

Geospatial Knowledge Infrastructure

Theme: Enabling the Future: Geospatial Knowledge Infrastructure for Sovereignty, Sustainability, and Resilience

From Maps to Knowledge Systems: Reframing GKI as Strategic National Infrastructure

Greg Scott

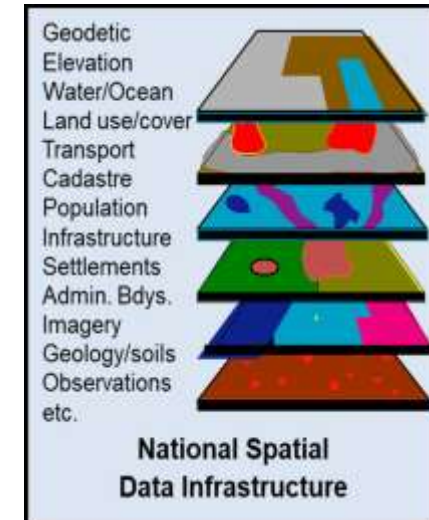
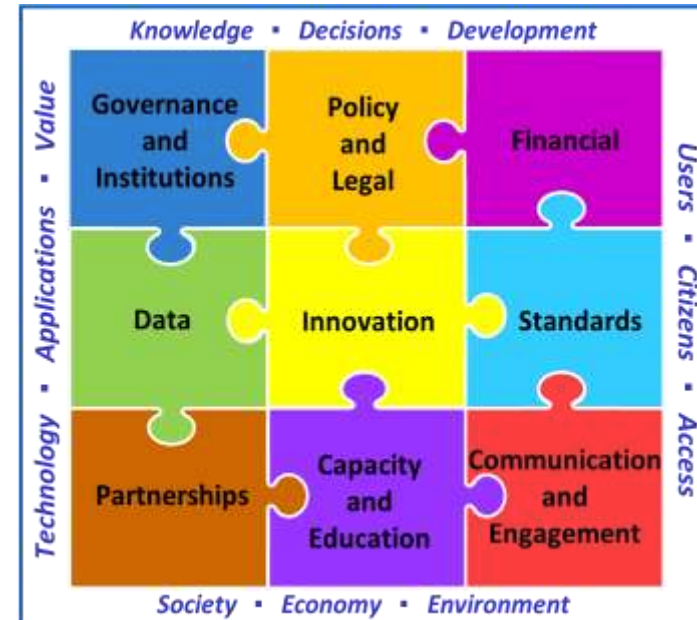
Executive Director
SDG Data Alliance
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Evolving NSDI, UN-IGIF and GKI Relationship



UN·IGIF
INTEGRATED GEOSPATIAL
INFORMATION FRAMEWORK



“Moving from data infrastructure to knowledge infrastructure”

