

Introduction to Geospatial Knowledge Infrastructure (GKI)

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**GEOSPATIAL
WORLD**
ADVANCING KNOWLEDGE FOR SUSTAINABILITY



Partners



Covid - 19

“We don’t know when the next epidemic will strike, but I believe we can protect ourselves if we invest in better tools, a more effective early detection system, and a more robust global response system. There are also some interesting advances that leverage the power of computing to help predict where pandemics are likely to emerge and model different approaches to preventing or containing them.”

(Bill Gates, April 27, 2018)

Epidemiology

The 5 W's:

- diagnosis or health event (what?)
- person (who?)
- place (where?)
- time (when?) and
- causes, risk factors, and modes of transmission (why/how?)



*Epidemiology provides **KNOWLEDGE** on incidence, distribution and possible controls. It is geospatial and predictive.*

Actionable knowledge

BBC The Geographer Home News Sport Weather iPlayer

NEWS

Home | War in Ukraine | Coronavirus | Climate | UK | World | Business | Politics | Tech | Science | Health

Health

Yemen cholera epidemic 'controlled' by computer predictions

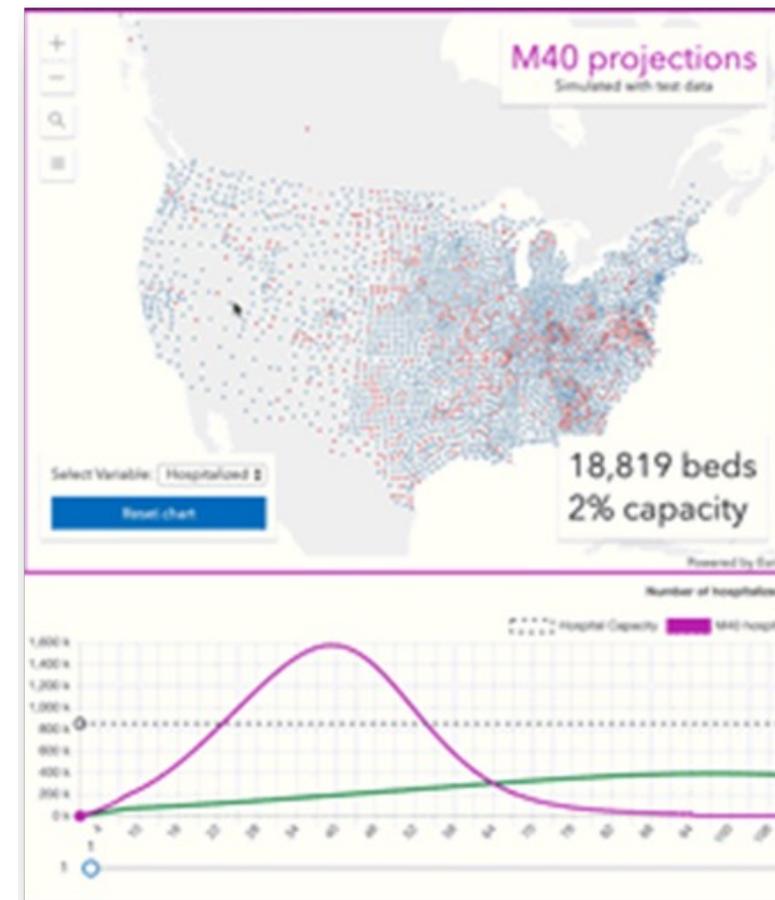
By Pallab Ghosh
Science correspondent, BBC News

27 August 2018



bluedot AI & ANALYTICS

- INFECTIOUS DISEASE OUTBREAKS
- HOSPITALS/HEALTHCARE FACILITIES
- LOCAL MOBILITY
- LIVESTOCK POPULATIONS
- MOSQUITOES & TICKS
- ANIMAL INFECTIOUS DISEASES
- POPULATION DEMOGRAPHICS
- GLOBAL FLIGHT TICKET SALES
- REAL-TIME CLIMATE

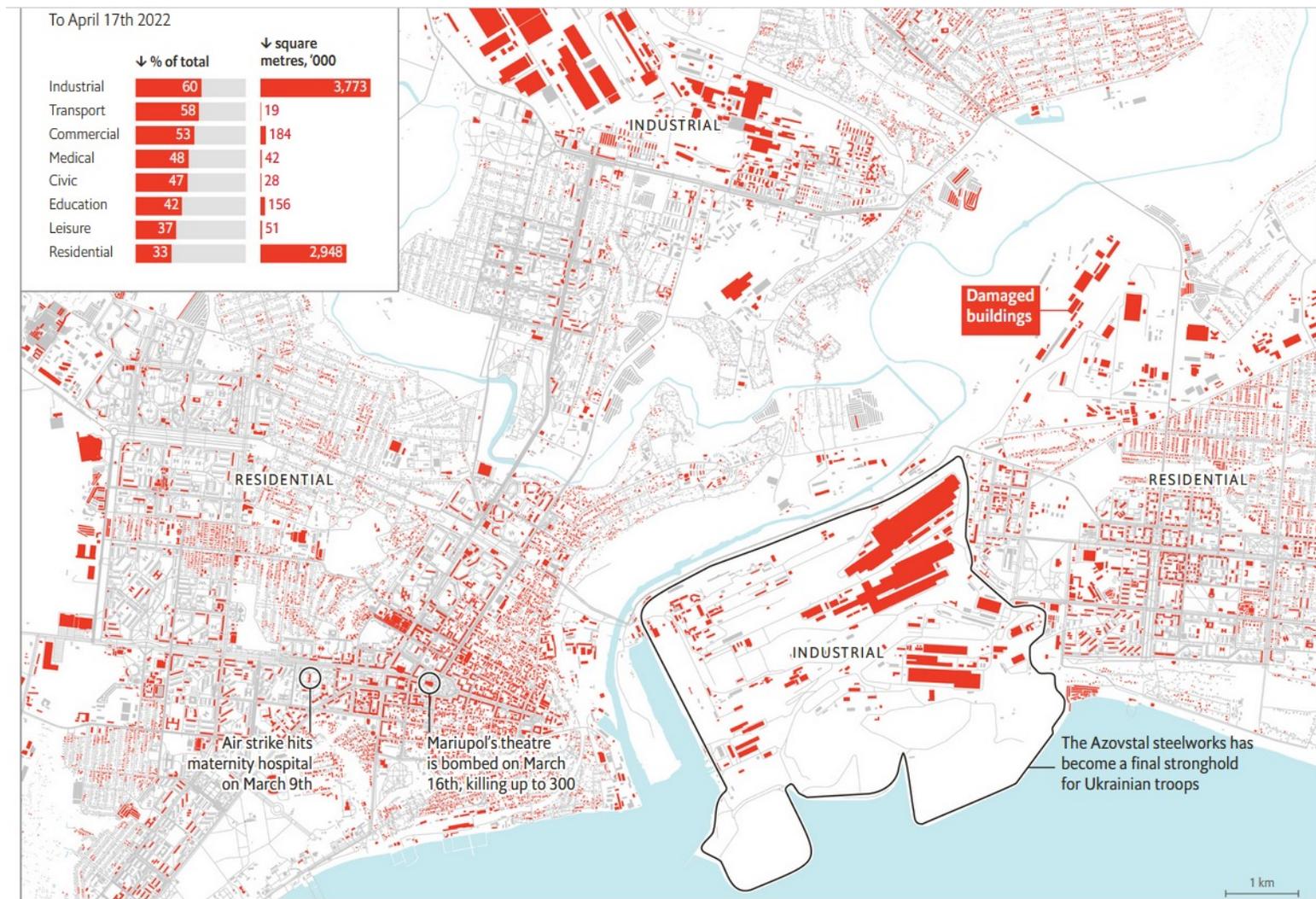


Geospatial Knowledge

Nearly half of Mariupol has suffered grave damage; 90% of it is residential



To produce this estimate, the Economist used freely available data from the synthetic-aperture radar aboard Sentinel-1, a European satellite duo



Agenda

1. Why Geospatial Knowledge Infrastructure (GKI)?
2. What is GKI?
 - Vision, definition and principles
 - The 6 elements
3. Relevance of GKI in serving humanity
4. GKI relationship with other initiatives.
5. GKI and national geospatial agencies.

