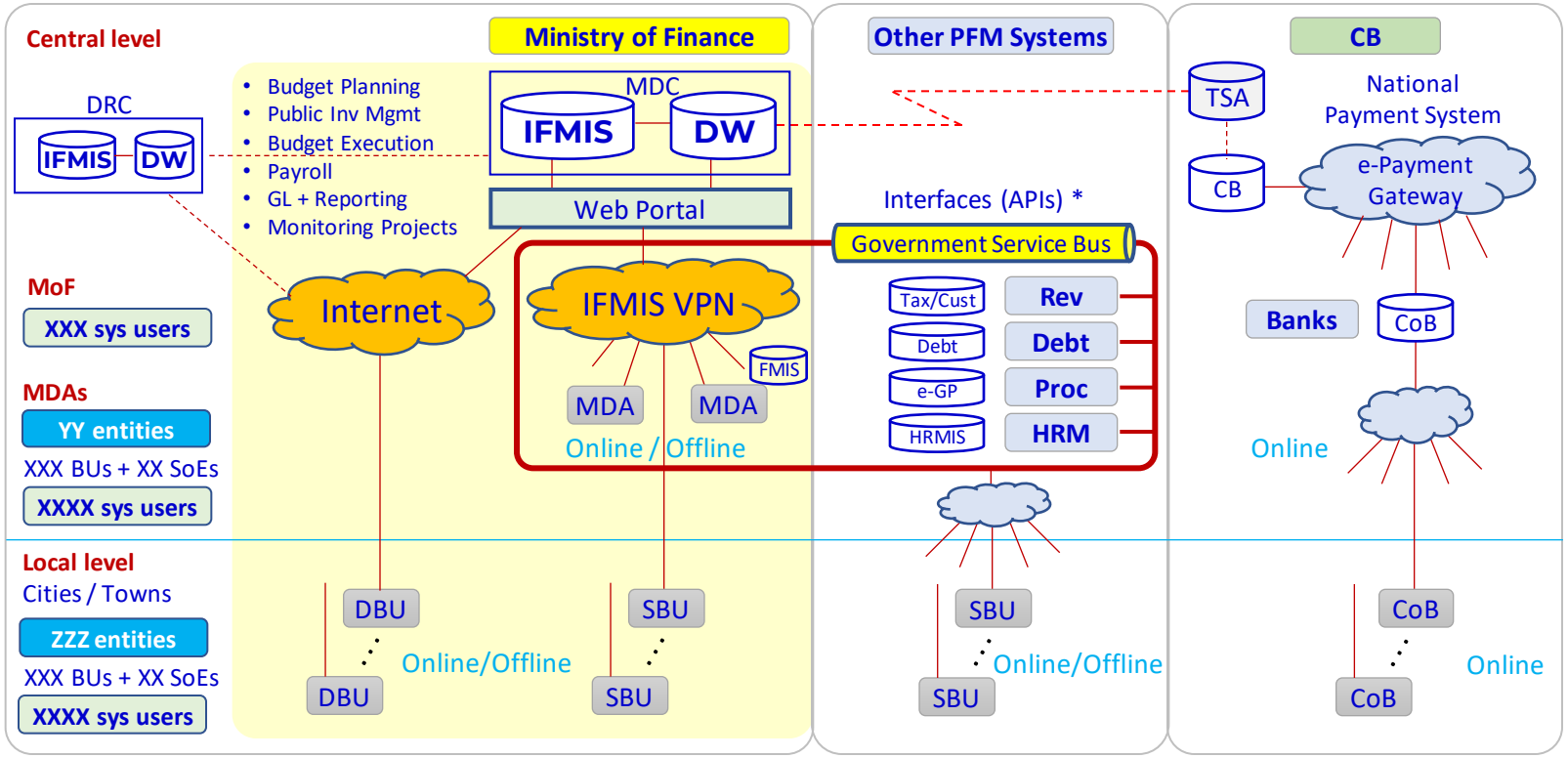
1. **Planning and Budgeting Modules**
   - **MYB** > Multi-Year Budget Preparation (including MEF)
   - **PIM** > Public Investment Management
   - **MPC** > Monitoring of projects and contracts
   - **REG** > Management of registries & budget classification
2. **Budget Execution Modules**
   - **MBA** > Management of budget allocations
   - **MEX** > Management of expenditures
   - **MRE** > Management of receipts
   - **PAY** > Payroll Calculations / Database
   - **CCM** > Commitment control & management
   - **CFM** > Cash forecasting and management
   - **ACC** > Accounting / General Ledger
3. **Transparent Government Reporting**
   - **DWH** > Data Warehouse, BI tools, Web Portal
   - **OBD** > Financial Reports / Open Budget Data
4. **Interfaces with other Government Systems**
   - **TSA interface** > Interface with National Payment System
   - **HRMIS** > Human Resource Management
   - **e-GP** > Public Procurement and **AMS >** Asset Management
   - **Tax & Customs** > Revenue Administration
   - **Debt** > Debt Management
   - **PMS** > Pension Management System
   - **AMS** > Audit Management System

Centralized web-based cloud-ready IFMIS platform

Shared IFMIS modules supporting all budget users online

IFMIS Scope: Central and local governments

PFM business processes can be simplified and optimized to avoid a substantial **opportunity cost** while transitioning to IFMIS.



IFMIS can be designed as a **cloud-ready** platform for seamless integration with the future Government Cloud once it arrives

MoF : Ministry of Finance
CB : Central Bank
DBU: District Budget User
MDC: Main Data Center