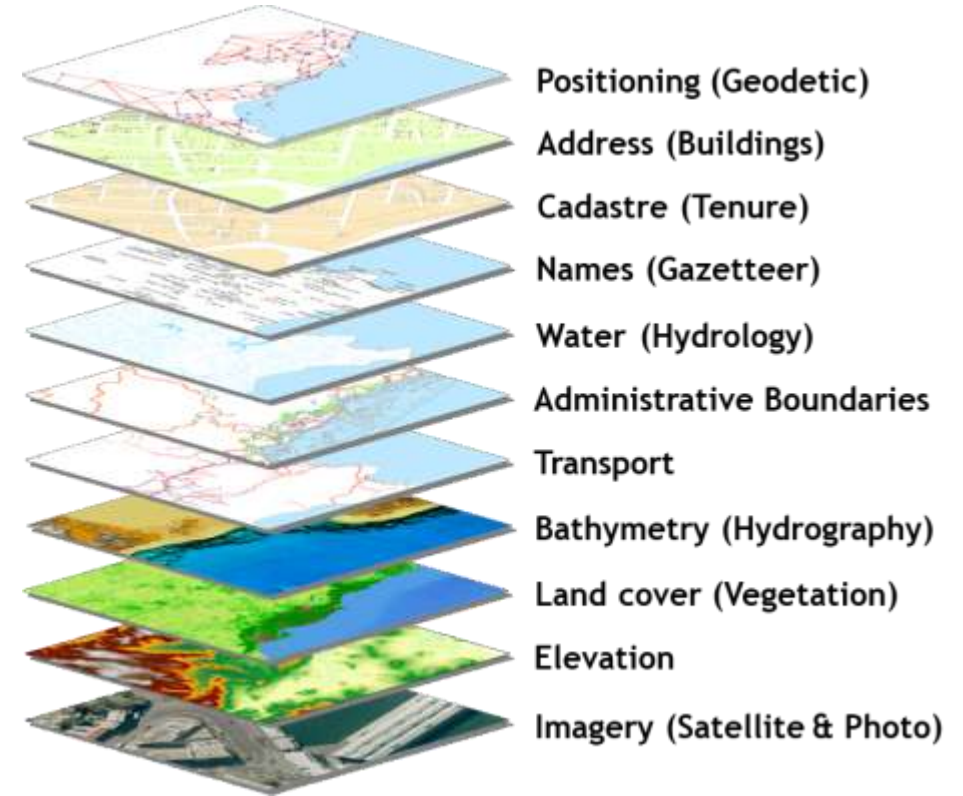
Geospatial Information: Our Origins

How old is this statement? **40 years!**

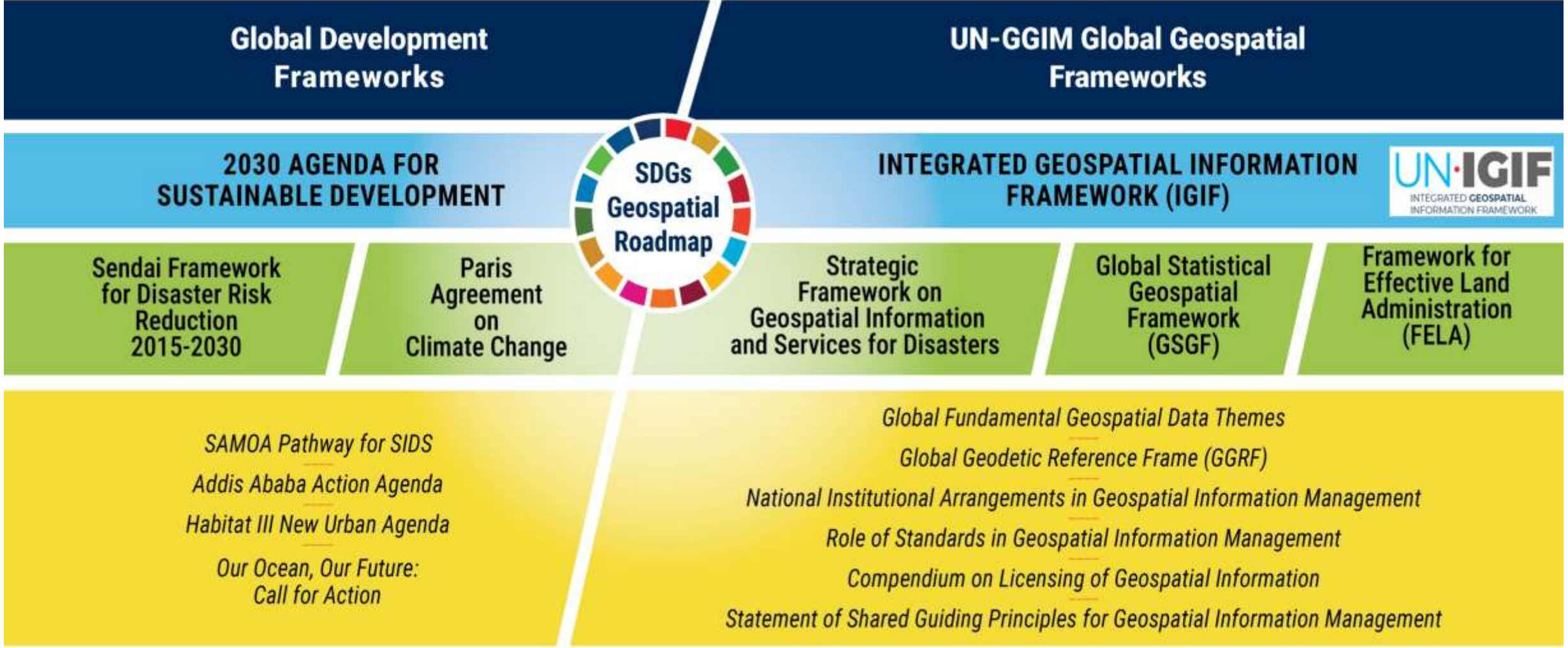
“Early SDI initiatives focused on data, accessibility, and services, the core components being policy, access network, technical standards, people (including partnerships) and data.

These soon led to the development of, firstly product-based SDI approaches, where models tended to be data producer and national mapping agency led, focusing on data production, database creation, and centralization;

and then process-based SDI approaches, driven more by data sharing and re-using data collected by a wide range of agencies for a great diversity of purposes.”



UN-GGIM and the UN-IGIF



An Overview of the UN-IGIF



The UN Integrated Geospatial Information Framework provides a basis and guide for developing, integrating and strengthening geospatial information management.

VISION						
The efficient use of geospatial information by all countries to effectively measure, monitor and achieve sustainable social, economic and environmental development – leaving no one behind						
MISSION						
To promote and support innovation and provide the leadership, coordination and standards necessary to deliver integrated geospatial information that can be leveraged to find sustainable solutions for social, economic and environmental development.						
STRATEGIC DRIVERS						
National Development Agenda • National Strategic Priorities • National Transformation Programme • Community Expectations • Multilateral trade agreements • Transforming our World: 2030 Agenda for Sustainable Development • New Urban Agenda • Sendai Framework for Disaster Risk Reduction 2015–2030 • Addis Ababa Action Agenda • Small Island Developing States Accelerated Modalities of Action (SAMOA Pathway) • United Nations Framework Convention on Climate Change (Paris Agreement) • United Nations Ocean Conference: Call for Action						
UNDERPINNING PRINCIPLES						
Strategic Enablement	Transparent and Accountable	Reliable, Accessible and Easily Used	Collaboration and Cooperation	Integrative Solution	Sustainable and Valued	Leadership and Commitment
GOALS						
Effective Geospatial Information Management	Increased Capacity, Capability and Knowledge Transfer	Integrated Geospatial Information Systems and Services	Economic Return on Investment			
Sustainable Education and Training Programs	International Cooperation and Partnerships Leveraged	Enhanced National Engagement and Communication	Enriched Societal Value and Benefits			

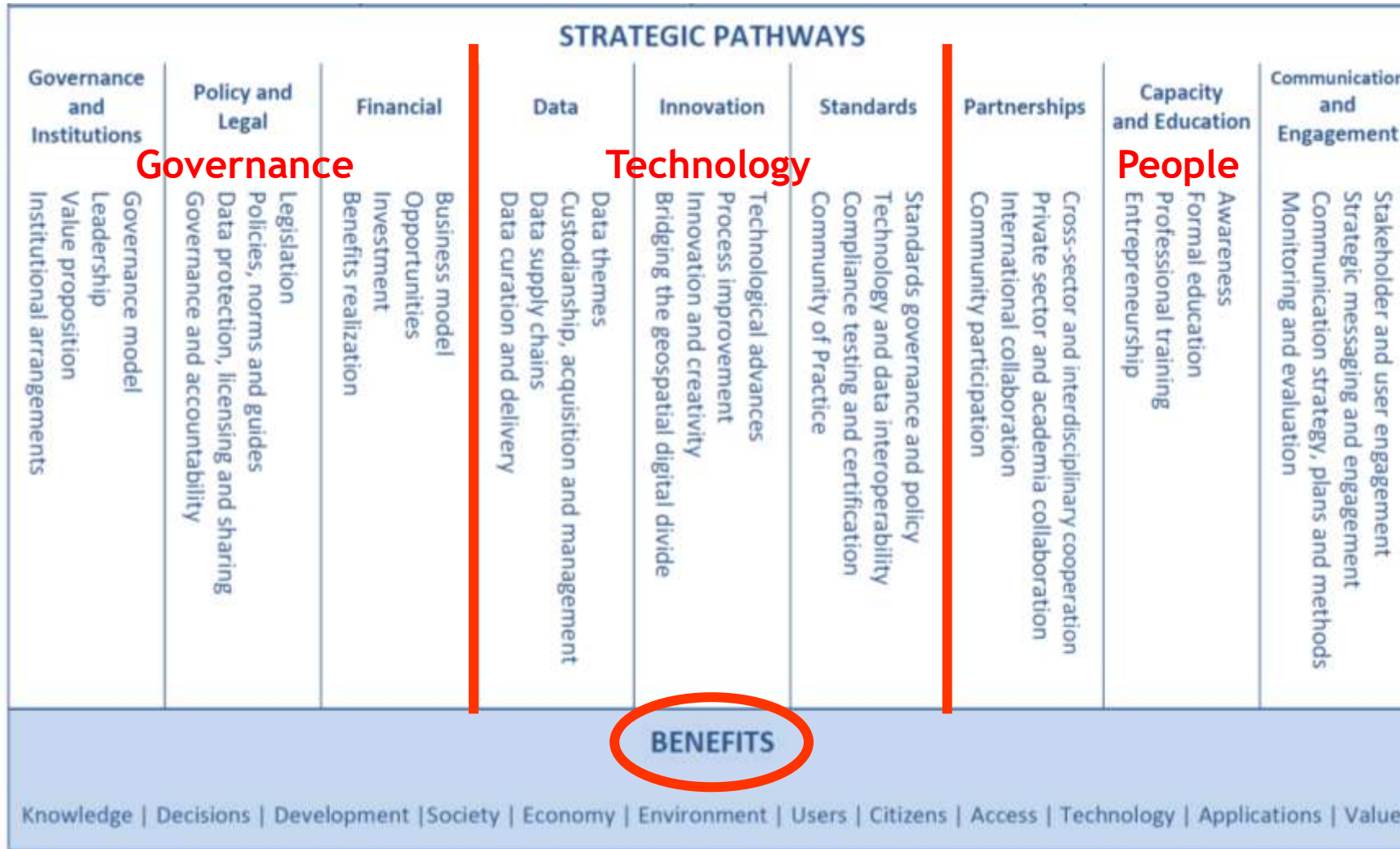


The Overarching Strategic Framework is a mechanism for articulating and demonstrating national leadership, cultivating champions, and developing the capacity to take positive steps.