Why a new concept? Location is everywhere

- **Global Navigation Satellite Systems** have democratized location and accurate time: GPS (USA), BeiDou / BDS (China), Galileo (Europe), GLONASS (Russia), IRNSS / NavIC (India), QZSS (Japan)
- **Ubiquity:** 1.1 GNSS devices per person in the world by 2029, with 0.2m smartphone absolute accuracy.
- **Open Position, Navigation, Time service:** the greatest government provided 'open geospatial service' ever
- **Resilience?** London Economics in 2017 estimated the economic impact to UK of a five-day disruption to GNSS at \$7 billion. Rand Corporation in 2022 advised US Government that risk was sufficiently low NOT to justify a 'back-up'



Why a new concept? Geospatial is changing



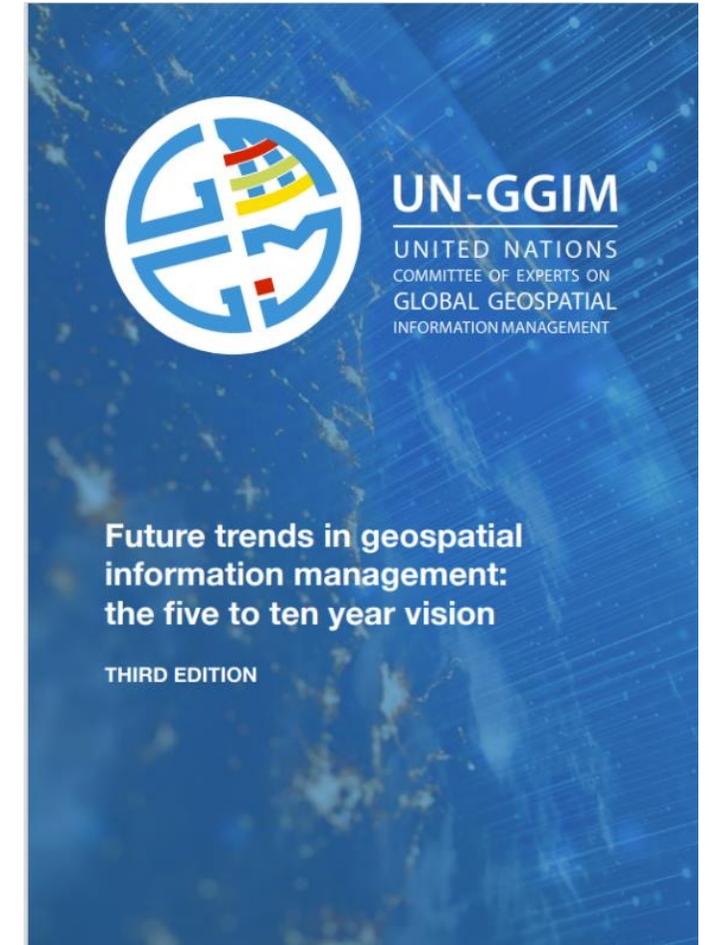
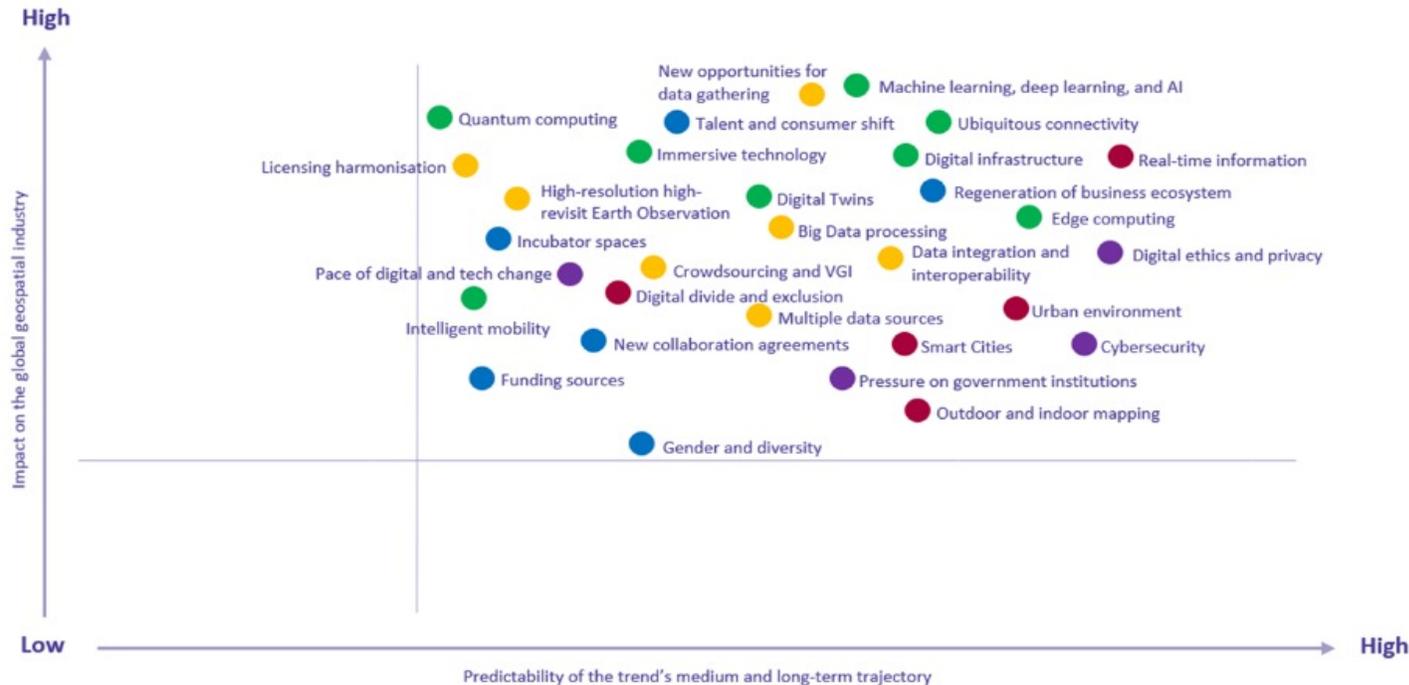
“These companies do not recognise a ‘geospatial sector’, it is just data, analytics and user interfaces in which location plays a greater or lesser part. Innovative geospatially enabled businesses are the norm and set high user expectations.” GKI White Paper

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Why a new concept? Geospatial is changing

Five prevailing drivers and an underlying set of trends

- Technological advancements
- Industry structural shift
- Legislative environment
- Rise of new data sources & analytical methods
- Evolution of customer requirements



Why a new concept? Users are changing



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GKI Project Year 2 User Industry Focus



Energy Transition



Transport & Infrastructure



Autonomous Driving



Land Administration



Logistics and Supply Chain



Cities



Public Safety and Security



Agriculture



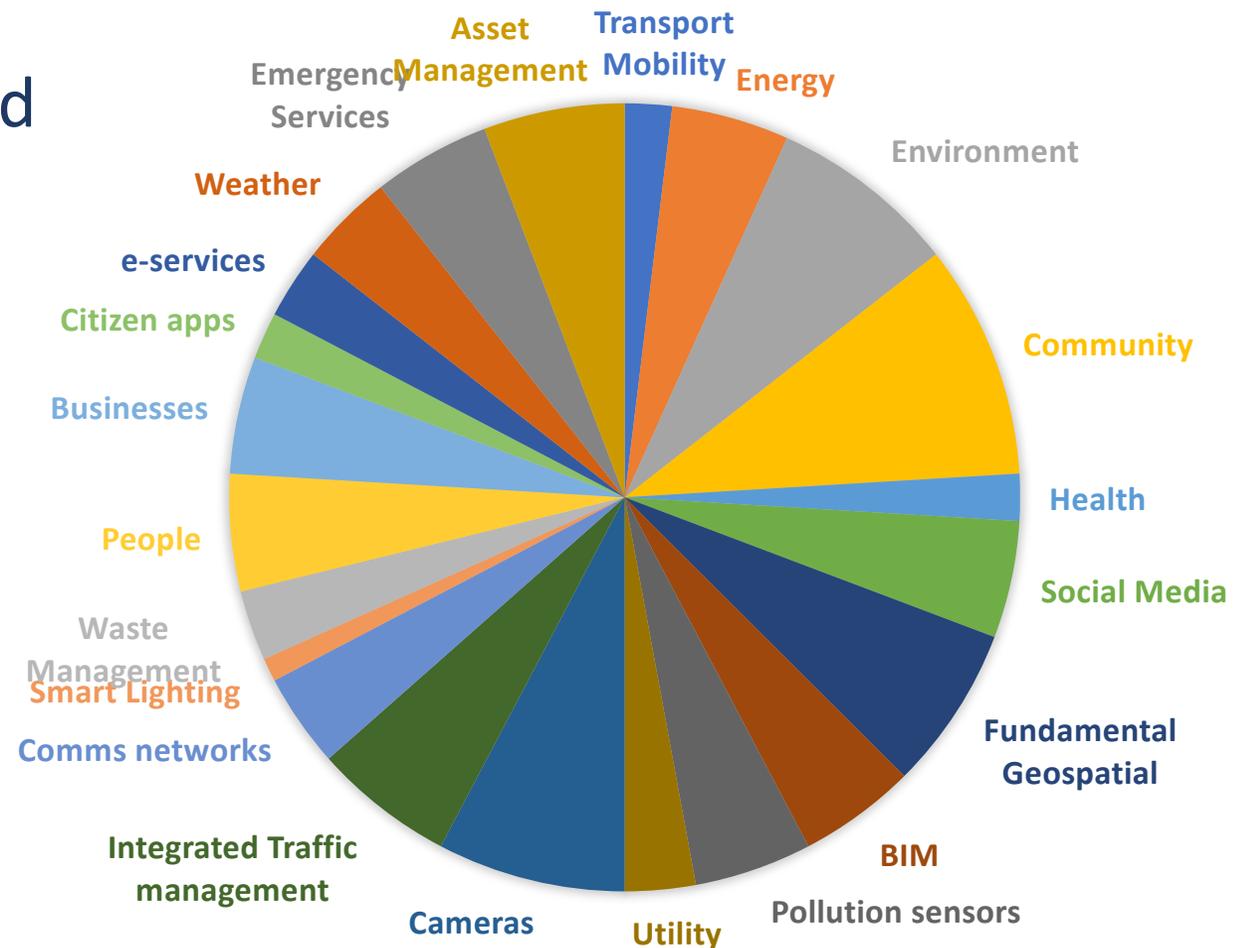
The geospatial ecosystem is now vast - everywhere

User Expectations: From data

“The volume of data is quadrupling every 5 years and by 2025 is estimated to be worth 5.8% of EU GDP.