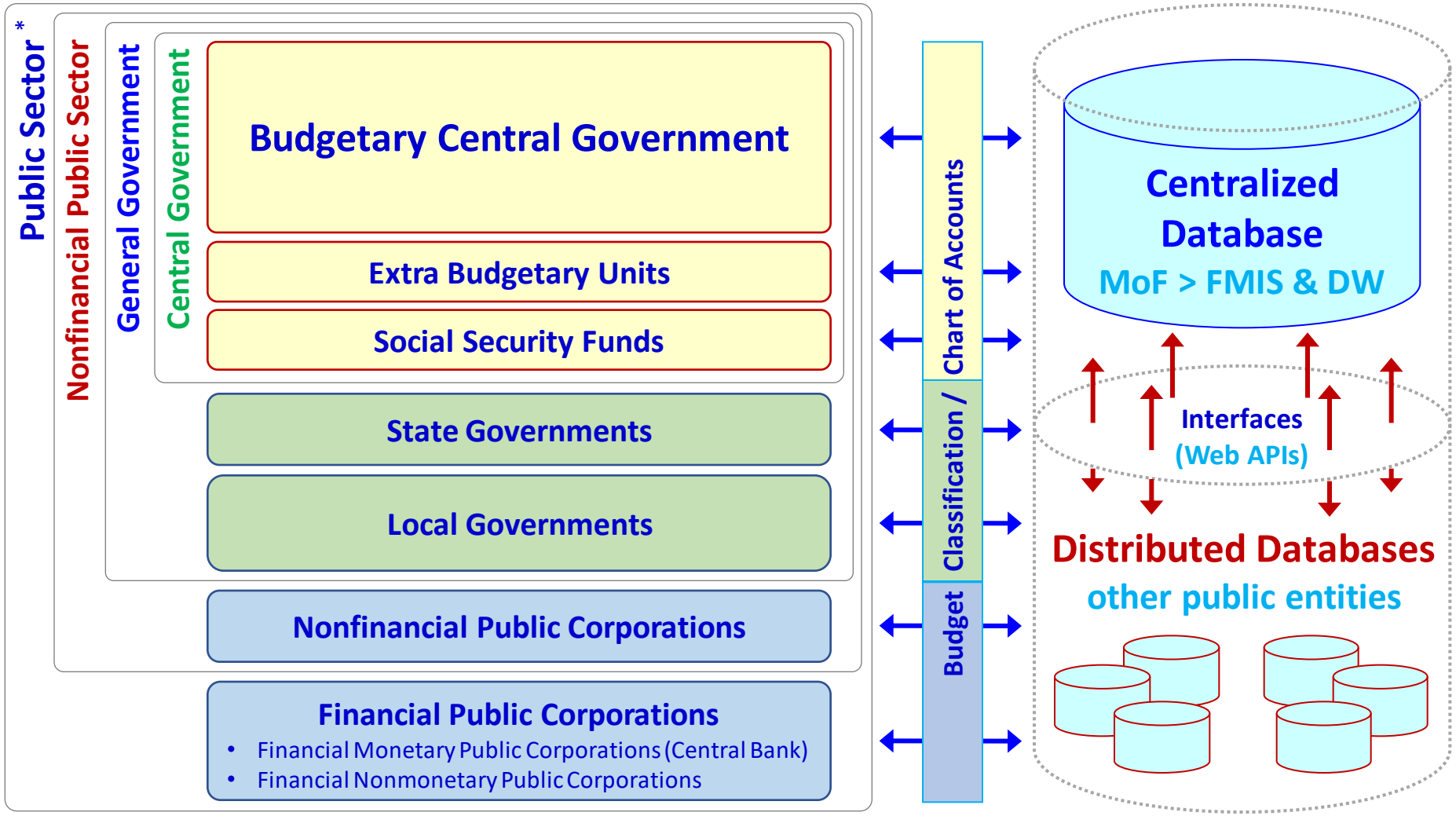
GovTech : GovTech
CoB : Commercial Banks
SBU: State Budget User
DRC: Disaster Recovery Center

MDA: Ministries, Departments, Agencies
TSA : Treasury Single Account
VPN: Virtual Private Network
API: Application Programming Interface

(*) There will be additional interfaces (APIs) with other PFM and government systems to use existing shared platforms such as National Digital ID and more.

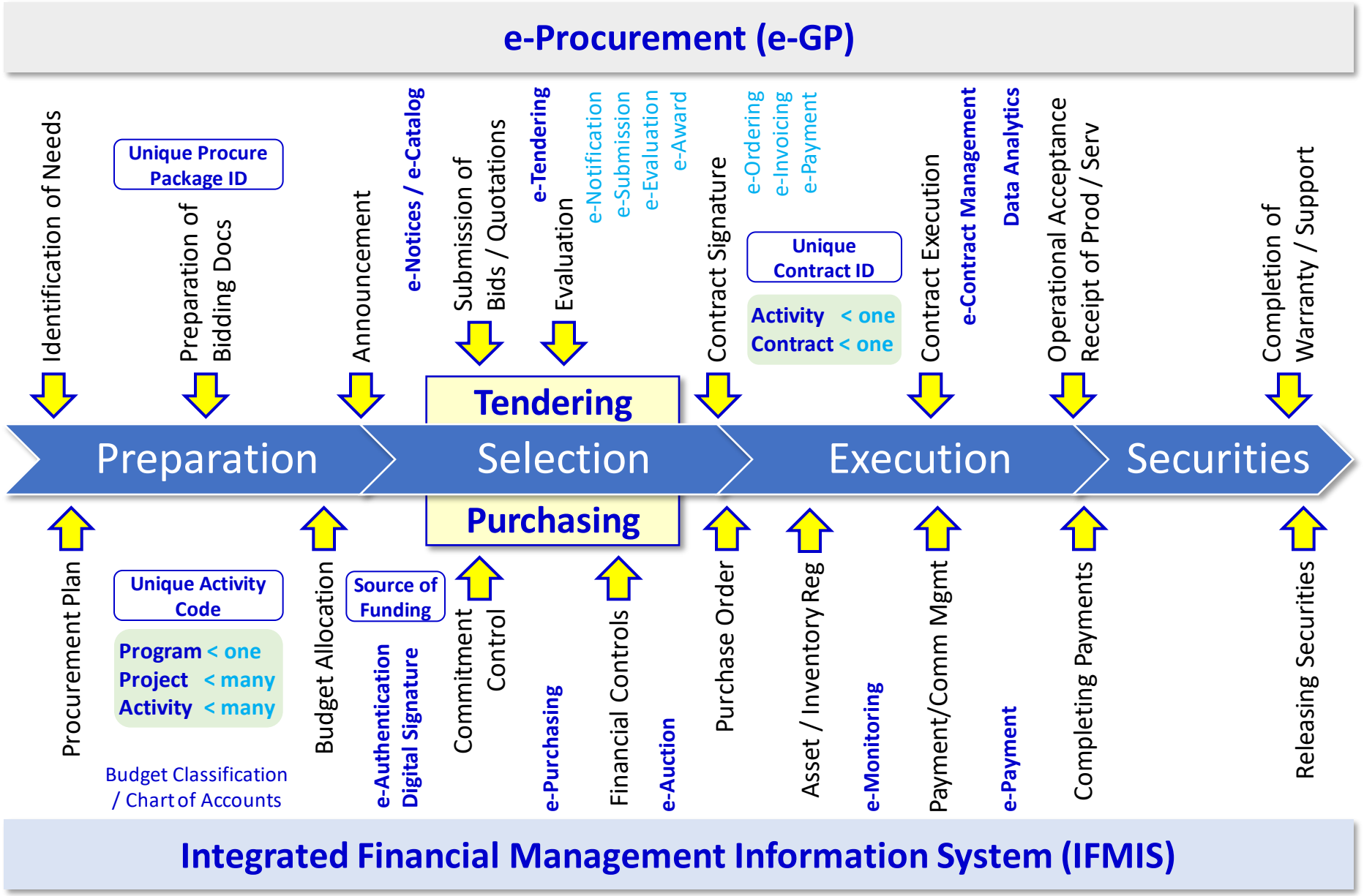
Expansion of IFMIS Scope

How to Automate Recording and Reporting of Public Finance Data?

