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<tr>
<td>1030 - 1200</td>
<td><strong>Lesson 1:</strong> Introduction to Geospatial Knowledge Infrastructure (GKI)</td>
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<td>- What is Geospatial Knowledge Infrastructure (GKI): the concept</td>
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<td><strong>Break</strong></td>
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<td>1500 - 1630</td>
<td><strong>Lesson 3:</strong> Integrated Geospatial Information Framework and Geospatial Knowledge Infrastructure</td>
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<td>1630 - 1800</td>
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“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. By it’s nature it is geospatial and predictive._
A little after midnight on 30 Dec 19, Canadian AI company blue dot picked up on a cluster of “unusual pneumonia” cases happening around a market in Wuhan, China. (CNBC)
Covid - exposing new data sources

Google  google.com/covid19/mobility

United Kingdom  May 9, 2020

Transit stations
-75% compared to baseline

Workplace
-49% compared to baseline
Covid - planning new norms (based on knowledge)

https://www.cityoflondon.gov.uk/services/transport-and-streets/Pages/covid-19-city-streets.aspx
Epidemic – leave no-one behind

About a third of the world’s urban population lives in informal settlements. How do we manage what is happening?

This photo by Unknown Author is licensed under CC BY-SA.

Health improvement through Geospatial Knowledge

• Using Met Office supercomputers, predict the specific amount of rain that will fall and where (10km grids).

• Add local information such as:
  • population density
  • access to clean water
  • seasonal temperature

• Model where cholera may break out in four weeks time and predict impacts.

• Decide and Act: UNICEF distributes hygiene kits, jerrycans and chlorine tablets to prevent the spread of disease. And it coordinates local health education campaigns.
Covid-19 is more than a health emergency

Knowledge to make complex decisions

- Agriculture
- Logistics
- Livelihoods
- Public safety
- Wider health
- Education
- Economic impact
- Business restructuring and jobs
- Government finances
- Foreign policy
- Rights and Responsibilities
Why a new concept? Global challenges

- Climate Change – carbon neutral
- Global and individual health and well being
- Urbanisation
- Managing scarce global resources
- Geopolitical uncertainty
- Sustainable development
- The digital divide
- Expectations of new generations
The government geospatial community today

- Data-centric
- Centralized system
- Desktop/web-portal
- 2D representation
- Supply-centric
- Static data
- Limited data range
- Professional users only
- Linear and independent
- Government

Spatial Data Infrastructure

If it exists..........
The data ecosystem today

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

---

European Commission, The European Data Strategy © European Union, February 2020
The data ecosystem today

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
Why a new concept? Expectations are changing

Knowledge on demand
## Why a new concept? The fourth industrial revolution

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<th>Advanced Analytics and Artificial Intelligence</th>
<th>Web 3.0</th>
<th>Knowledge on demand</th>
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<tr>
<td>Robotics</td>
<td>The growth of Space</td>
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<td>Internet of Things</td>
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<td>Cloud and Edge Computing</td>
<td>Renewable energy technologies</td>
<td>Autonomous Systems</td>
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<td>Big Data</td>
<td>Ubiquitous sensors</td>
<td>3D printing and bespoke production</td>
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<tr>
<td>Computing power</td>
<td>Continuous high-data connectivity (5G, satellite broadband, fibre)</td>
<td>Personal Smart Devices</td>
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**Digital Disruption is accelerating**
Why a new concept? Technology
Why a new concept? Users are changing
Why a new concept? Location is everywhere

- **Global Navigation Satellite Systems** have democratized location and accurate time: Global Positioning System (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.
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
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
The geospatial ecosystem is now vast - everywhere
Exercise 1:

• Small Group Exercise with whiteboards
• Individually, describe the 3 highest socio-economic priorities in your nations? (4 words for each priority).
• As a group, consider which of everyone’s priorities you think would benefit from better geospatial knowledge.
• Feedback to the room.
The Digital Journey

- Paper and desk phones
- Mainframes and desktops
- Web 1.0
- Search Engines
- Web 2.0, Smartphones, apps, connectivity, social media
- Web 3.0, Knowledge on Demand, IoT, 5G & satellite connectivity, AI & advanced analytics, automation, augmented reality
The Geospatial Journey

Analogue Mapping
Digital Cartography
Geographic Information Systems
Spatial Data Infrastructure
GNSS
Search Engines
Web 1.0
Mainframes and desktops
Paper and desk phones
Web 2.0, Smartphones, apps, connectivity, social media
Web 3.0, Knowledge on Demand, IoT, 5G & satellite connectivity, AI & advanced analytics, automation, augmented reality
Integrated Geospatial Information Management

What is the next step?