An Overview of the UN-IGIF

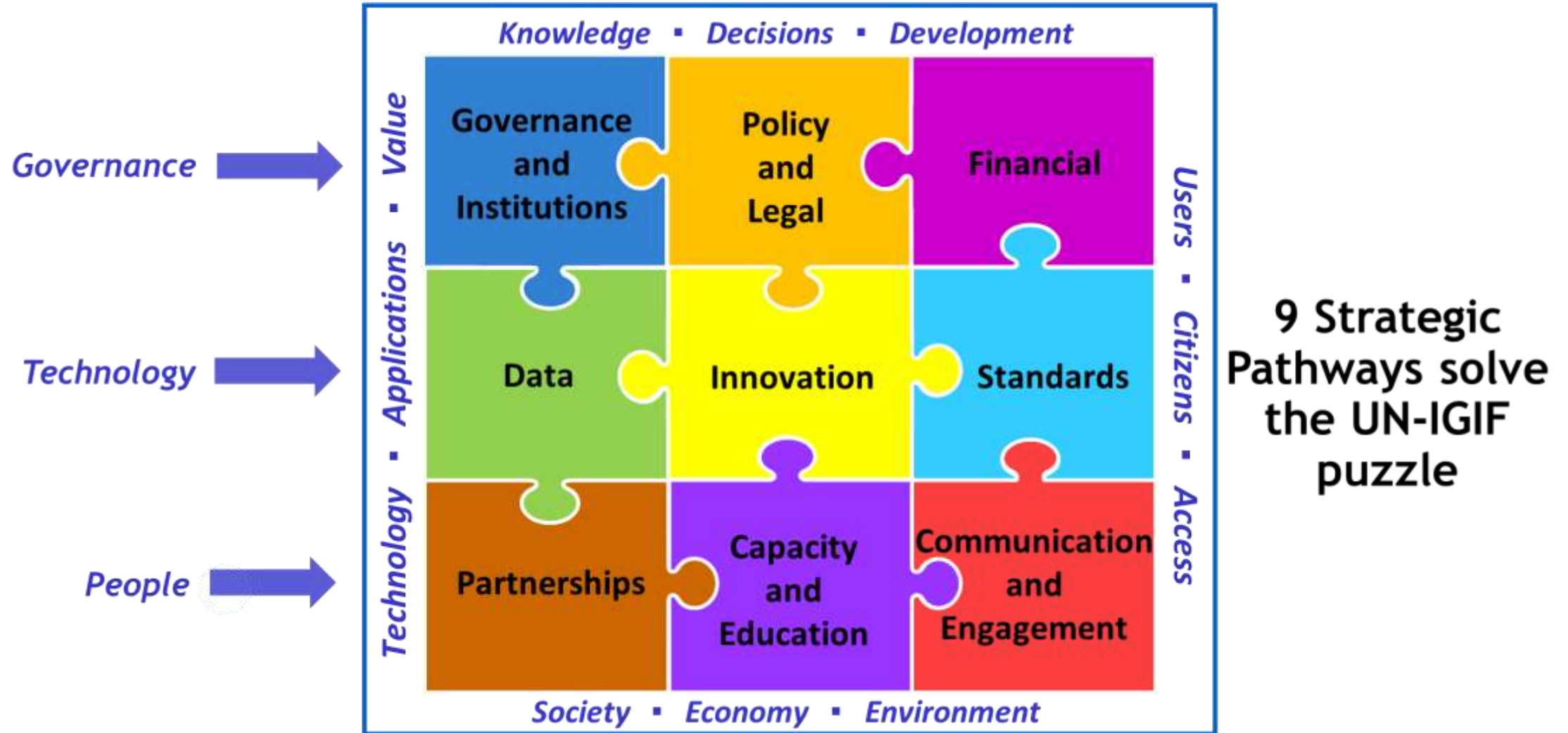


Geospatial information has immense social and economic value. Citizens, communities, business sectors, governments, and many other stakeholders benefit every day.



Anchored by 9 Strategic Pathways, the IGIF is a mechanism for articulating and demonstrating national leadership in geospatial information, and the capacity to take positive steps. The Strategic Pathways 'implement' the IGIF through actions.

An Overview of the UN-IGIF



GKI Concepts: 2020-2022

As part of the emerging ‘knowledge infrastructure’, GKI seeks to bring a **geospatial dimension to the wider digital ecosystem.**

We (geospatial community) well understand geospatial information, but it is now broader than in the past. Geospatial requires **‘integration’ – of data, technology, applications, analytics, modelling, infrastructure, industry, organizations, innovation...and knowledge.**

While anchored by geospatial information, the GKI **engages with a broader range of industry and engineering sectors.**

With geospatial information at the heart of the advancing knowledge environment, the GKI **moves the geospatial sector closer to the wider 4IR data ecosystem.**