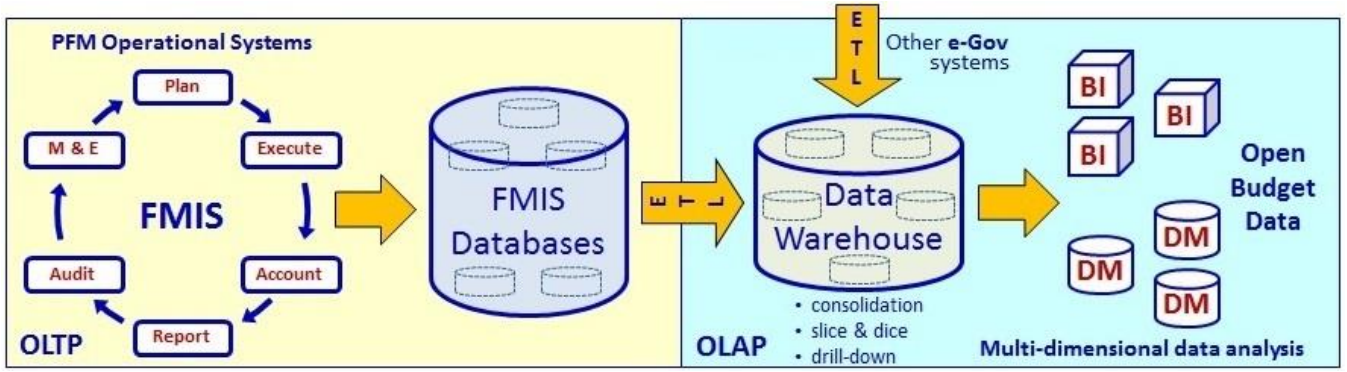


* Institutional structure of "Public Sector", as defined in the IMF Govt Finance Statistics 2014 Manual

IFMIS & e-GP > Data Exchange



Brazil > Connecting Foundations & Frontiers



Foundations → **Frontiers**

Provide feedback to IFMIS for improving data quality & value

CGU, Brazil

Apply Machine Learning (AI)

Machine Learning Engine

- **Volume** Scale of data
- **Velocity** Speed of analysis
- **Variety** Different forms
- **Veracity** Uncertainty of data

Open Source Tools for Big Data

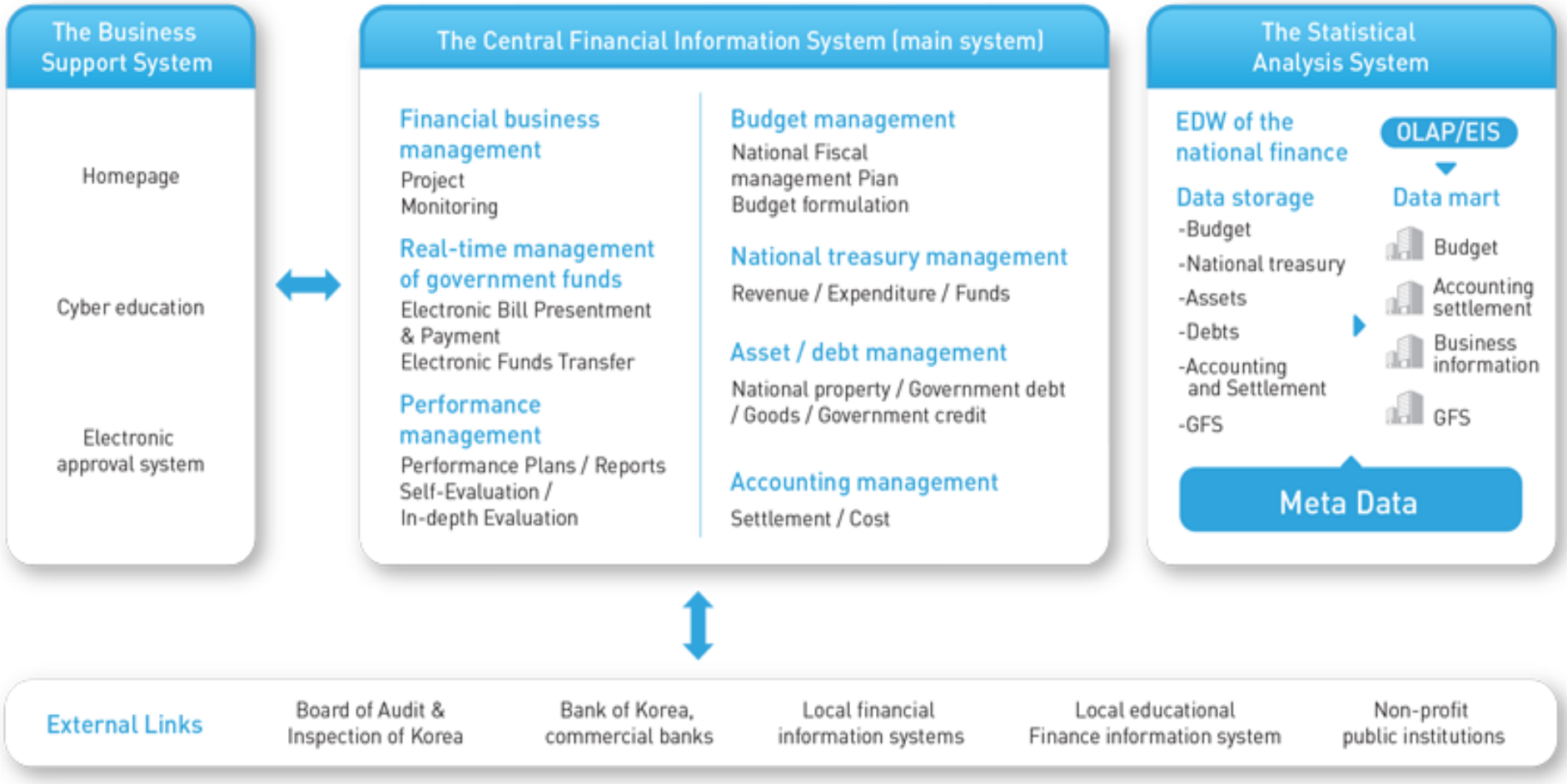
python, cloudera IMPALA, hadoop, talend, openstack, redhat, Hortonworks, tableau, pentaho, mongoDB., MySQL, SKYTREE

Combine "digital value" of FMIS with "out of government" data

Satellites, Sensors, IoT, Smart phones, …

dBrain+ > Integrated PFM Information System

- Support **all fiscal activities and transactions** of government finance
- Back Up government financial innovation
- On-line **Real-time Management** of Government Finance
- Produce Government Financial Statistics and Information Analysis
- **AI** for policy management and the prediction of national treasury balance



Source: https://www.fis.kr/en

Use of AI in Public Sector

Priorities Going Forward

- Governments must adopt policies and governance frameworks that promote human-centric AI while maximizing opportunities. Critical aspects of the **policy framework** are listed below:
  - AI policy anchored in ethical principles would be essential.
  - Transparency and accountability through inclusion and multi-stakeholder engagement at every step of the AI policy design and implementation.
  - These policies should also promote digital skills, and broader education in science, technology, engineering, and mathematics (STEM) to support people as they adjust to the shifting nature of work in the coming decades.
  - The regulatory framework to fight online propaganda, misinformation, libel, and cybercrimes should be given priority.
  - Strengthen privacy, data protection, and civil liberties and monitor compliance, which is typically weak in most settings.
- Investments should be made in **human capital** and **digital infrastructure**.
- **Risks** should be identified and managed, rather than avoided.