Geospatial Knowledge Infrastructure
The Power of Where

Geospatial Knowledge at the Heart of Tomorrow’s Sustainable Digital Society
“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 Chair UK Geospatial Commission
Geospatial Knowledge Infrastructure (GKI)

Geospatial Knowledge at the Heart of Tomorrow’s Sustainable Digital Society
Vision
Geospatial Knowledge at the heart of tomorrow’s global digital society.
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 (3)

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.

Goals
- Geo-located data is the industry norm
- Continuously updated fundamental geospatial information is available at community, national and global levels.
- Geospatial data and analytics communities partner at the heart of predictive analytics and modelling.
- Users future needs drive the geospatial knowledge ecosystem.
- Government digital policies and strategies are optimised to maximise the value of location
Principles

- Knowledge focus.
- Integrate with wider digital infrastructures.
- Led by users along the value chain.
- Achievable actions now then scale.
- Agility.
- Decentralised..
- Predictive.
GKI supports all nations

Working in partnerships, Ecopia.AI uses machine learning techniques to automatically extract features from remote sensing data, creating fundamental data for a nation. Examples include the whole of sub-Saharan Africa.

Current, accurate, 3D elevation data enables important knowledge applications, e.g. flood-risk management, infrastructure projects, natural resources management, and disaster response. The US Geological Survey collaborates with other agencies to co-create a national LIDAR collection program, leveraging the expertise and capacity of private sector mapping firms.

Drivers in Bengaluru spend an average of 71% extra travel time stuck in traffic. As part of its smart mobility mission, TomTom monitors real time traffic flow so that drivers know the fastest current route. The aggregated data has wider use too, giving city planners and environmental teams insights to improve matters.

Climate Change impacts everything from loss of cities to loss to food security. One company fighting back is Indigo, combining satellite imagery and AI to support regenerative farming practices, measure crop health and predict yields.
GKI Elements

- Integrated Policy Framework
- Foundation Data
- Partnerships and Collaboration
- Industry Leadership
- Applications, Analytics and Modelling
- Geospatial Dimension to the Wider Digital Ecosystem

Geospatial Knowledge at the heart of tomorrow’s global digital society
GKI Elements

Governments

Digital ecosystem & infrastructure

Geospatial Knowledge at the heart of tomorrow’s global digital society

Integrated Policy Framework

Foundation Data

Partnerships and Collaboration

Industry Leadership

Applications, Analytics and Modelling

Geospatial Dimension to the Wider Digital Ecosystem
Integrated Policy Framework
2020 - India

**Tweet**

_Narendra Modi_ @narendramodi · Feb 15

Our government has taken a decision that will provide a huge impetus to Digital India. Liberalising policies governing the acquisition and production of geospatial data is a massive step in our vision for an Aatmanirbhar Bharat.

#mapmakingsimplified

[pib.gov.in/PressReleaseI...](pib.gov.in/PressReleaseI...)
GKI: ‘geospatial’ in the national digital ecosystem
Integrated Policy Framework

- Integrated Digital Governance
- Core Geospatial Policies
- Global Policy Alignment
- Open Data
- Knowledge Legislation
- Government Research, Development and Innovation
- Digital Education
• Foundation data as part of a national digital infrastructure.
• Foundation data that utilises 4IR technologies to meet user requirements for continuously updated data.
Foundation Data

• The User
• Global Geodetic Reference Framework (GGRF)
• 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
Partnerships and Collaboration

- Widespread cross-sector geospatial knowledge engagement.
- A new age of industry-government geospatial knowledge and foundation data partnership.
- Innovative industry.
Partnerships and Collaboration

• Public Private Partnerships
• Knowledge Stakeholders
• Geospatial Knowledge Co-creation
• Collaborative Innovation
• Citizen Partnership
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.
Industry Leadership

• Growing the Data Economy
• Growing the Knowledge Economy
• Private Investment
• Diversity
• Collaborative Innovation
• Global Village
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.
Applications, Analytics, Modelling

• Consumer Applications
• Predictive Analytics, Modelling and Simulation
• Automation
• Knowledge Visualization
• Assurance
• From individual companies to global institutions, location becomes a fundamental attribute within data and information, and a core element of data infrastructures and business processes.
• Geospatial technologies and standards are seamlessly integrated into web, business and government systems and enterprises.
Geospatial Dimension to the Digital Infrastructure

- Digital Infrastructure
- Knowledge on Demand
- Integrated Standards
- Real Time Data Processing
- People
- Open Positioning Infrastructure
- Value Measurement
Exercise 2: GKI Elements

As a small group, consider all the priorities you listed for Exercise 1.