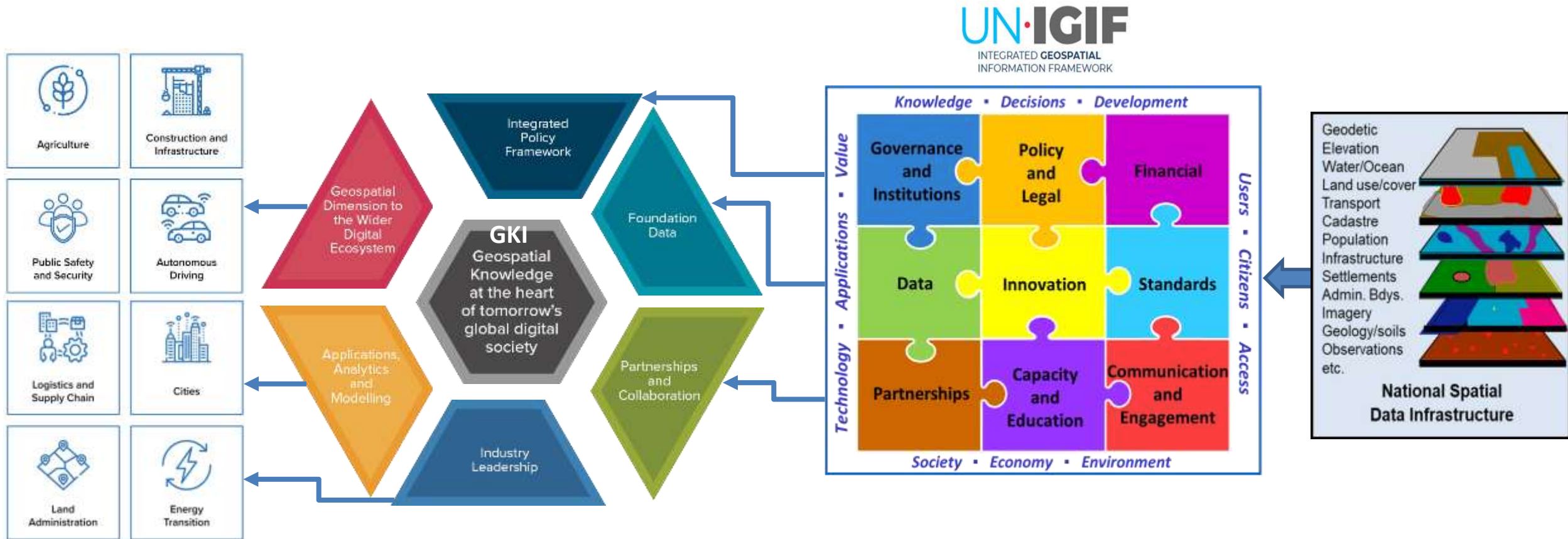


GKI Concepts: 2020-2022



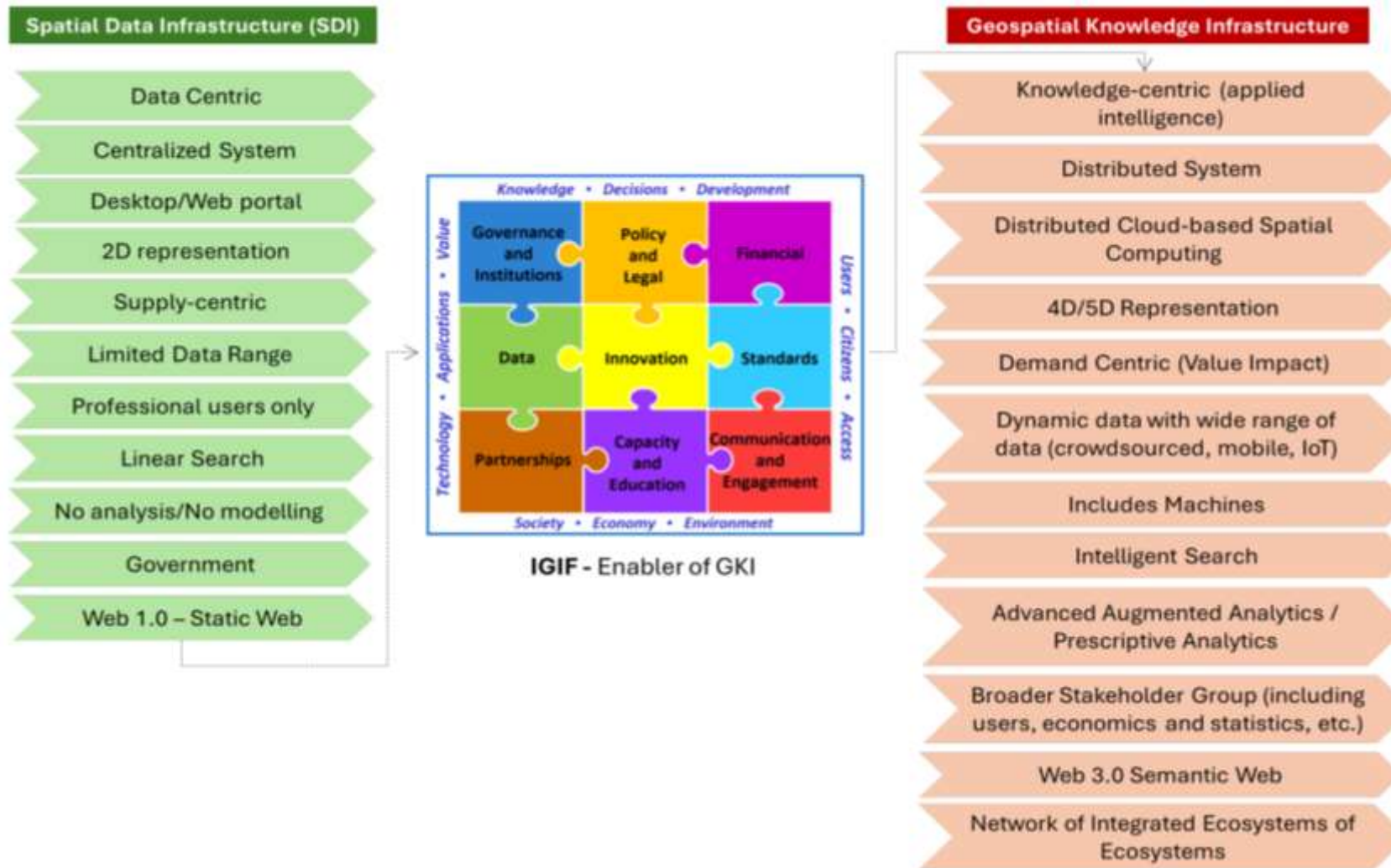
The GKI seeks to add a 'location-based knowledge' dimension to the broader industry and digital ecosystem, to mainstream geospatial data, expertise, technologies, and analytics; and leverage the many new opportunities enabled by the 4IR.

Evolving NSDI, UN-IGIF and GKI Relationship



“Moving from data infrastructure to knowledge infrastructure”

Evolving NSDI, UN-IGIF and GKI Relationship





3. Leveraging GKI to Accelerate Progress on the SDGs

Transitioning Towards GKI Today

*“The world is evolving at an unprecedented pace, driven by **rapid technological advancements and the urgent need to address complex global challenges**. From climate change and public health crises to urbanization and geopolitical uncertainties, decision-makers require more than traditional data—they need integrated, real-time insights to navigate effectively.”*

“GKI provides a comprehensive blueprint for integrating digital economies, societies, and citizens with geospatial approaches, data, and technologies.”

*“**Moving up the data value chain** – from fragmented data management to integrated knowledge ecosystems.”*

*“Together, **GKI and UN-IGIF** will significantly enhance the global geospatial ecosystem, driving innovation and enabling more informed policymaking, better resource management, and improved resilience to global challenges. The future geospatial ecosystem, as envisioned through the GKI, will be more inclusive, intelligent, and collaborative.”*



Source: GKI Readiness Index 2025

Realizing the Data Value Chain

There is a recognition of the urgent **'data needs, availability and use'** towards the wider digital data and information ecosystem, including **geospatial, Earth observations** and other **location-based information** across industry sectors.