Source: Artificial Intelligence in the Public Sector: Maximizing Opportunities, Managing Risks (2020); EFI Insight-Governance. Washington, DC, World Bank

Dimensions of Interoperability

1 Legal Interoperability

Refers to regulations aimed at: lifting sectoral restrictions in the use and storage of data; unify data licenses; define data recording practices, among other things.

Removing legal barriers to interoperability and encouraging cooperation between administrations

3 Semantic Interoperability

Refers to vocabularies, database repositories, and other elements that make it possible to understand the contents of a table, file, or statistic and their storage and transmission format.

Develop common schemas, catalogues and protocols to describe data exchanges

Main focus of many countries so far

2 Organizational Interoperability

This is how administrative entities align their process. Organizational IoP is composed of two pillars, business process harmonization, and organizational relationships.

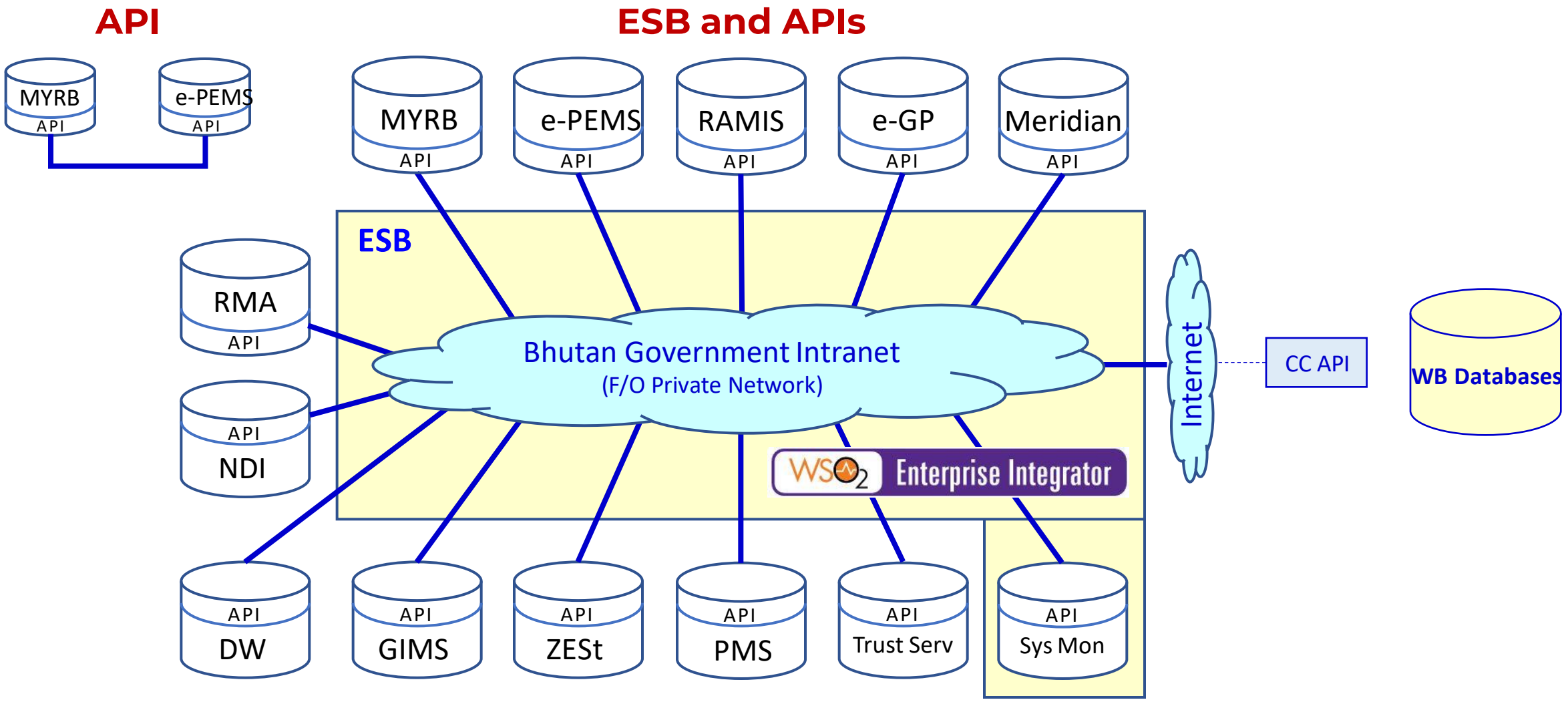
Align organizational processes, responsibilities, and expectations, institutional structure for leadership and coordination

4 Technological Interoperability

Technical IoP covers applications and infrastructures that enable data sharing between different entities. This includes interface specs, connection and data integration services, secure communication protocols, etc.

