Future Geospatial Information Ecosystem

What is the Role of UN-GGIM

A United Nations Initiative

UN-GGIM Webinar
12 June 2023

Dr Lesley Arnold (FSSSI)
Director, Geospatial Frameworks
Adjunct Associate Professor, Curtin University
Non-Executive Director, AuScope
Non-Executive Director, Australian Urban Research Innovation Network (AURIN)
Board Member, Geoscience Australia Location Program
Takeaways

• What are we trying to achieve?
• Why we can’t achieve it now?
• What transformation looks like?
• What we need to consider?
What are we trying to achieve?
From Data to Knowledge and Insight

Data and Information

- What does it look like?
- How is it delivered?
- Who is it for?

Knowledge

- How can it be trusted?
- How and where will it be used?

Insight
Three Drivers for Change

Technology the Enabler

Unified solutions to global problems
- Address common challenges
- Harness geospatial intelligence from a local to global level
- Leverage/share Innovation

Equitable access to knowledge
- Societal expectations for knowledge on-demand
- Deliver contextualised knowledge for individuals
- Designed for general users

Bridge the geospatial digital divide
- An ecosystem accessible and usable to all
- Knowledge available to everyone
- An ecosystem that, in its design, prioritises developing nations.
Unified Solutions to Global Challenges?

Our challenges are set to become more complex

Climate Geoengineering

Deep Sea Mining

Migration/Refugees

Future Geospatial Information Ecosystem
Three Drivers for Change
Technology the Enabler

Unified solutions to global problems
• Address common challenges
• Harness geospatial intelligence from a local to global level
• Leverage/share Innovation

Equitable access to knowledge
• Societal expectations for knowledge on-demand
• Deliver contextualised knowledge for individuals
• Designed for general users
People have similar questions of data content.....asked in different contexts

Question: Will this property be flooded?

- Emergency Responder: Yes, you should evacuate the area
- Home Buyer: Yes. Reevaluate buying this property
- Insurance Broker: Yes. Higher insurance fees apply
- Urban Planner: Yes. Avoid building in this area
Three Drivers for Change
Technology the Enabler

Unified solutions to global problems
• Address common challenges
• Harness geospatial intelligence from a local to global level
• Leverage/share Innovation

Equitable access to knowledge
• Societal expectations for knowledge on-demand
• Deliver contextualised knowledge for individuals
• Designed for general users

Bridge the geospatial digital divide
• An ecosystem accessible and usable to all
• Knowledge available to everyone
• An ecosystem that, in its design, prioritises developing nations.
Think of the Kenyan Farmer

“How much fertilizer and where?”

• Able to answer questions
• Geoanalytics that understand their individual needs
• Able to access globally available data
• Cheap accessible infrastructure
• No need for a degree in geospatial technologies
• Confidence in answers
Why can’t we achieve knowledge on-demand now?
Current SDI Capabilities

Data sharing
Integrated data
Reuse / repurpose
Analytics
Applications
Decision-making
Policy Setting
Benefits accruing
So why change?
SDI Limitations

- Human accessible
- Push data vs get answers
- Professional users only
- Knowledge Delay
- Limited integration
- Lack opportunity

SDI Catalogues are **not** machine friendly.
Search Engines and Apps can’t action SDI Data

Web of Data

Scientists can compare their data to millions of datasets worldwide within seconds by running a query (script) – that traverses data linkages.

Knowledge on-demand
- ChatGPT
- Virtual assistants “Hi Siri”

All require access to ‘quality’ machine actionable data.
It’s Our “Narnia Moment”
The Data, The Metadata and The Warehouse.
Data Needs to be FAIR. But that’s only one aspect.
Teach Machines to Think Like Us

1. Interpret question
   - Natural Language Processing

2. Find right data
   - Spatial Filtering and Semantic Search

3. Understand concepts
   - Domain and Data Vocabularies

4. Process the data
   - Process Ontologies, Geoanalytics and Spatial Filtering

5. Return a result
   - W3C Standards

Artificial Intelligence and Semantic Web Technologies
What will the transformation to a future Geospatial Information Ecosystem look like.
Differentiating an Infrastructure and Ecosystem

**Infrastructure**

*An infrastructure is built* – it consists of the physical and organizational structures and facilities needed for an operation - SDIs and System of Systems.