“Data has no value unless used to solve a problem”

EXAMPLE – DIGITAL CITY DATA AND APPLICATIONS



User Expectations: From data to knowledge

“The volume of data is quadrupling every 5 years and by 2025 is estimated to be worth 5.8% of EU GDP.

“Data has no value unless used to solve a problem”

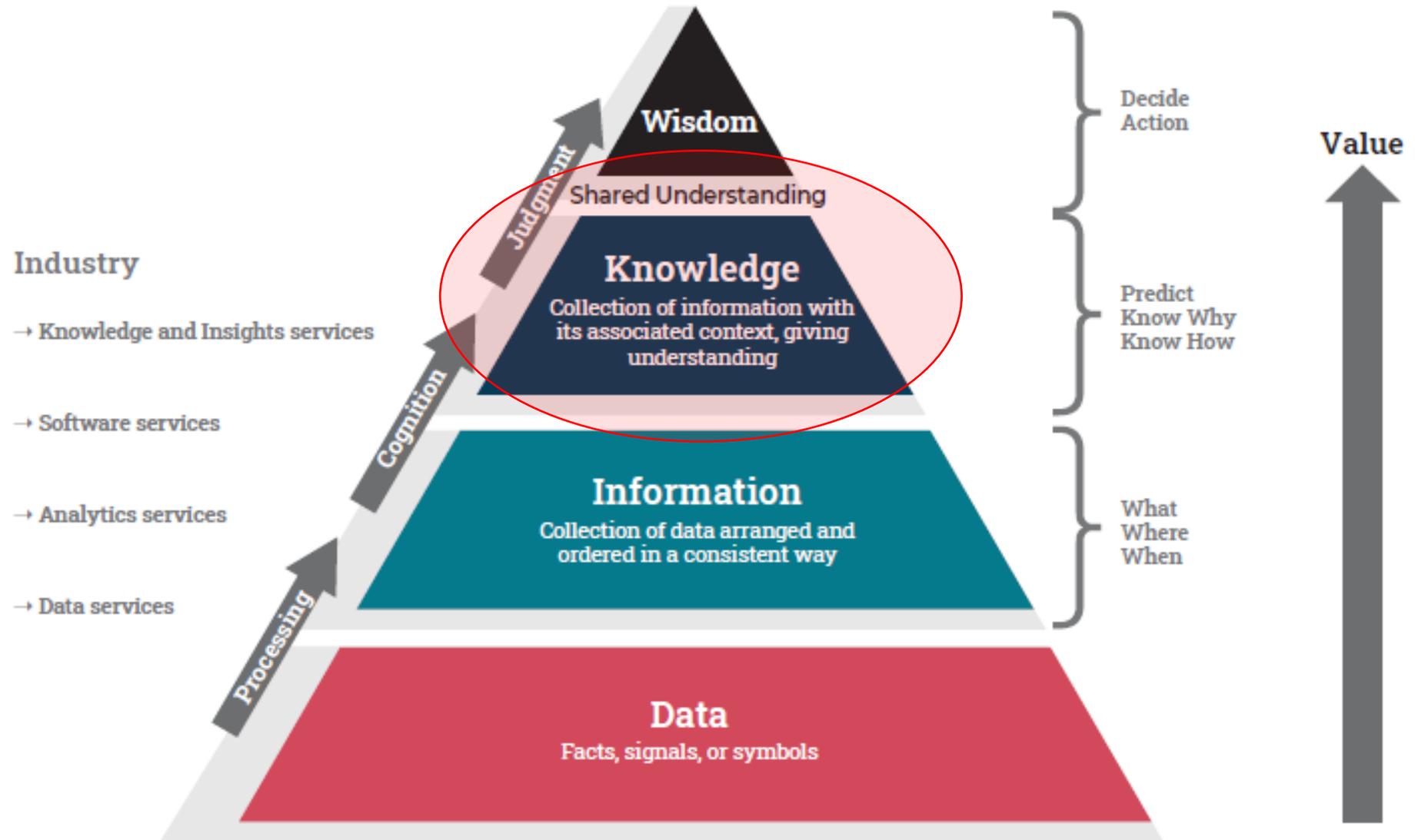
**Models, apps, AI
and location**

“City planners must plan 10 to 40 years ahead, facing increasingly multi-faceted challenges, such as hitting net-zero (70% of greenhouse gas emissions are from cities).

They seek knowledge - modelling scenarios using the best data and tools available and seeking citizen participation.”

Why a new concept? Expectations are changing

“Knowledge on demand”



"The goal is to turn data into information, and information into insight" Carly Fiorina, former chair Hewlett Packard

"Digital Transformation is just beginning... We need to come together and think about what's coming next, now is the time to go faster – not to slow down!" Mr. Jack Dangermond, President of Esri

"Systems thinking is key to geospatial information. We need to unlock ecosystems, economics and entrepreneurship." Mr. Nigel Clifford, Operating Executive, Marlin Operations Group and Deputy-Chair UK Geospatial Commission

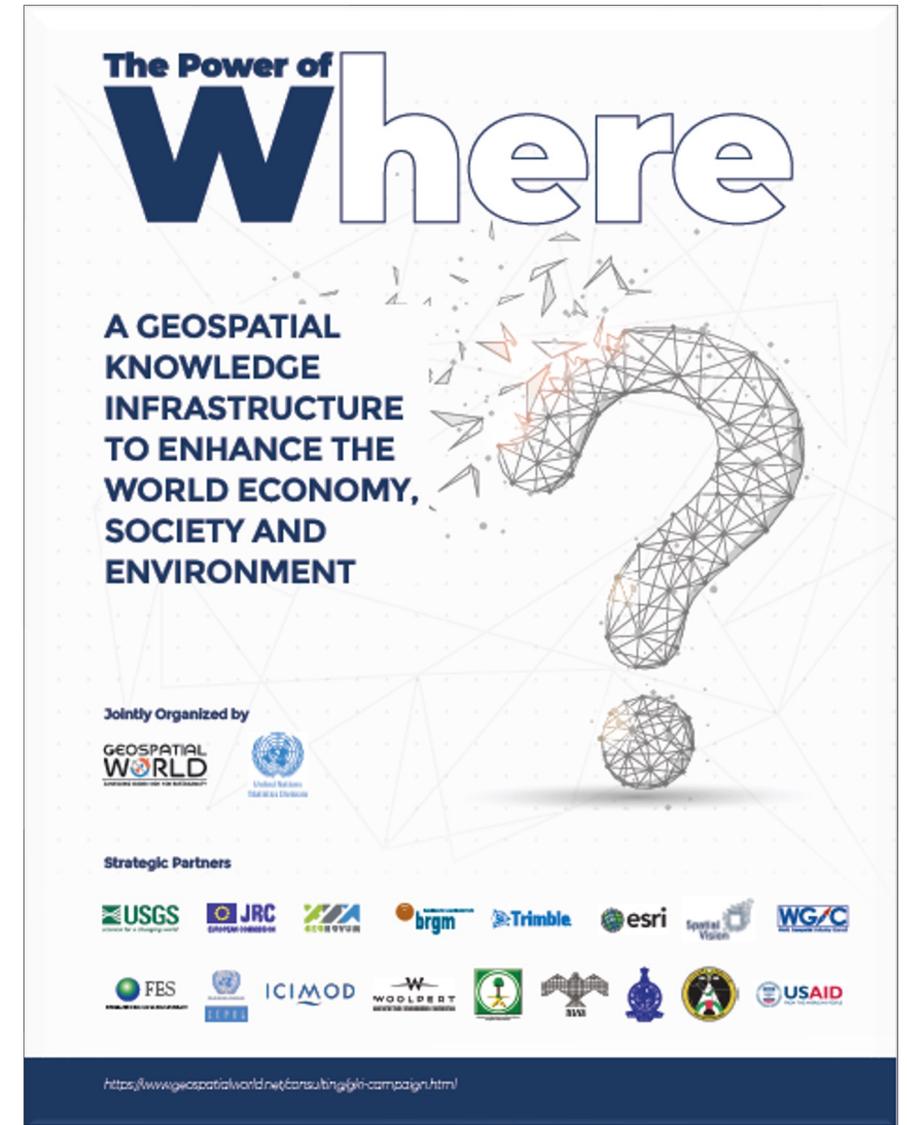
Exercise 1 – The Impact of 4IR

What do you think is the single biggest technological change impacting society, why, and how does it impact the geospatial ecosystem?

Discuss in pairs, 2 minutes to consider.