However, the availability of and accessibility to data remains the vital missing link for many of the world's countries.

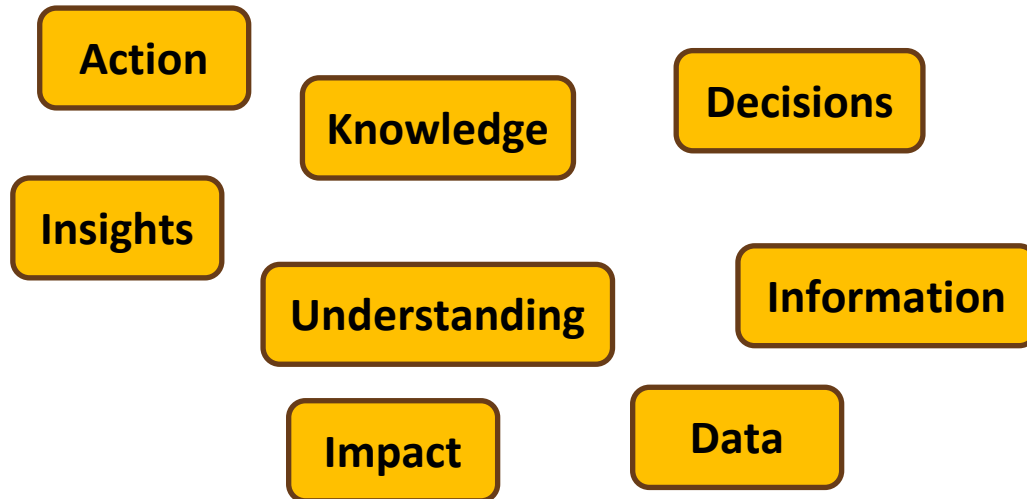
Many innovative **technologies, data acquisition** capabilities, and even petabytes of data, exist. BUT...many countries either **do not have access** to this data or **do not know what to do with it** or **how to use it**.

Therefore, how do we **extract** more **value** and **purpose** from (often fragmented) **data** to **create impact**?



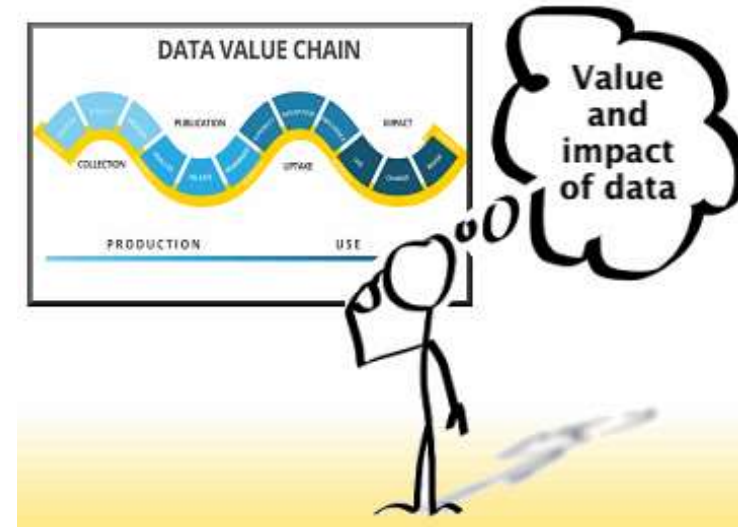
Realizing the Data Value Chain

Below are different elements of the Data Value Chain.
Can you organize them into a logical sequence?



The Data Value Chain:

Data > Information > Knowledge/Understanding > Insights > Decisions > Action > Impact



Realizing the Data Value Chain

Ensuring **Data** has **Impact**

If data is **arranged, organized and structured**, it then becomes the building blocks of information. Then the real value begins...

From (often integrating) **Data** we build **Information**

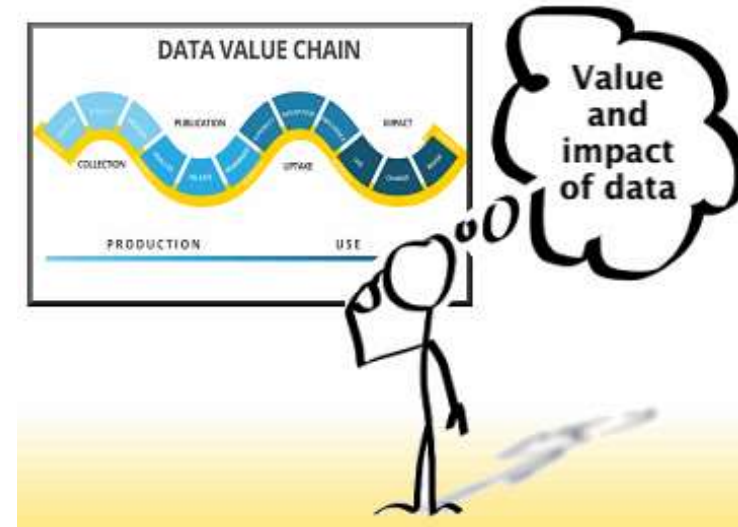
enabling us to create **Knowledge** (or **Understanding**) which provides with it **Insights**

enabling us to then make **Decisions** in such a way as to take **Action**

that has measurable and positive **Impact**.

The Data Value Chain:

Data > Information > Knowledge/Understanding > Insights > Decisions > Action > Impact





4. Geospatial Intelligence for Targeting Social Inequities and Service Delivery Gaps



Emergence of Geospatial Intelligence

*“The world is **“GKI provides a comprehensive blueprint for integrating digital economies, societies, and citizens with geospatial approaches, data, and technologies.”***

*“Looking toward the long-term horizon, the industry is undergoing a structural transformation toward GKI – a knowledge-led, integrated paradigm that positions **geospatial data as a strategic asset** at the core of national digital economies.*

*This transition is **shaped by strategic, technology-led imperatives**, such as cross-sector data integration, the adoption of AI/ML and edge computing, and the **operationalization of geospatial intelligence** within **digital public infrastructure**”*

Next-generation geospatial intelligence (GEOINT) involves the advanced collection, analysis, and application of geospatial data to provide actionable insights, often using cutting-edge technologies and emerging trends.