Which GKI elements are most important in ensuring ‘geospatial knowledge’ helps meet your priorities.

For your own country, which single GKI element is most needed?
The geospatial community today

- Data-centric
- Centralized system
- Desktop/web-portal
- 2D representation
- Supply-centric
- Static data
- Limited data range
- Professional users only
- Linear and independent
- Government
The geospatial community today and tomorrow

- Data-centric
- Centralized system
- Desktop/web-portal
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**Spatial Data Infrastructure**

**Geospatial Knowledge Infrastructure**

- Analytics-centric (fit for analytics data)
- Distributed system
- Distributed cloud-based
- 4D/5D representation
- Demand-centric (user-centric)
- Dynamic data with wide range of data (crowdsourced, mobile, IoT, etc.)
- Non-spatial users as well
- Intelligent search
- On-the-fly data analysis
- Predictive modeling
- Government, industry and citizens
United Nations Integrated Geospatial Information Framework (UN IGIF)

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

Anchored by 9 Strategic Pathways, the Framework is a mechanism for articulating and demonstrating national leadership in geospatial information, and the capacity to take positive steps.
Relationship between United Nations Integrated Geospatial Information Framework (UN IGIF) and GKI

- **IGIF 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.

- **GKI Description**: 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.
Relationship between GKI and UN IGIF

National Knowledge Infrastructure

Spatially considered digital, trade, AI, space, innovation etc policies

Open positioning, allied & real-time data, wider digital infrastructure, knowledge on demand, integrated standards etc

Autonomy, Applications, knowledge visualization etc

Growing knowledge and data economy, investment etc

Industry

Government

Common Goal: Benefitting the World economy, society and the environment

National Integrated Geospatial Information

Geospatial Knowledge at the heart of tomorrow’s global digital society

Integrated Policy Framework

Applications, Analytics and Modelling

Partnerships and Collaboration

Intelligence

Foundation Data

Co-creation models, PPP models, collaborative innovation etc

Growing knowledge and data economy, investment etc

Geospatial Knowledge Infrastructure

Geospatial Dimension to the Wider Digital Ecosystem

Open positioning, allied & real-time data, wider digital infrastructure, knowledge on demand, integrated standards etc

Autonomy, Applications, knowledge visualization etc

Common Goal: Benefitting the World economy, society and the environment

United Nations Integrated Geospatial Information Framework

DRAFT AT 09/04/21
# Questions and Discussion

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The session will focus on:

- What is Geospatial Knowledge Infrastructure (GKI): the concept
- Key elements
- Relevance of Geospatial Knowledge Infrastructure
- GKI complimenting other initiatives
- Fundamental data themes, geospatial technologies, integration, value-applications to give knowledge
Summary

• The 4th Industrial Revolution is driving massive change to societies and economies, largely through networks, digitization, automation and medical science. GNSS is a major contributing capability.
• The geospatial ‘customer’ is changing; location is increasingly part of technologies, supply chains, consumer experiences.
• GKI 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.
• GKI brings the geospatial and wider digital ecosystem together. This includes cross-sector industry and government digital policy-makers.
Next Session

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| 1300 – 1430  | **Lesson 2:** Geospatial Knowledge Infrastructure: Benefits and Transformation  
               The session will focus on:  
               - Value proposition and relevance of GKI in today’s context  
               - How GKI will benefit National Mapping Agencies  
               - Changing role and transformation required  
| 1430 - 1500  | **Break**                                        |
| 1500 - 1630  | **Lesson 3:** Integrated Geospatial Information Framework (IGIF) and Geospatial Knowledge Infrastructure (GKI)  
| 1630 - 1800  | **Course Reception**                            |
Introduction to Geospatial Knowledge Infrastructure

John Kedar

Jointly Organized by

Partners