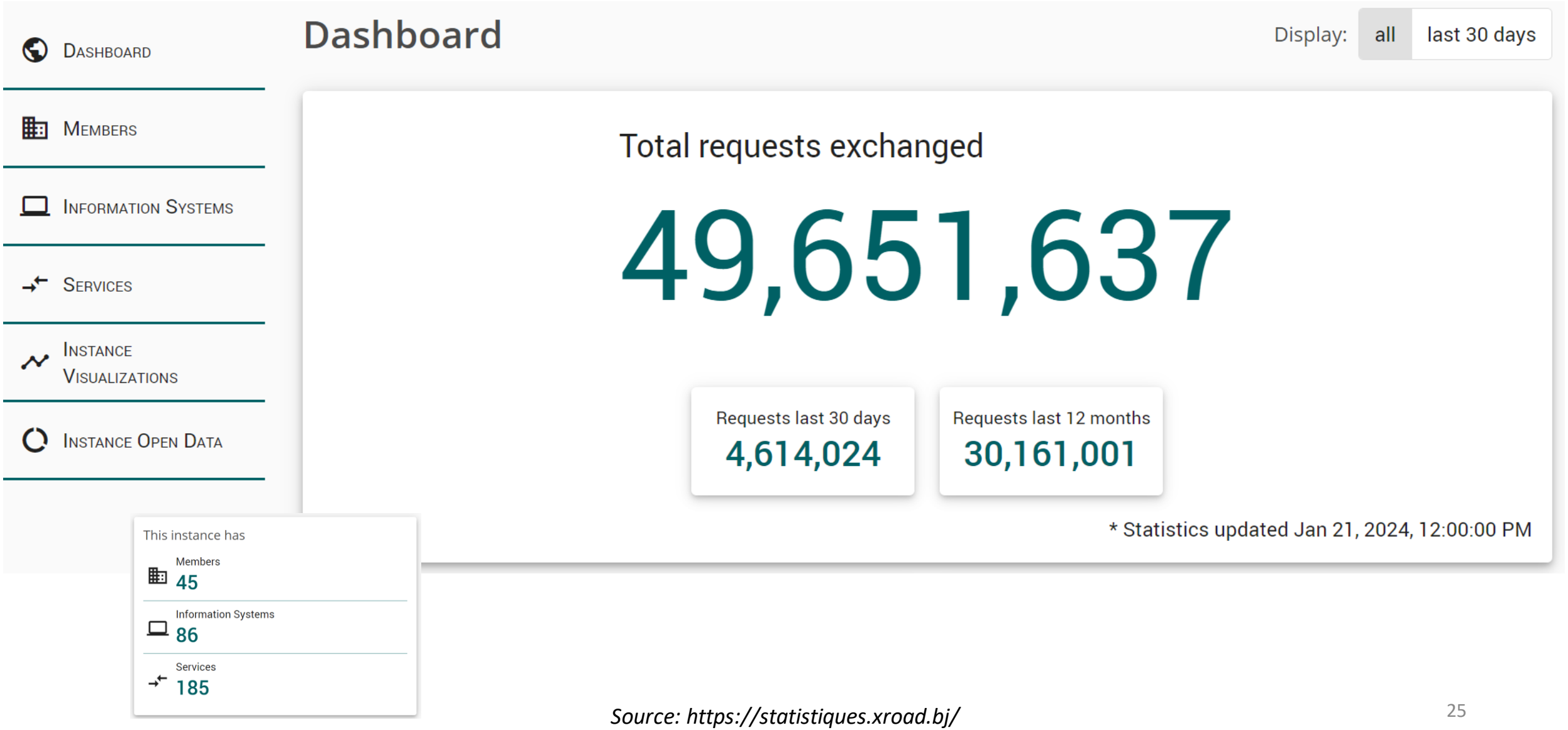
Have the applications and infrastructure connecting systems and services

Using GSB (APIs) to improve IFMIS interoperability



Benin > Interoperability Catalogue

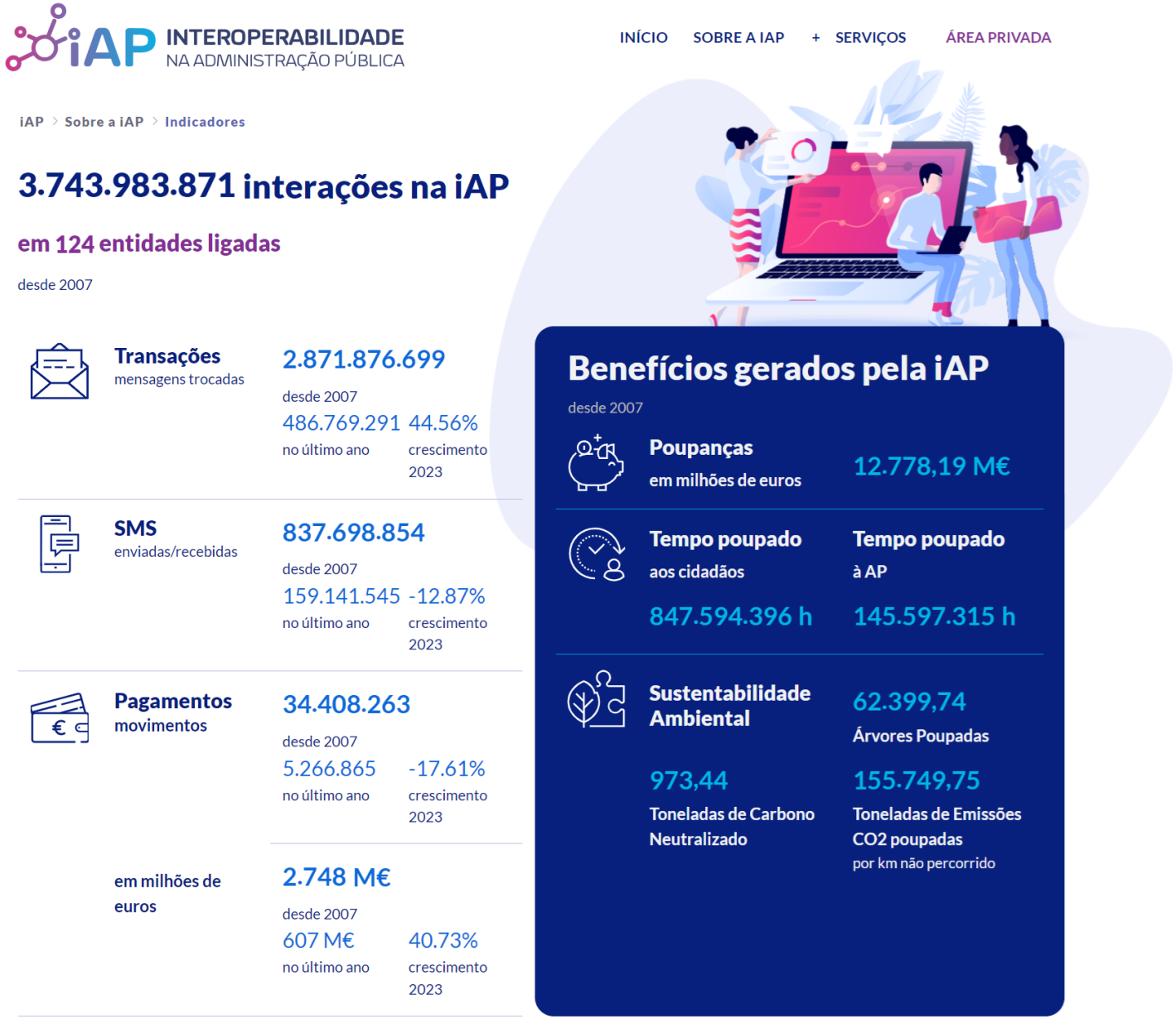
Interoperability catalogue of services in Benin