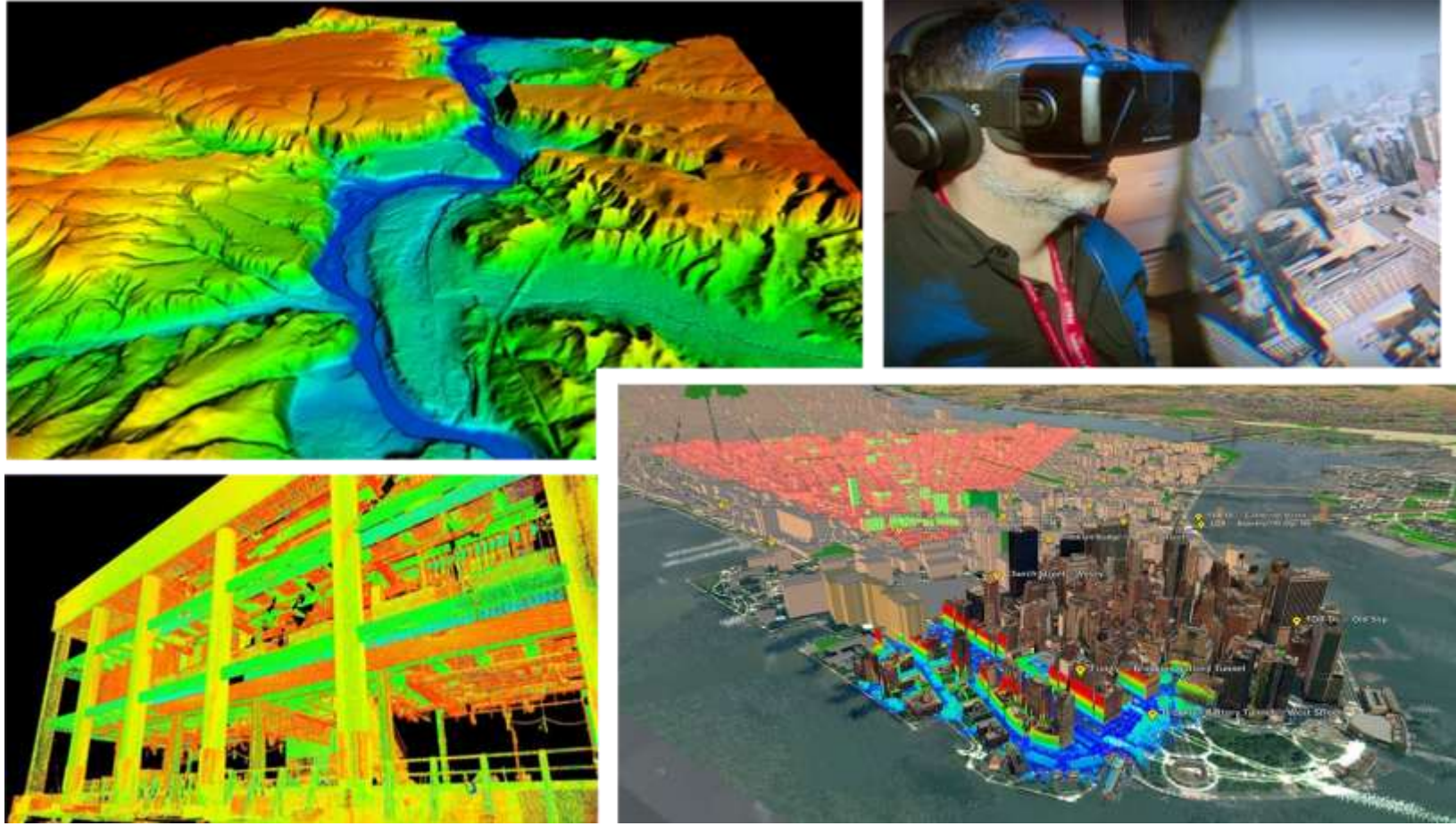
Source: GKI Readiness Index 2025

Adoption of Geospatial Intelligence



We are Building Geospatial Intelligence into our Cities

Adoption of Geospatial Intelligence



With Geospatial Data, Modelling and Analytics

Adoption of Geospatial Intelligence



The disruptive nature of digital transformation, technology, innovation, and their exponential impacts, means that society's expectations on how, and at what level of detail, we record what is happening where and when are changing at a rapid pace.

Combined with Disruptive Technologies, AI, Innovation & Smart Digital Transformations

Challenges for Geospatial Intelligence

But... these digital technologies and solutions bring with them a growing digital divide

- How do we bridge the gap in technology access among urban populations?
- The digital divide in urban areas is not just a matter of access to the internet.
- It encompasses a range of factors, including broadband availability, digital literacy, the affordability of digital devices, and the capacity to use technology in ways that enhance economic and social outcomes.
- For many, it even includes having access to reliable electricity!
- As cities become smarter, there is a risk is that these disparities will widen, leaving behind those who cannot participate in the digital economy... and leverage geospatial intelligence!



Challenges for Geospatial Intelligence



The Urban Digital Divide

Challenges for Geospatial Intelligence



The Geospatial Digital Divide

GKI Delivering Geospatial Intelligence

The good news... sustainable development is top of the agenda!

- Geospatial technologies are playing a crucial role in monitoring and managing the environment, including climate change, deforestation, and resource management.
- Geospatial technology has emerged as a pivotal tool in environmental conservation, enabling precise mapping, monitoring, and management of natural resources.
- Geospatial technology also enables continuous monitoring and assessment of key climate-related parameters. It provides real-time data on land cover changes, deforestation, glacier melting, sea ice extent, and carbon dioxide emissions.



Credit: Santosh Kumar Bhoda

GKI Delivering Geospatial Intelligence

- **Artificial Intelligence (AI) and Machine Learning (ML):** Integration of AI and ML into geospatial data analysis efficiently detects patterns, anomalies, or changes.
- **Big Data and Cloud Computing:** To manage, process, and share geospatial data at scale, making advanced technologies more accessible to more users.
- **Internet of Things (IoT):** Integration of IoT devices with geospatial technologies enables real-time data collection and analysis.
- **3D Mapping and Virtual Reality:** Enabling more immersive and intuitive visualization of spatial data.
- **Location-based Services:** Demand for location-based services and location intelligence continues to grow.
- **Data Collection and Generation:** Drones, satellites, and LiDAR are redefining how geospatial data is collected.
- **Business Model Transformation:** Democratizing access to advanced geospatial technologies, making them more affordable and accessible.



Credit: Santosh Kumar Bhoda



5. Building Institutional Capacity to Operationalize GKI for Social Impact

WHAT???



What does “**building institutional capacity to operationalize Geospatial Knowledge Infrastructure (GKI) for social impact**” mean?