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Fundamentals - Vision



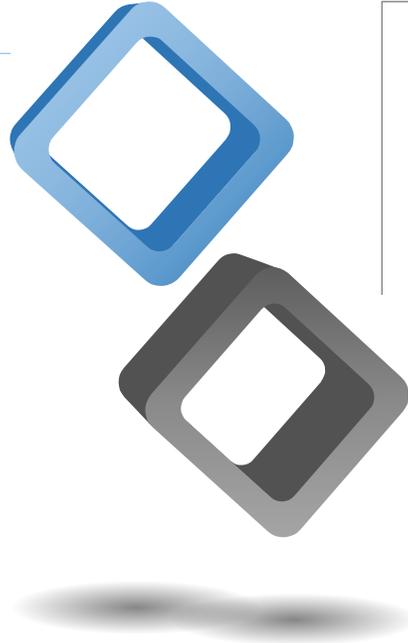
- **Vision**

Geospatial Knowledge at the heart of tomorrow's global digital society.

Fundamentals - Definition

Vision

Geospatial Knowledge at the heart of tomorrow's global digital society.



Definition

A Geospatial Knowledge Infrastructure provides a blueprint to integrate digital economies, societies and citizens with geospatial approaches, data and technologies and in so doing deliver the location-based knowledge, services and automation expected in the 4IR age.

Fundamentals - Principles

Vision

Geospatial Knowledge at the heart of tomorrow's sustainable digital society.

Definition

A Geospatial Knowledge Infrastructure provides a blueprint to integrate digital economies, societies and citizens with geospatial approaches, data and technologies and in so doing deliver the location-based knowledge, services and automation expected in the 4IR age.



Principles

- Knowledge focus.
- Integrate with wider digital infrastructures.
- Led by users along the value chain.
- Achievable actions now, then scale.
- Agility.
- Decentralized.
- Predictive.

GKI Elements

*Digital ecosystem
& infrastructure*

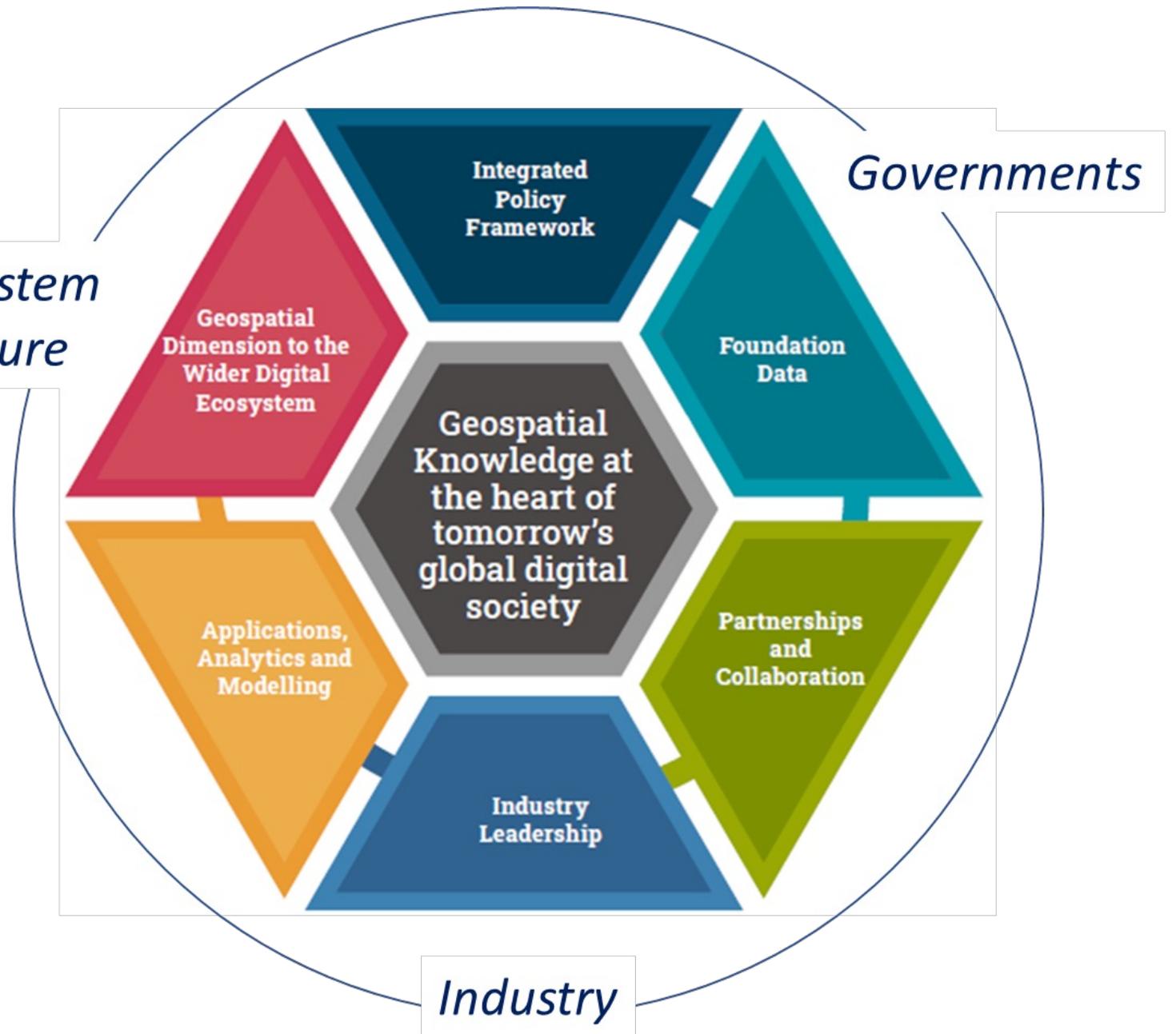
Governments

**Geospatial
Knowledge at
the heart of
tomorrow's
global digital
society**

Industry

GKI Elements

*Digital ecosystem
& infrastructure*



Integrated Policy Framework



- Improved, integrated, evidence-based government policies and services.
- Established frameworks that maximise the benefits of geospatial knowledge to nations.
- A digital infrastructure and economy.
- Resilient nations prepared for crisis.

Foundation Data



- Foundation data as part of a national digital infrastructure.
- Continuously updated foundation data, utilising 4IR technologies.
- Services based on current and future user requirements, understanding the value chain.
- Earth Observation

Foundation data includes the UN GGIM

fundamental geospatial data themes



Global Geodetic Reference Frame



Geographical Names



Addresses



Functional Areas



Buildings and Settlements



Land Parcels



Transport Networks



Elevation and Depth



Population Distribution



Land Cover and Land Use



Geology and Soils



Physical Infrastructure



Water



Orthoimagery

.....but is also much broader

Partnerships and Collaboration



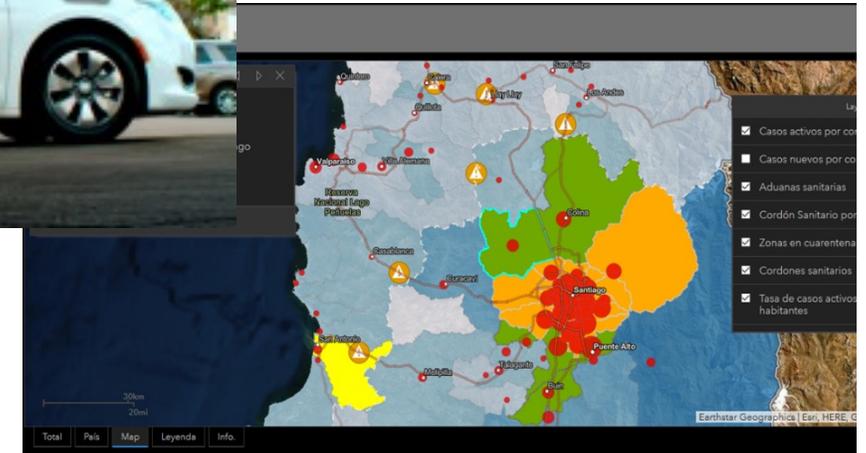
- Widespread cross-sector geospatial knowledge engagement.
- Industry-government geospatial knowledge and foundation data partnerships.
- Diverse ideas - innovative industry.

Industry Leadership



- Increased use of geospatial capabilities across all industry sectors.
- Industry able to meet the exacting requirements of foundation data agencies and at year-on-year lowering prices.
- Recognising that the industry geospatial knowledge ecosystem is broad and growing, professional associations will grow into this space.

Applications, Analytics, Modelling



- Widespread use of geospatial tools, data and knowledge within consumer applications.
- Geospatial knowledge that provides prediction and foresight, not hindsight.
- Trust in geospatial derived knowledge for the human or automated use it is to be put.