Source: https://statistiques.xroad.bj/

Portugal > Interoperability Savings

Interoperability Dashboard in Portugal



Source: https://iap.gov.pt/web/iap/iAP-em-numeros

Thank You

Q&A

- **GovTech/GTMI web page:** https://www.worldbank.org/en/programs/govtech/gtmi
- **GTMI Dashboard:** https://www.worldbank.org/en/data/interactive/2022/10/21/govtech-maturity-index-gtmi-data-dashboard
- **GTMI Report (OKR):** https://openknowledge.worldbank.org/handle/10986/36233
- **2022 GTMI Update (OKR):** https://openknowledge.worldbank.org/handle/10986/38499
- **GovTech Dataset:** https://datacatalog.worldbank.org/search/dataset/0037889/GovTech-Dataset
- **GovTech Projects Database:** https://datacatalog.worldbank.org/search/dataset/0038056/digital-governance-projects-database
- **GovTech OLC e-Learning course #1**: https://olc.worldbank.org/content/govtech-fundamentals-and-key-concepts
- **GovTech OLC e-Learning course #2:** https://olc.worldbank.org/content/trends-govtech-solutions-public-financial-management

GovTech
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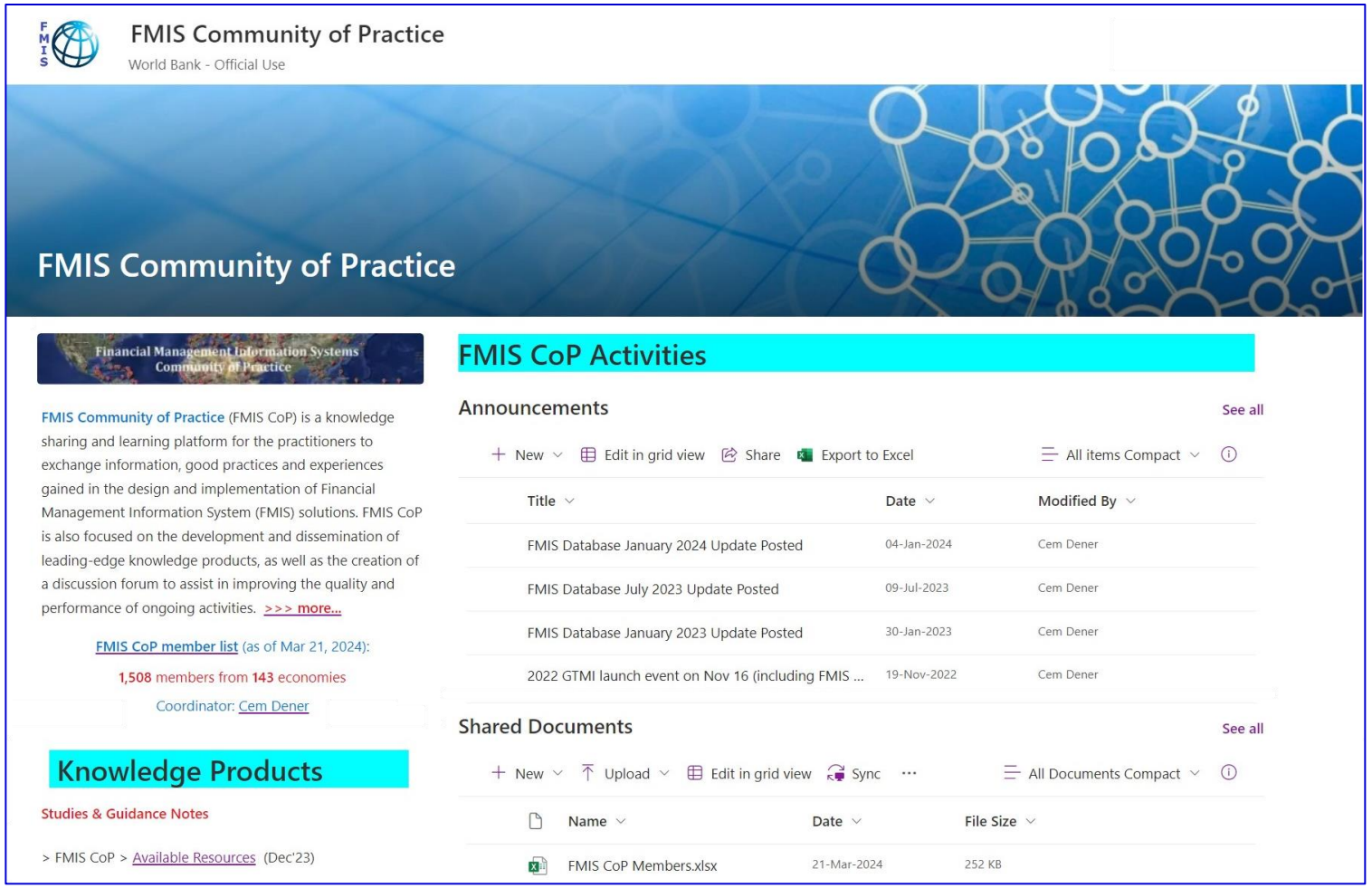
FMIS Community of Practice

- Objective : To assist the practitioners (government officials, WB staff/consultants, and development partners) in improving the effectiveness of PFM operations and service delivery by sharing knowledge and experiences, and producing relevant, leading edge knowledge products on integrated FMIS solutions.
- FMIS CoP was established in Sep 2010. As of Apr 2024, 1,500+ members from 143 economies.



GovTech
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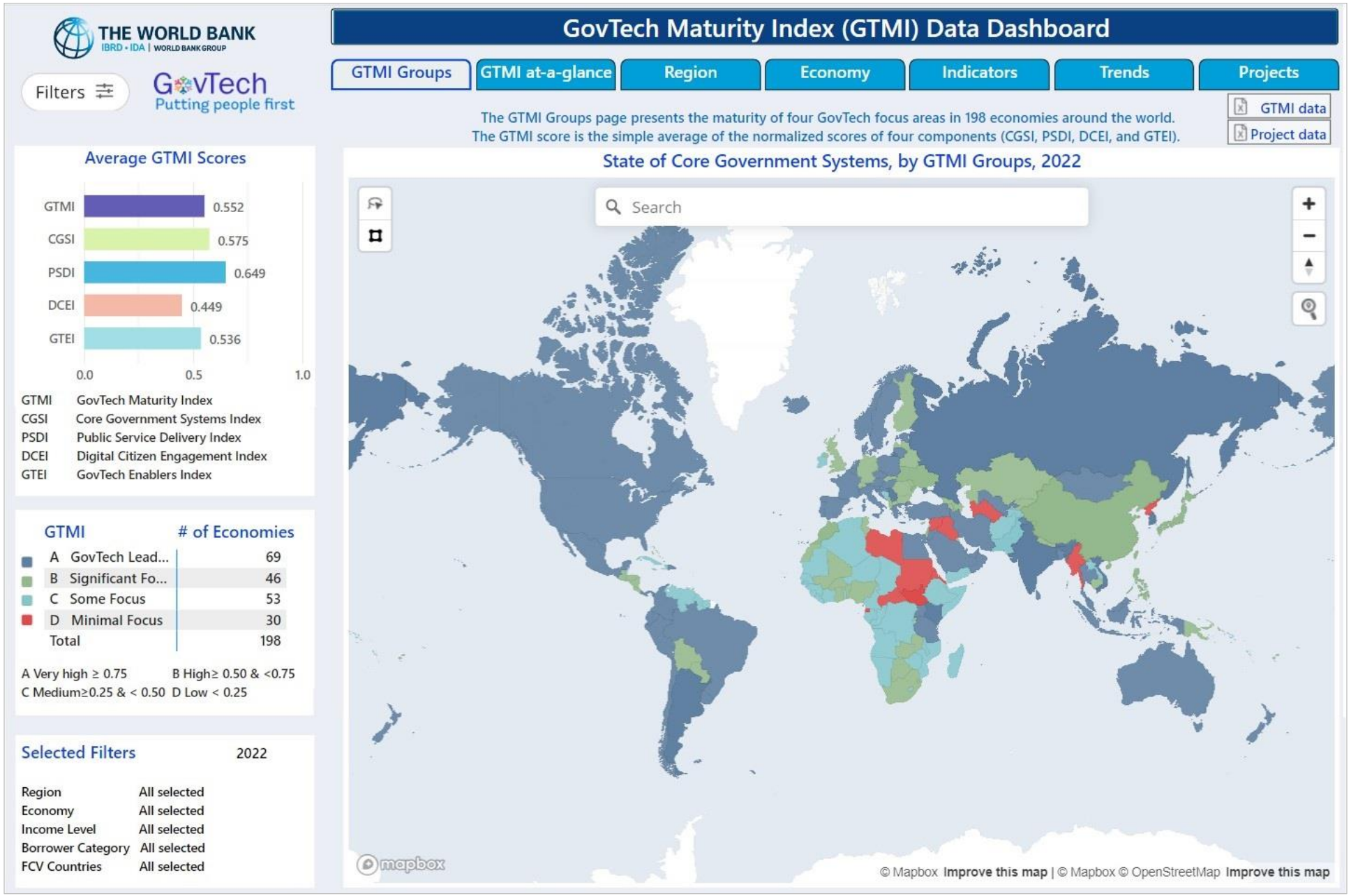
GTMI Data Dashboard