*“Building institutional capacity for Geospatial Knowledge Infrastructure (GKI) involves **developing policies for open data access and sharing, implementing training programs to enhance skills in areas like AI and cloud computing, fostering public-private partnerships to broaden the data value chain, and strategically shifting from a data-centric to a knowledge-centric approach to empower evidence-based decision-making for social impact. This transition is crucial for leveraging location-based information to address pressing global and local challenges.**”*

Key Strategies:

Develop supportive policies

Provide targeted training

Foster collaboration and partnerships

Shift to a knowledge-centric model

Promote data-driven decision-making

Embrace technological advancements

Bridge the digital divide

GKI Readiness Index 2022

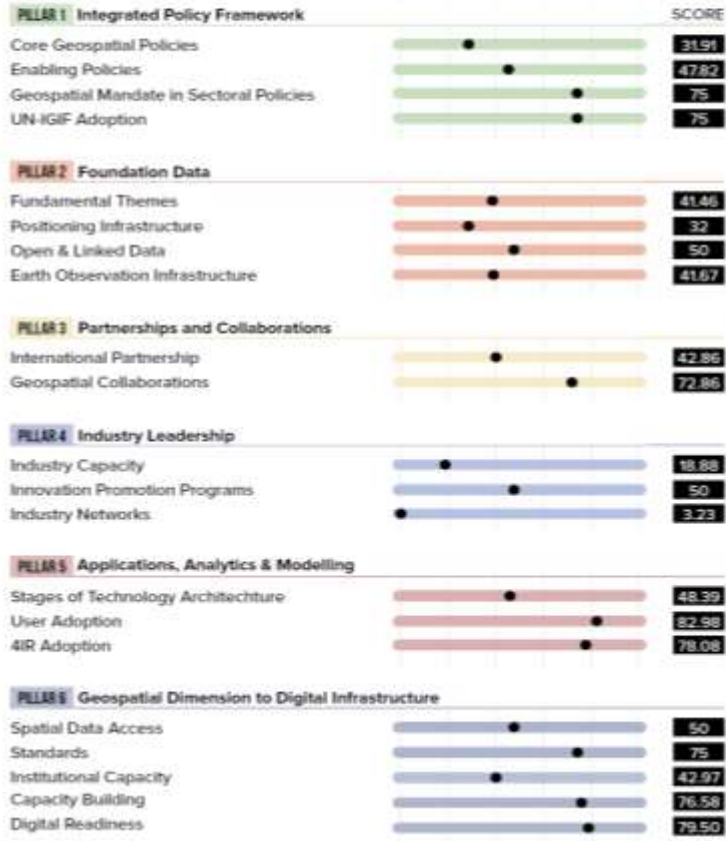
SAUDI ARABIA

COUNTRY RANKING

32

SCORE - 46.93

0 20 40 60 80 100



GEOGRAPHIC AREA (SQ. KM.)
2149690



GDP (USD)
833.54 Billion



POPULATION
35.34 Million



MAJOR GEOSPATIAL AGENCIES
General Authority for Survey and Geospatial Information (GASGI)
Saudi Space Commission
Saudi Geological Survey

*The relative scores are mentioned here, which is calculated by comparing the absolute score of a particular country with the highest absolute score.

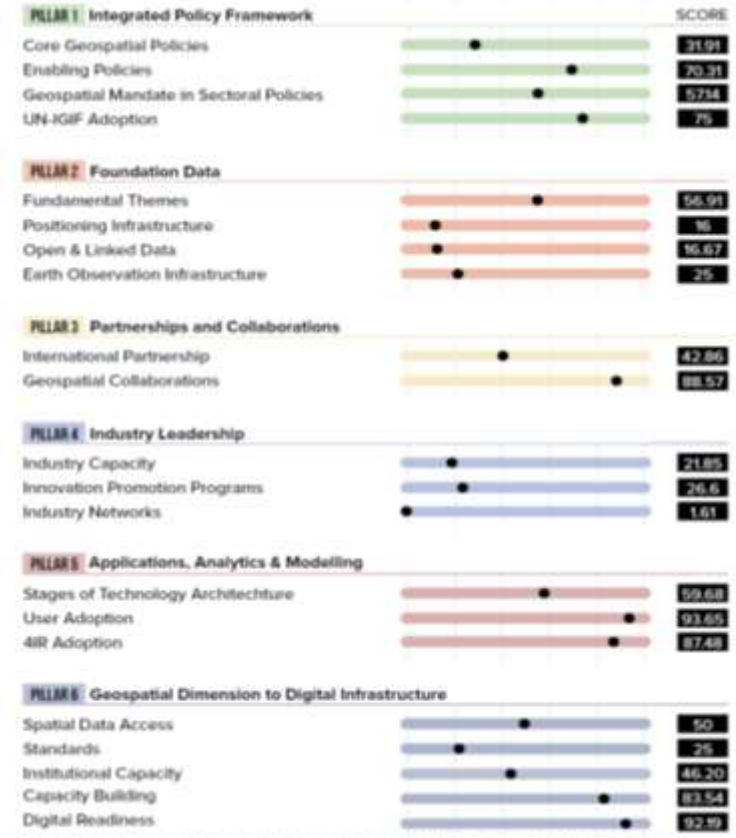
UAE

COUNTRY RANKING

36

SCORE - 43.3

0 20 40 60 80 100



GEOGRAPHIC AREA (SQ. KM.)
71020



GDP (USD)
640 Billion



POPULATION
9.99 Million



MAJOR GEOSPATIAL AGENCIES
Federal Geographic Information Centre (FGIC)
UAE Space Agency

*The relative scores are mentioned here, which is calculated by comparing the absolute score of a particular country with the highest absolute score.

BASIC FACTS

Capital	Riyadh
Geographic Area (Thousand sq. km)	2149.69
Population (Million)	33.66
GDP (Million USD)	1100

PRIMARY AGENCIES

- General Authority for Survey and Geospatial Information (GEOSA)
- Saudi Space Agency/Saudi Space Commission (SSC)
- Hydrography Directorate, GEOSA
- Saudi Geological Survey (SGS)

RANK IN GLOBAL INDICES

World Competitiveness Index	16
Global Innovation Index	47

E-Government Development Index	6
Network Readiness Index	35

GKI RANK AND SCORE (PILLAR-WISE)

INFRASTRUCTURE Rank: 71 | Score: 85.05

1.1 Geospatial Infrastructure	95.68
1.2 Space Infrastructure	73.94
1.3 Hydrographic Infrastructure	80.60

INSTITUTIONAL CAPACITY Rank: 25 | Score: 26.67

2.1 Geospatial Institutional Readiness	29.31
2.2 Knowledge Ecosystem Readiness*	24.50

INDUSTRY ECOSYSTEM Rank: 81 | Score: 40.70

3.1 Industry Capacity	42.90
3.2 Incubation and Entrepreneurship	19.98
3.3 Innovation and Government Efficiency	56.22

POLICY LANDSCAPE Rank: 61 | Score: 56.27

4.1 Geospatial and Space Policy Governance	44.48
4.2 Geospatial Integration in Cross-Sector Policies	65.31
4.3 Integrated Digital Innovation and Data Governance Policies	64.94
4.4 Adaptive Regulatory Governance*	73.80

USER ADOPTION Rank: 121 | Score: 77.51

5.1 Geospatial Application Assessment	75.99
5.2 User Digital Innovation Readiness*	76.70
5.3 Digital Transformation and Application*	80.25