Geospatial Dimension to the Digital Infrastructure



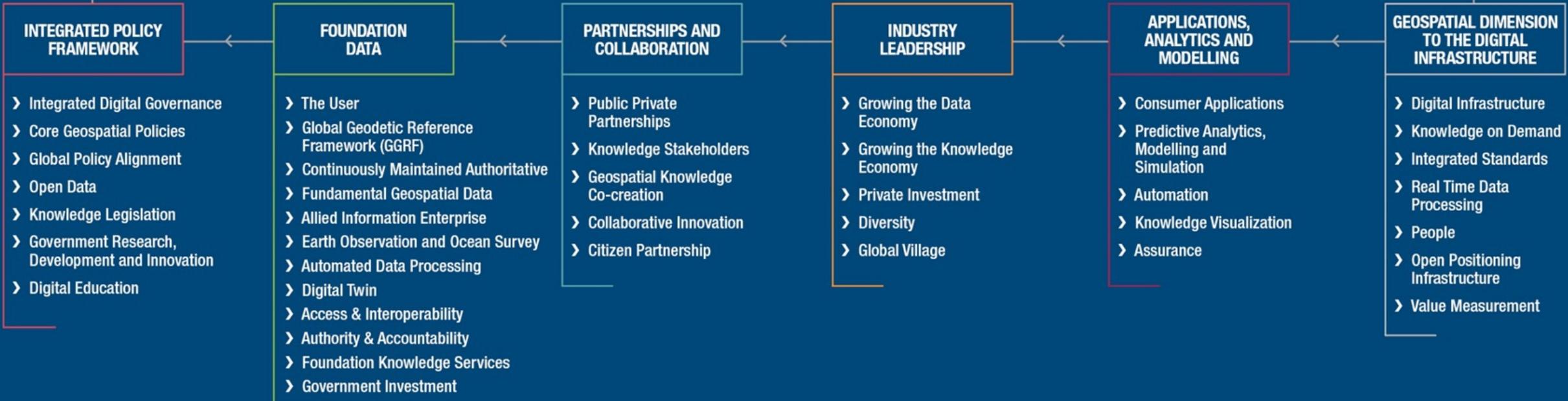
- From individual companies to global institutions, location becomes a fundamental attribute within data and a core element of data infrastructures and business process.
- Geospatial technologies and standards are seamlessly integrated into web, business and government systems and enterprises.

GEOSPATIAL KNOWLEDGE AT THE HEART OF TOMORROW'S GLOBAL DIGITAL SOCIETY

Principles of GKI



Elements of GKI



Example Initiative

Element 3: Partnerships and Collaboration

Initiative 3.2: Knowledge Stakeholders

Example Recommendations:

- Geospatial Industry bodies refocus from representing a narrow band of survey and geospatial companies to the broad geospatial knowledge ecosystem across industry sectors.
- Foundation data organisations offer wider-ranging partner arrangements with value-added service providers, particularly knowledge service companies, and seek fair profit distribution across the value chain

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The 2030 Agenda for Sustainable Development

“We resolve, between now and 2030, to end poverty and hunger everywhere; to combat inequalities within and among countries; to build peaceful, just and inclusive societies; to protect human rights and promote gender equality and the empowerment of women and girls; and to ensure the lasting protection of the planet and its natural resources.” The nations of the World in signing the 2030 Agenda

The 2030 Agenda is comprehensive, setting out 17 sustainable development goals (SDGs) containing 168 targets for nations to reach. Every goal impacts humanity.

“The availability of high-quality data is also critical, helping decision makers to understand where investments can have the greatest impact” Antonio Guterres, Secretary-General of the United Nations

Geospatial knowledge is not just about measuring progress. It supports all aspects of achieving SDG targets.

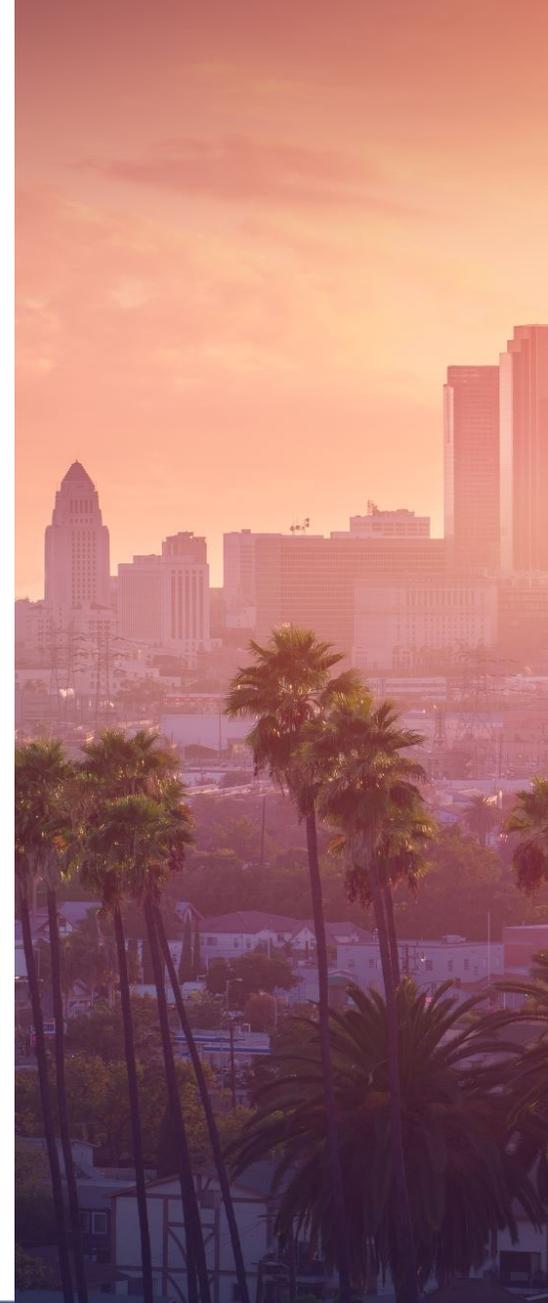


SDG 11: Sustainable Cities



Target 11.3. By 2030, enhance inclusive and sustainable urbanization and capacity for participatory, integrated and sustainable human settlement planning and management.

- Plan 10 to 40 years ahead, modelling scenarios using the best data and tools available now.
- Partnerships: Citizen, industry, government.
- Multi-source integrated near real-time foundation data is a real prospect given city density, in time integrating with other data to become a digital twin.
- Bias in decision making is a concern, though. Data and AI training sets alike often underrepresent informal settlements and poorer districts in cities.



SDG 5: Gender Equality

Target 5.a. Reforms to give women equal rights to economic resources, as well as access to ownership and control over land.....

- Land Rights
- Consumers can undertake geospatial actions that professionals have considered their role. Processes slow to change despite the availability of data, drones, smartphones and guidance.
- Integrated policies, transparency and improved governance.
- Diversity in industry and government geospatial knowledge ecosystem



SDG 7: Affordable and Clean Energy

Target 7.2. By 2030, increase substantially the share of renewable energy in the global energy mix.

- from renewable power generation site selection to optimizing the location of charging points for electric vehicle
- integration of different energy systems data into a single digital 'power systems map' that opens real opportunities for improvements
- Partnerships



SDG 2, Zero Hunger

- **Target 2.3. By 2030, double the agricultural productivity and incomes of small-scale food producers.**
- knowledge enables a holistic approach to improving the whole crop production system on a specific holding.
- Industry - accessible services for smartphones with integration and analysis hidden from the user.
- Ground truth from farmers for improved modelling
- Governments - open high-resolution soils and hydrometeorology data for small holders and industry.
- Earth observation supports crop monitoring and yield prediction.

Exercise 2: Geospatial **knowledge** supporting national priorities

- Identify one socio-economic priority relevant to your nations.
- Consider how that one priority could benefit from better geospatial knowledge.