GTMI Regional Briefs

A series of 2022 GTMI Regional Briefs were prepared to present an overview of the progress in GovTech maturity within the last two years, along with the good practices, gaps, and opportunities for accelerating public sector digital transformation.

- **AFE** East and Southern Africa
- **AFW** West and Central Africa
- **EAP** East Asia and Pacific
- **ECA** Europe and Central Asia
- **LAC** Latin America and the Caribbean
- **MNA** Middle East and North Africa
- **SAR** South Asia

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GovTech Academy

GovTech Academy e-Learning courses launched through Open Learning Campus (OLC)

ABOUT THE COURSE

Governments have been using technology to modernize the public sector for decades. The World Bank Group (WBG) has been a partner providing both financing and technical assistance to support countries' digital transformation journeys since the 1980s. Over the last five years, developing countries have more frequently been requesting WBG funding and advisory support to design even more advanced digital transformation programs to increase government efficiency and improve access and quality of service delivery, enhance transparency and reduce corruption, improve governance and oversight, and modernize core government operations. The World Bank's GovTech Initiative launched in 2019 appropriately responds to this growing demand.

The "GovTech: Fundamentals and Key Concepts" self-paced e-Learning course introduces the GovTech concepts, focus areas, solutions, and good practices to support digital transformation reforms of governments around the world.

ABOUT THE COURSE

This is the second e-Learning course of the World Bank's GovTech Academy program that was launched in 2020 to assist the World Bank staff and client countries working on digital transformation in the public sector through knowledge sharing and learning activities.

The first GovTech course "GovTech: Fundamentals and Key Concepts" was launched in November 2021 to introduce the GovTech concepts, focus areas, solutions, GovTech Maturity Index (GTMI), and good practices, and assists practitioners in the design of new digital transformation projects.

This self-paced e-Learning course (Trends in GovTech Solutions for Public Financial Management) explores the role of digital technology in the modernization and enhancement of Public Financial Management (PFM) systems, and the associated risks, challenges, and opportunities with a focus on fragile and low-income countries. It also looks at the innovative GovTech solutions and trends for budgeting, tax administration, public procurement, and financial fraud detection.

GovTech OLC e-Learning course #1:

GovTech: Fundamentals and Key Concepts

MODULES

The GovTech: Fundamentals and Key Concepts self-paced course consists of four modules:

- **Module 1**, "GovTech: The Latest Generation in Public Sector Reforms," presents the definition of GovTech, the evolution of digital government, and GovTech approaches, and introduces the GovTech Global Partnership.
- **Module 2**, "GovTech Focal Areas: How They Work in Practice," explains the four GovTech focal areas in detail.
- **Module 3**, "GovTech Maturity Index (GTMI)," presents the objective, methodology, findings, and conclusions of the GTMI that measures the maturity of four GovTech focus areas.
- **Module 4**, "GovTech Solutions for Practitioners," describes different types of digital government investments, gives examples from GovTech solutions in the four focal areas, and describes GovTech challenges and opportunities.

GovTech OLC e-Learning course #2:

Trends in GovTech Solutions for PFM

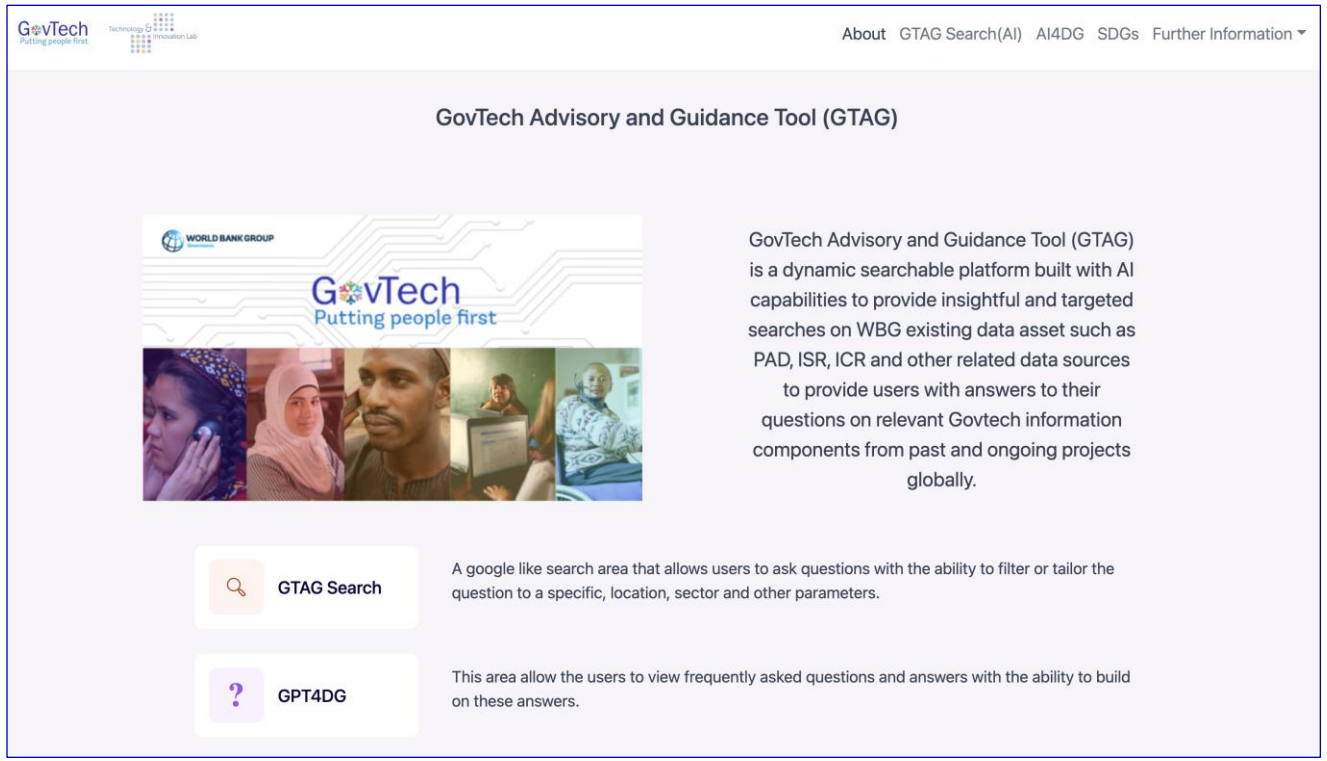
MODULES

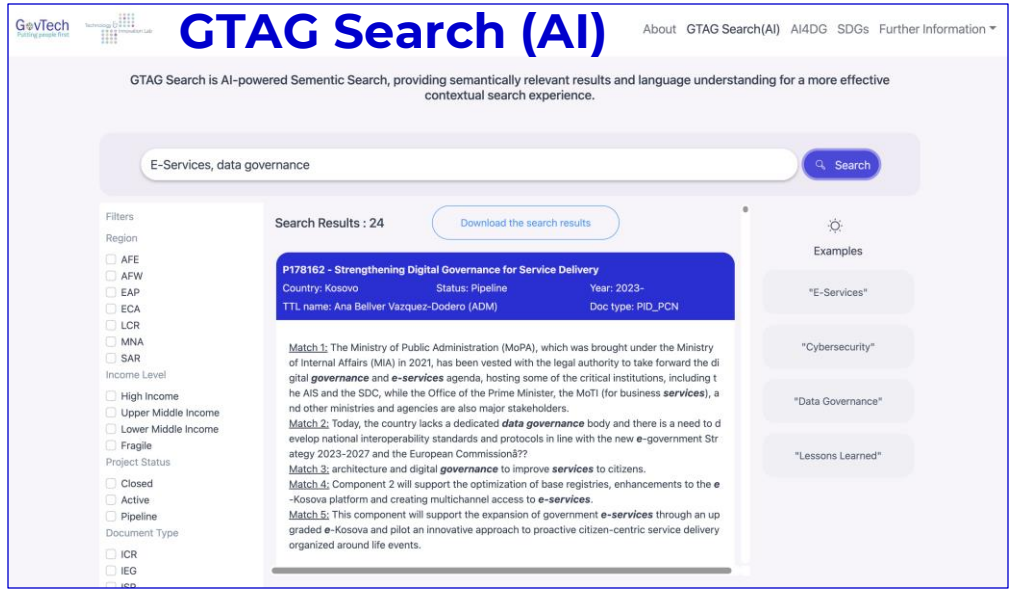
The Trends in GovTech Solutions for Public Financial Management self-paced course consists of five modules:

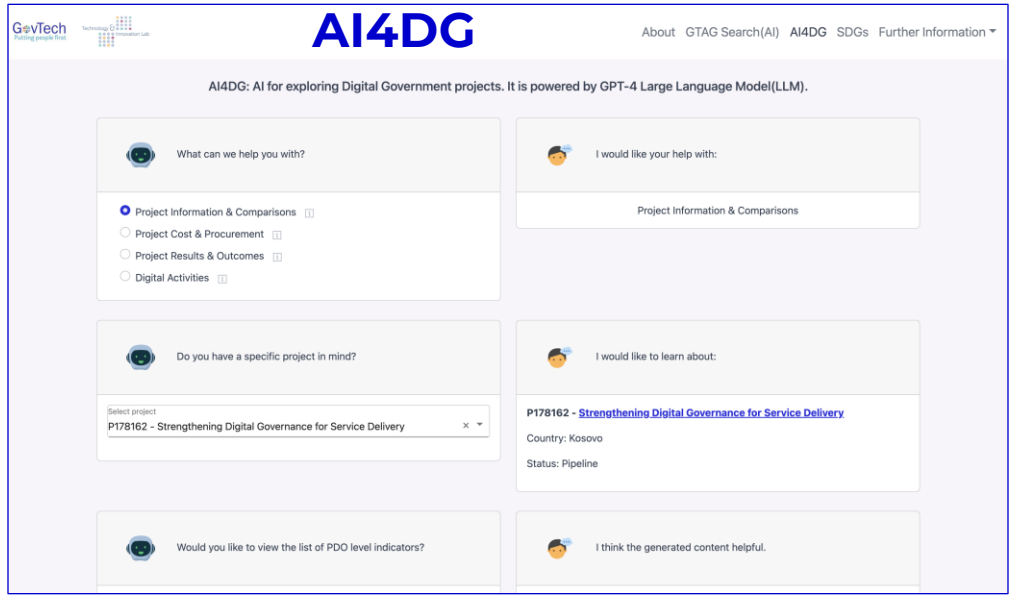
- **Module 1**, "Use of New Technologies in Public Financial Management," explores how technology innovations can have an impact on PFM, as well as the challenges and benefits associated with digital transformation.
- **Module 2**, "Public Budgeting," explains trends in the modernization and interoperability of financial management information systems and other PFM solutions, and how these platforms can transform the process of planning, executing, monitoring, and reporting public budgets.
- **Module 3**, "Tax Administration," talks about why technology maturity is important for a transition to digital tax administration and how different technologies can improve the tax administration processes and transparency.
- **Module 4**, "Public Procurement," explores the context for improving the procurement of GovTech solutions, innovative procurement solutions, e-Procurement, and Procurement Data Analytics.
- **Module 5**, "Financial Auditing," covers the transition to data-driven financial auditing and the application of digital technology to fraud detection.

GovTech Advisory and Guidance Tool (GTAG)

Surfacing Hidden Data (WB Pilot Implementation)







- Increased knowledge and capacity for Digital Government/GovTech problem identification and project design across the World Bank and beyond, by providing good practice examples of GovTech related components, objectives, activities and performance indicators, budgets, drawing on existing GovTech projects and projects with GovTech focused components.
- Task teams will be able to search relevant project documents that fit client needs and development objectives in a more efficient manner.