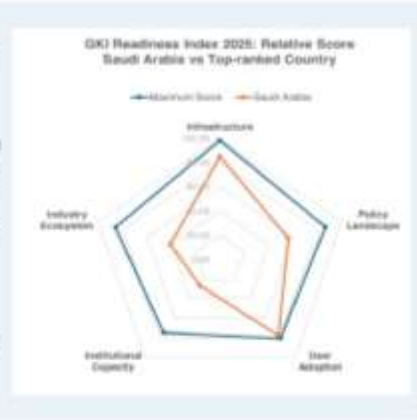
STRENGTHS

- Strong top-down mandate for geospatial modernization under Vision 2030, with high-level policy and funding support.
- Significant investments in national mapping, 3D city models, Digital Twin and geospatial infrastructure for mega-projects (e.g., NEOM, Digital Twin of Cities).
- Leadership of the General Authority for Survey and Geospatial Information (GEOSA) centralizes policy and data governance.
- Growing application and adoption for geospatial technologies in infrastructure, defense, and smart city development.
- Forward looking strategy to expand investments in developing the geospatial and space industry ecosystem.

WEAKNESS

- Institutional and technical capacity gaps remain in terms of workforce development and advanced analytics.
- Real-time data systems and public geospatial services are still at an early stage of maturity.
- Limited open data culture and constrained access to foundational geospatial datasets.

Note: *Use of relevant global indices for pillar score normalization. Refer to the relevant global indices in Annexure 4



BASIC FACTS

Capital	Abu Dhabi
Geographic Area (Thousand sq. km)	83.60
Population (Million)	10.84
GDP (Million USD)	545050

PRIMARY AGENCIES

- Federal Geographic Information Center (FGIC)
- United Arab Emirates Space Agency

RANK IN GLOBAL INDICES

World Competitiveness Index	7
Global Innovation Index	32

E-Government Development Index	11
Network Readiness Index	28

GKI RANK AND SCORE (PILLAR-WISE)

INFRASTRUCTURE Rank: 42 | Score: 58.43

1.1 Geospatial Infrastructure	57.22
1.2 Space Infrastructure	66.42
1.3 Hydrographic Infrastructure	43.67

INSTITUTIONAL CAPACITY Rank: 27 | Score: 25.25

2.1 Geospatial Institutional Readiness	19.15
2.2 Knowledge Ecosystem Readiness*	30.25

INDUSTRY ECOSYSTEM Rank: 15 | Score: 37.43

3.1 Industry Capacity	38.87
3.2 Incubation and Entrepreneurship	10.25
3.3 Innovation and Government Efficiency	67.44

POLICY LANDSCAPE Rank: 26 | Score: 34.77

4.1 Geospatial and Space Policy Governance	17.16
4.2 Geospatial Integration in Cross-Sector Policies	43.62
4.3 Integrated Digital Innovation and Data Governance Policies	47.34
4.4 Adaptive Regulatory Governance*	71.07

USER ADOPTION Rank: 19 | Score: 66.64

5.1 Geospatial Application Assessment	64.80
5.2 User Digital Innovation Readiness*	81.01
5.3 Digital Transformation and Application*	69.45

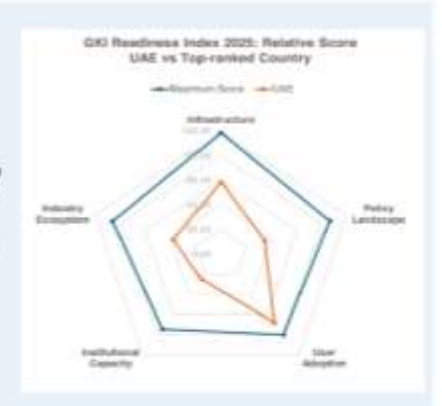
STRENGTHS

- Strong national push toward geospatial modernization through programs like Smart Dubai and Abu Dhabi Digital Authority.
- Centralized governance and funding accelerate adoption of spatial infrastructure across government services.
- Advanced urban digital twin pilots and 3D mapping support mega-projects such as smart cities, utilities and transportation.
- Openness to international geospatial partnerships enhances

WEAKNESS

- Limited open data availability for public and commercial innovation.
- Reliance on vendor-led systems restricts long-term ecosystem development.
- Geospatial workforce development remains a constraint to scaling adoption.
- Civic and community-level geospatial use remains underdeveloped compared to institutional investment.

Note: *Use of relevant global indices for pillar score normalization. Refer to the relevant global indices in Annexure 4



GKI Readiness Index 2025

Building National Institutional Capacity

How is the Kingdom of Saudi Arabia Responding to the Digital Divide?

Question:

The digital divide is widening as technology advances and becomes crucial for many different elements of our daily life.

Does the Kingdom of Saudi Arabia have a 'digital divide' and, if so, what might be some examples of this divide?

Building National Institutional Capacity

Factors contributing to the digital divide in Saudi Arabia:

- **Urban vs Rural Access:** Urban areas, such as Riyadh, Jeddah, and Dammam, enjoy high levels of internet connectivity and advanced digital infrastructure. Rural or remote areas, especially in desert regions, often face challenges in accessing high-speed internet and modern telecommunications.
- **Affordability and Income Gaps:** While internet access has become more affordable over the years, lower-income individuals and families may still find digital devices and services expensive.
- **Digital Literacy:** There is a disparity in digital literacy, with younger and urban populations often being more tech-savvy compared to older or rural populations.
- **Gender Gap:** Cultural and societal norms have historically limited women's access to technology in some areas, although this has improved significantly in recent years with progressive reforms.
- **Language Barriers:** A reliance on English-language content can sometimes hinder access for Arabic-speaking populations, though local initiatives have aimed to bridge this gap.

Building National Institutional Capacity

Saudi Arabia's Efforts to Bridge the Digital Divide:

- **Vision 2030:** The Saudi government's Vision 2030 initiative emphasizes the development of a digital economy and bridging the gap in technology access across the Kingdom. Projects under this vision include expanding broadband coverage to rural areas and implementing 5G networks.
- **Universal Service Fund (USF):** Saudi Arabia has introduced programs to subsidize internet access in underserved areas, ensuring wider connectivity.
- **Investment in Infrastructure:** Significant investments have been made to build fiber-optic networks and expand mobile broadband coverage, even to remote regions.
- **Digital Literacy Programs:** The government has launched education and training programs to improve digital skills, particularly targeting students, women, and underrepresented groups.
- **E-Government Services:** By expanding e-government services, Saudi Arabia has increased digital adoption among citizens who need access to public services online.

Progress Made

- Saudi Arabia has one of the highest internet penetration rates in the Middle East, exceeding 97% as of recent reports. The roll-out of 5G networks and a growing tech-savvy population have helped reduce the digital divide significantly. Initiatives focused on marginalized groups, like women and rural communities, have begun to yield positive results.



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Thank you !