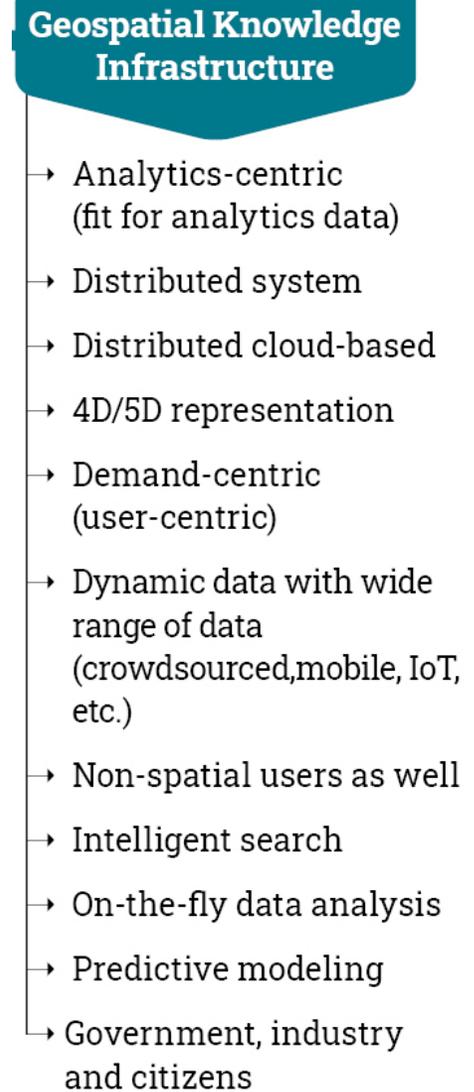
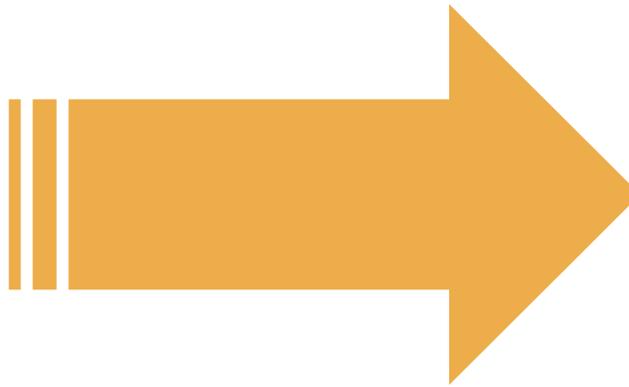
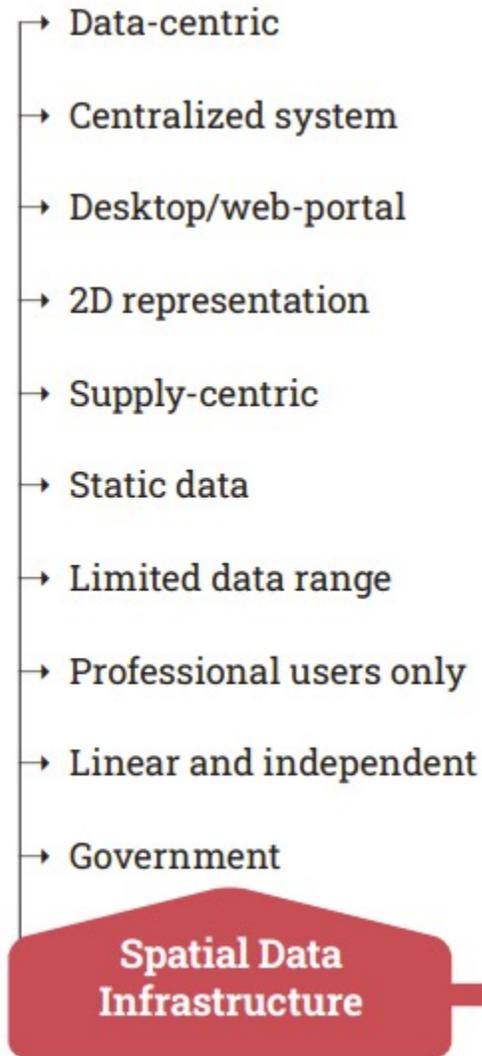
This exercise is about **knowledge not just geospatial data**.

Small Group Exercise with flipcharts – 5 minutes to consider and 2 groups will be selected to feedback to everyone

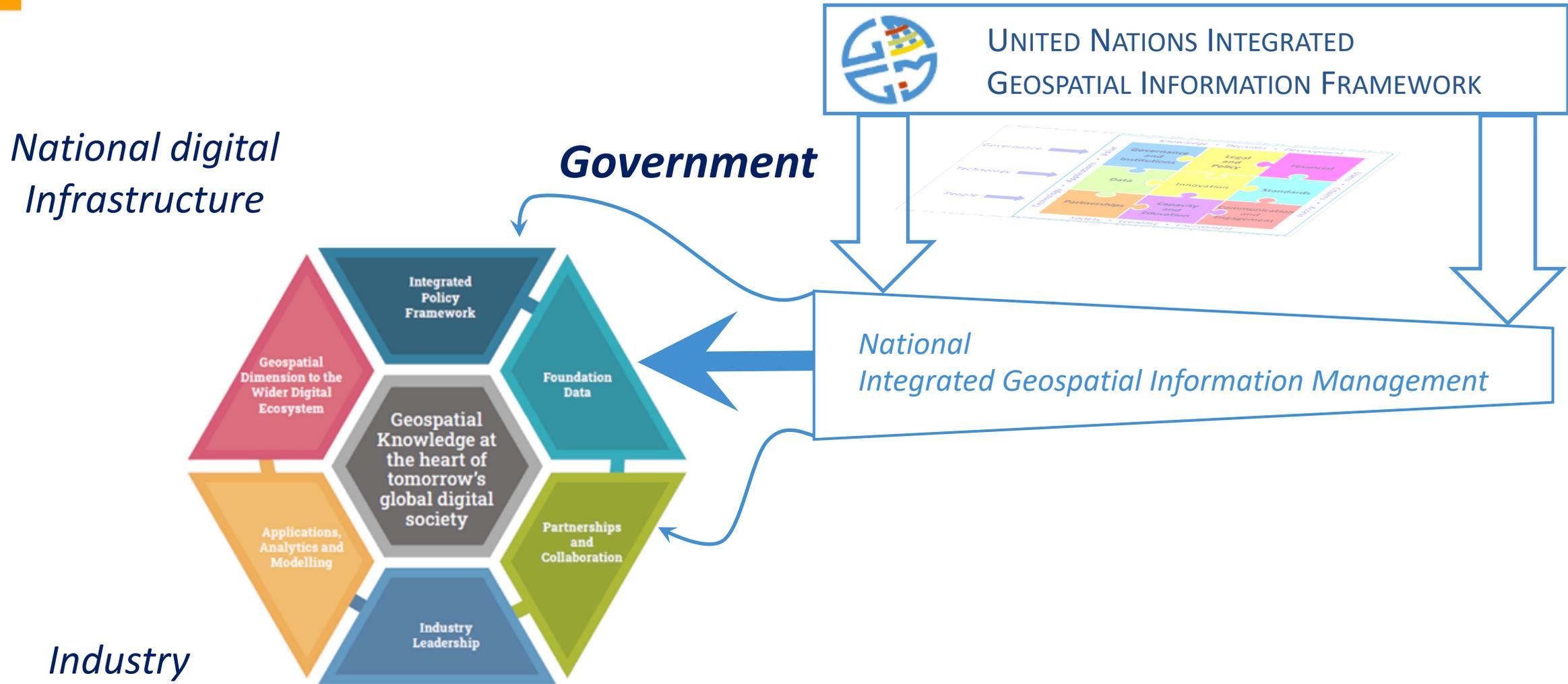
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NSDI towards GKI



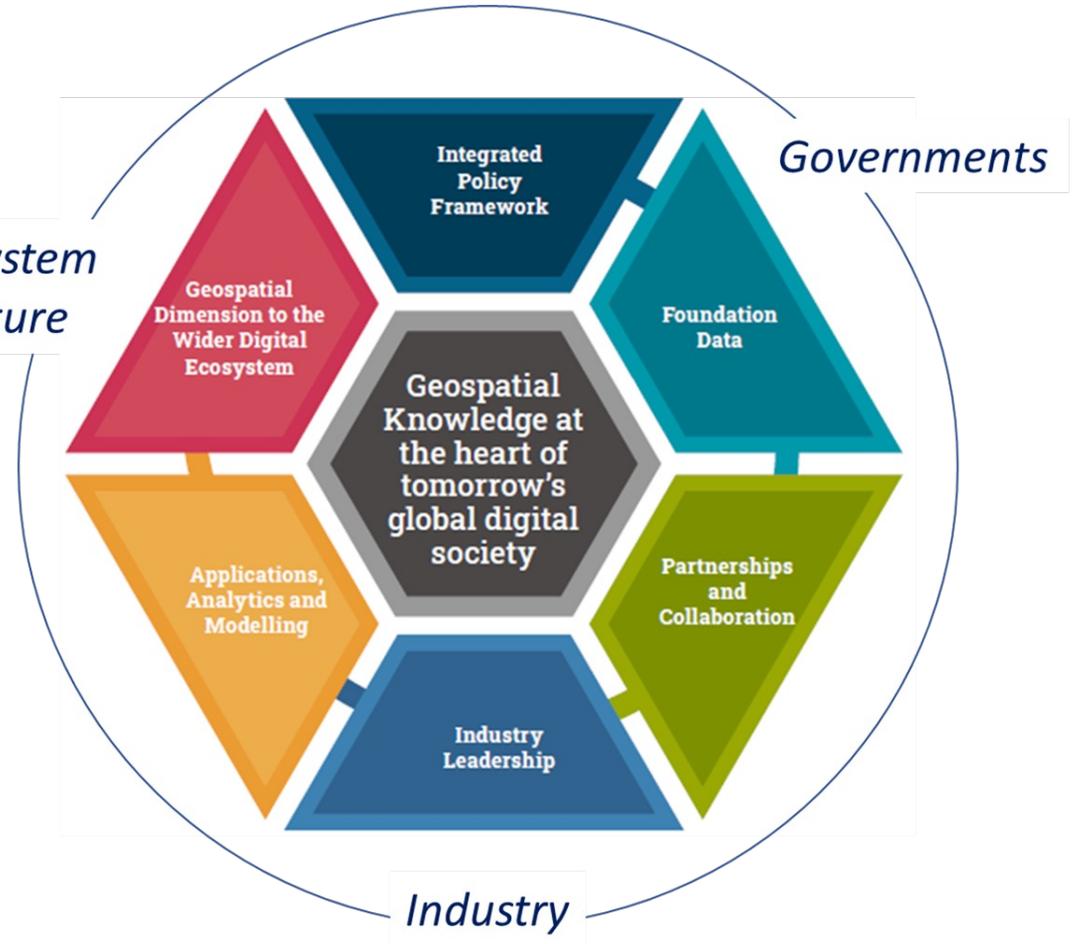
GKI and the UN Integrated Geospatial Information Framework



GKI is the hook into the wider digital infrastructure



*Digital ecosystem
& infrastructure*

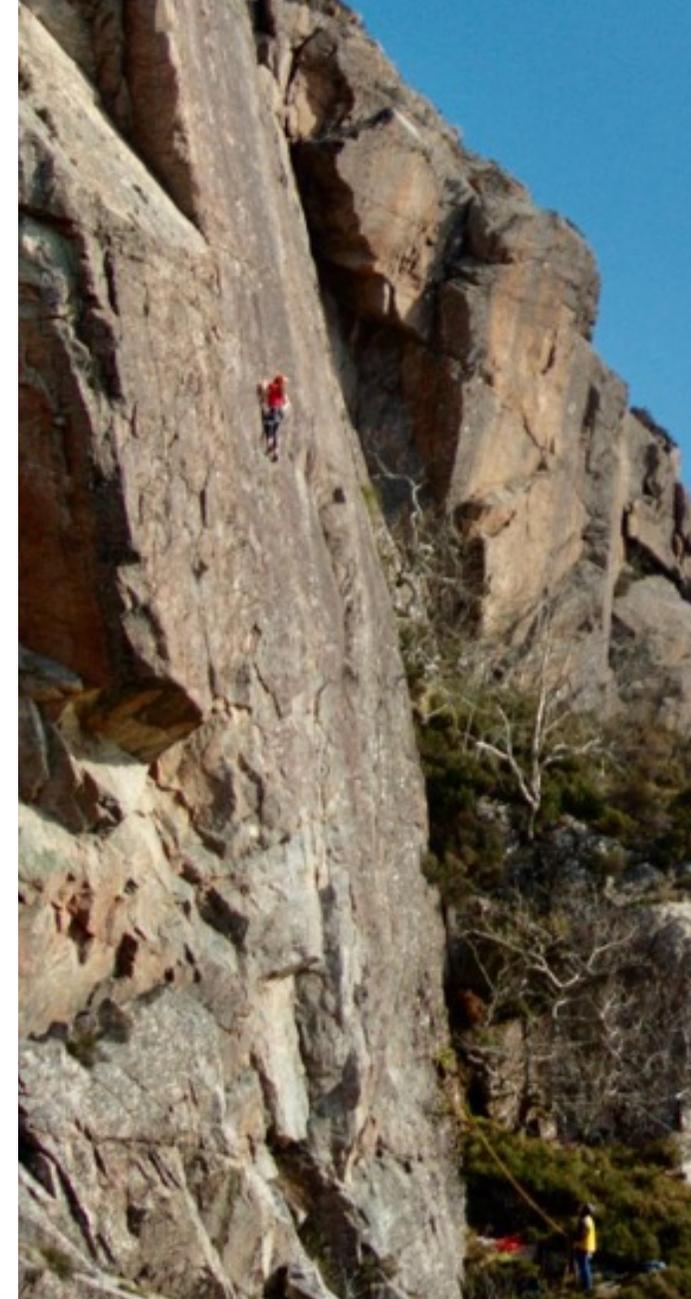


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Challenges for NMGAs

- Changing user environment.
- Maintenance – currency, accuracy, detail.
- Refining large amounts of raw data.
- Pace of change in geospatial technologies.
- 4th Industrial Revolution users and technologies.
- Competition – Crowd, Google etc, other government agencies: all can bypass national mapping agencies.
- Funding Mechanisms.
- Capacity to change.



GKI White Paper considerations for NMGAs

- Foundation Data

- The User
- Global Geodetic Reference Framework
Continuously Maintained Authoritative
Fundamental Geospatial Data
- Allied Information Enterprise
- Earth Observation and Ocean Survey
- Automated Data Processing
- Digital Twin
- Access & Interoperability
- Authority & Accountability
- Foundation Knowledge Services
- Government Investment

- Integrated Policy Framework:

- Digital Education
- Core Geospatial Policies (aligned)
- Integrated digital governance and policy

- Partnerships and Collaboration:

- Collaborative Innovation
- PPP and Co-Creation

- Geospatial Dimension to the Digital
Ecosystem

- Digital Infrastructure
- Open positioning infrastructure
- Integrated standards

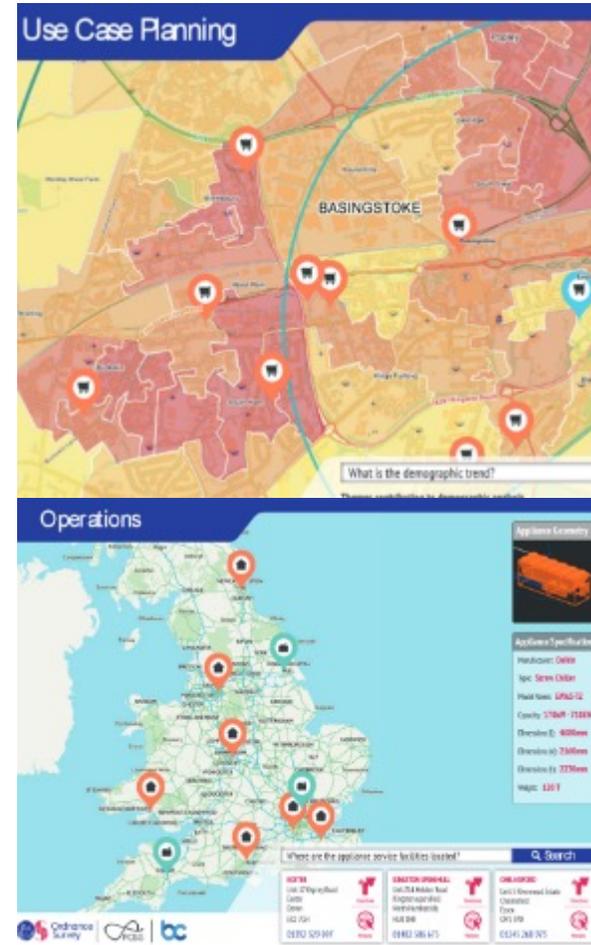
Understanding 2020s customer challenges



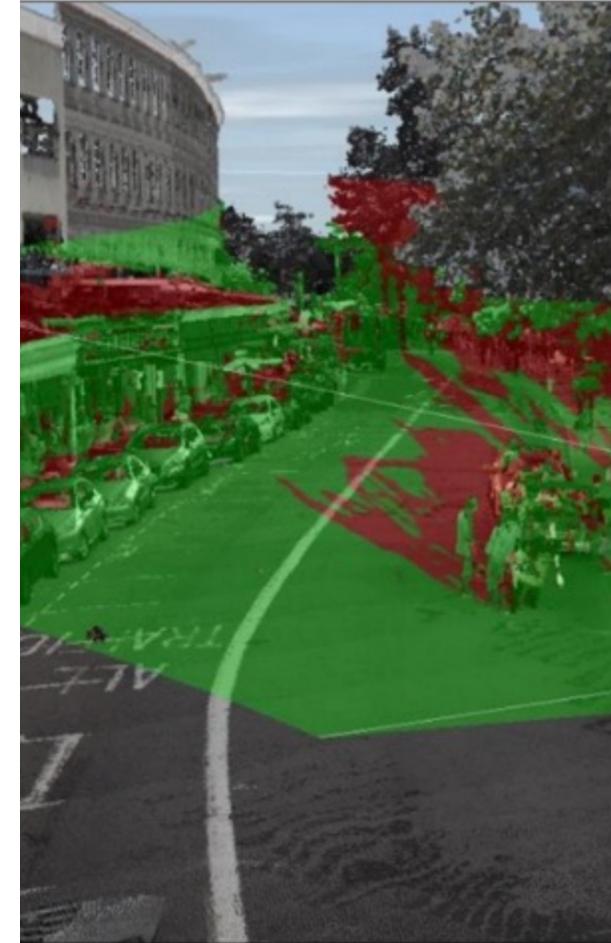
Efficiency



Profit

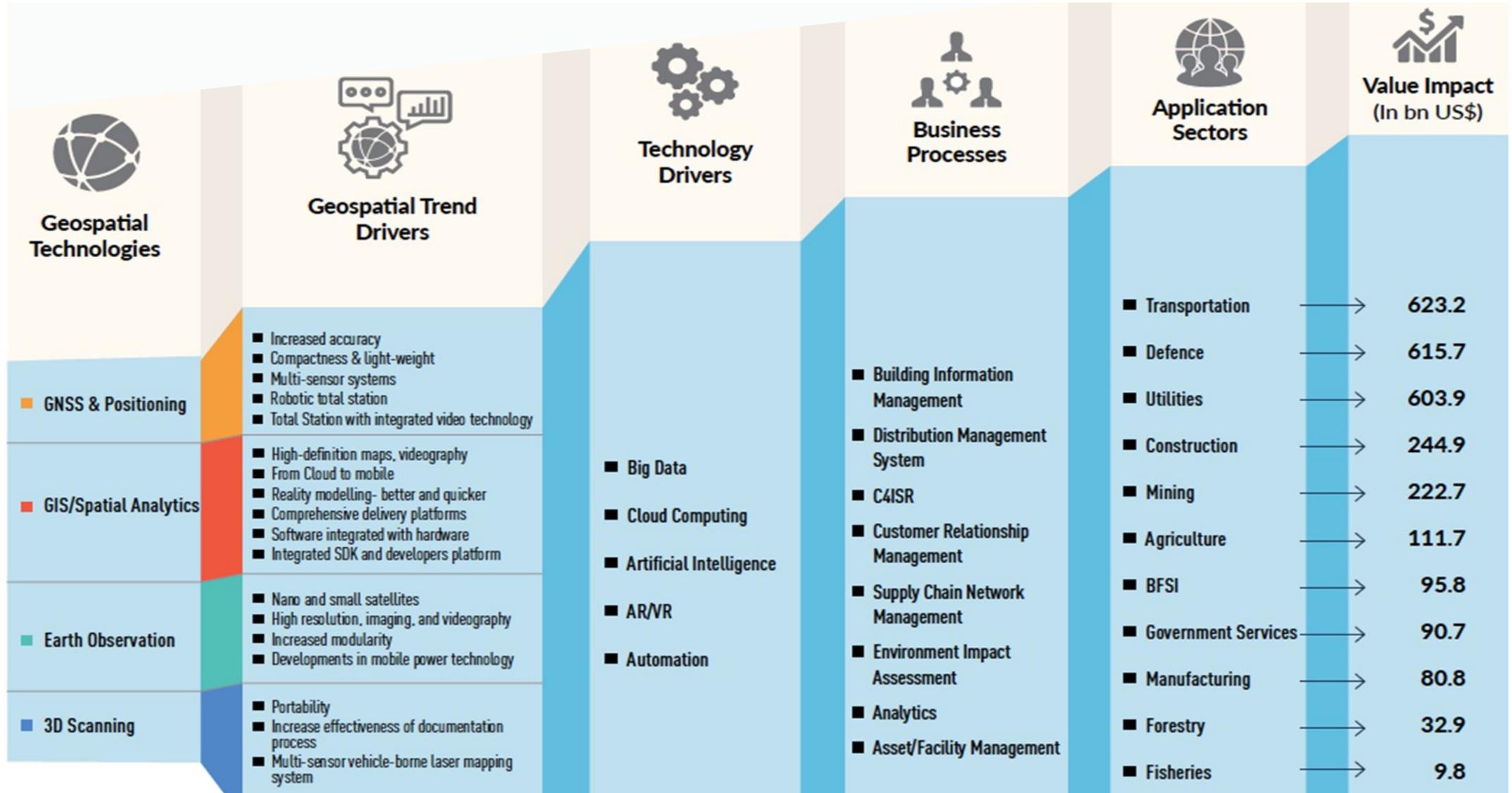


Answers



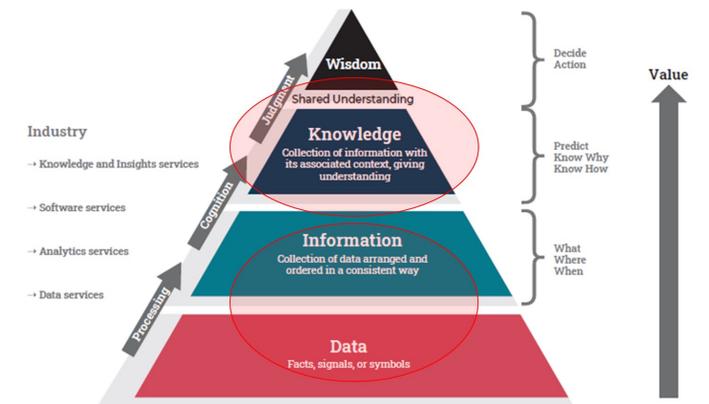
Competitive advantage

Understanding the value chain



Providing data ready for knowledge applications

- Make data available
- FAIR Principles: Findability, Accessibility, Interoperability and Reusability.
 - Data needs to be machine discoverable, machine accessible, machine readable
- Data and metadata designed for interoperability
- Open standards
- Linked geospatial data
- Use of APIs
- National registers to support data integration
- Authority and accountability
- Improved updating of data



National Mapping Agencies benefit from GKI

Continuously Maintained Authoritative Fundamental Geospatial Data



- Wider visibility of benefits and investment
- Expanding Role (but competitive)
- Growing customer base, new uses and users
- Integrated digital governance and policy
- Open positioning infrastructure
- Earth Observation and other sensors
- Automated data processing
- Partnerships and co-creation
- Digital Infrastructure thinks 'geo'
- Integrated Web and Geo standards

Automated data processing

Working in partnerships, Ecopia.AI uses machine learning techniques to automatically extract features such as buildings, roads, bridges, water bodies, and trees from remote sensing data, creating essential foundation data for a nation. Examples include the whole of sub-Saharan Africa from satellite imagery.



Sensors, automation and new collection sources

- Deep Learning Techniques
- Object classification
- Image compression algorithms
- Static data to cross correlate with sensors
- (Autonomous hydrographic data collection)



Partnership co-creating data using other's sensors



2019 pilot: Vehicle sensors routinely collecting features into Ordnance Survey Mastermap database. A partnership with Intel and a utility company

Exercise 3 – Group Discussion

What do you think is the most important role for geospatial agencies over the next decade?

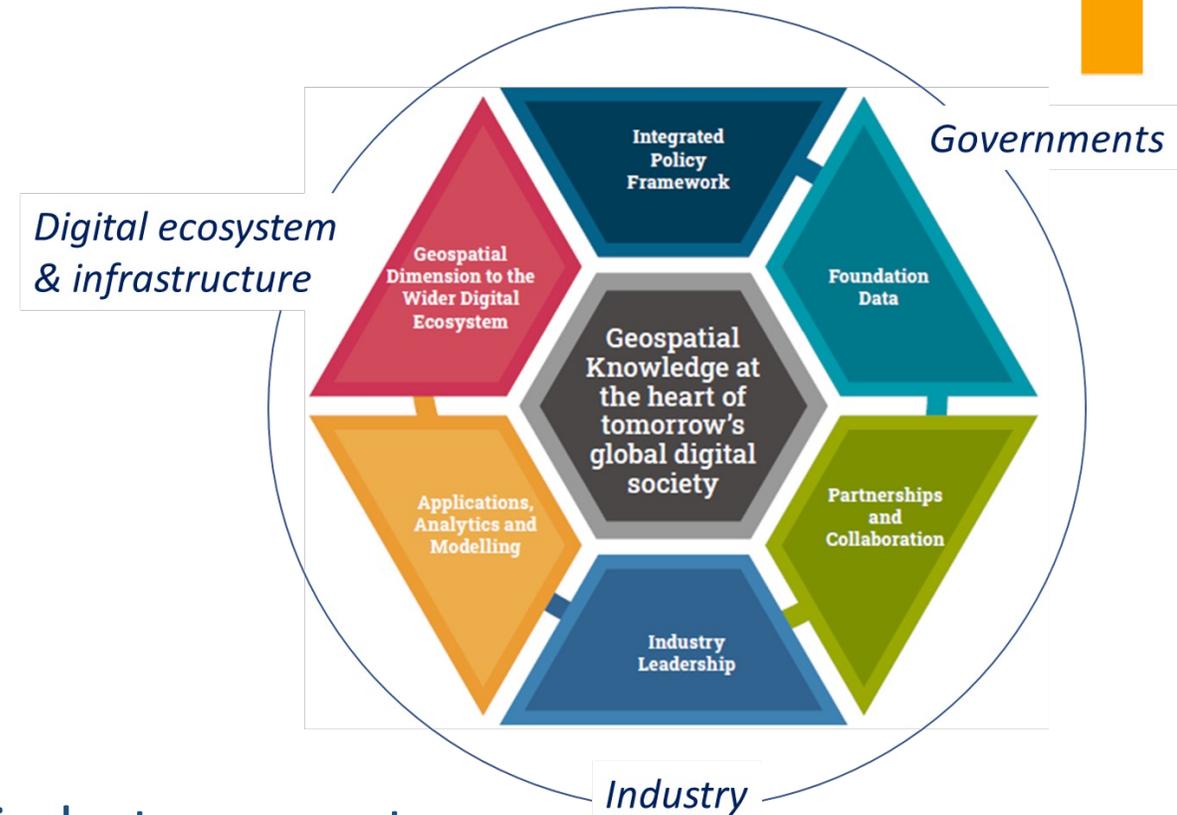
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Questions



Summary

- GKI takes advantage of technological advances to deliver knowledge.
- GKI hooks geospatial into the digital ecosystem
- GKI is relevant to all stakeholders.
- For NMGAs, GKI:
 - Connects NMGAs into wider digital and industry ecosystem to improve overall value-chain.
 - Relies on geospatial agencies to provide trusted ‘knowledge-ready’ data.
 - Opens doors to innovative ways to solve old challenges.



Geospatial Knowledge Infrastructure - at the heart of tomorrow's society and economy

Resources:

GKI Project: <https://geospatialmedia.net/gki-campaign.html>

GKI White Paper: <https://www.geospatialworld.net/gw-assets/pdf/GKI-White-Paper.pdf>

UN GGIM Future Trends: https://ggim.un.org/meetings/GGIM-committee/10th-Session/documents/Future_Trends_Report_THIRD_EDITION_digital_accessible.pdf