**Ecosystem**

*An ecosystem evolves* – it is an environment consisting of component parts that interact with one another - IoT and the Web of Data.
Future Geospatial Information Ecosystem

**Geospatial Continuum**

On the same journey, just unique starting points.

1. **Analog Mapping**
   - Paper
   - Production of maps by hand

2. **Digital Cartography**
   - GIS
   - Geospatial data compiled, analyzed and formatted into a virtual image

3. **Spatial Data Infrastructures**
   - Data Hub
   - An infrastructure for organising and making data and services accessible

4. **Geospatial Knowledge Infrastructure**
   - System of Systems
   - Systems that interoperate and consume geospatial data

5. **Ecosystem**
   - Global ecosystem permitting intelligent interactions between data and services

**Future Geospatial Continuum**

Maximising your geospatial investment
Web Continuum

**Web 1.0**  
Read Only Web  
- html pages  
  “READ ONLY”

**Web 2.0**  
Social Web  
- SDIs come of age  
  “READ-WRITE”

**Web 3.0**  
Semantic Web  
- Transformation of Internet into a database  
  “READ-WRITE-EXECUTE”

**Web 4.0+**  
Spatial Web  
- Seamless integration of convergent technologies - physical and digital world  
  Largely Speculative

Not spatial as in “Geospatial” rather hyperspace

Note: Categorization of web stages is not universally agreed and boundaries between are blurry
## AI Continuum

<table>
<thead>
<tr>
<th>Translation, question/answer, sentiment analysis</th>
<th>Image recognition/classification</th>
<th>Auton. vehicles, surveillance systems, medical imaging, AR</th>
<th>Speech/gesture recognition, scene understanding</th>
<th>Image, text, virtual reality, art, music composition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Natural Language Processing</td>
<td>Machine Learning</td>
<td>Computer Vision</td>
<td>Perception</td>
<td>Generative Models</td>
</tr>
<tr>
<td>Understand, interpret, generate human language</td>
<td>Learn from data without being explicitly programmed</td>
<td>Understand and interpret visual information</td>
<td>Perceive/understand world through sensors - sight, sound, touch, taste</td>
<td>Generate new data similar to a given dataset</td>
</tr>
</tbody>
</table>

**Future Geospatial Information Ecosystem**
Generative AI

Generate an answer to almost any question

ChatGPT
DeepArt.io
DeepDream
DALL-E
Chatbots
Make-a-Video
Jukedeck
Lyrebird
GAN Terrain Generation (fantasy maps)
Spatial Data Infrastructures

Human centered – A person searches, retrieves, processes and analyses data via a web catalogue to obtain knowledge.

Geoverse

Machined centered – AI searches, retrieves, processes and analyses data to deliver knowledge directly to a person’s device or another machine.

System of Systems

Distributed/federated interconnected systems managed under the control of humans and include advanced machine analytics and AI.

Emerging Ecosystem

Circa web 2.0
Spatial Data Infrastructures
Human centered Data Hubs – A person searches, retrieves, processes and analyses data via a web catalogue to obtain knowledge.

System of Systems
Distributed/federated interconnected systems managed under the control of humans and include advanced machine analytics and AI.

Emerging Ecosystem
Emerging Ecosystem

Spatial Data Infrastructures
Human centered – A person searches, retrieves, processes and analyses data via a web catalogue to obtain knowledge.

System of Systems
Distributed/federated interconnected systems managed under the control of humans and include advanced machine analytics and AI

Emerging Ecosystem
Machined centered – AI searches, retrieves, processes and analyses data to deliver knowledge direct to a person’s device or another machine.

Circa web 2.0
Bi-directional

Circa web 3.0+
Multimodal
Emerging Ecosystem

Spatial Data Infrastructures
Human centered – A person searches, retrieves, processes and analyses data via a web catalogue to obtain knowledge.

System of Systems
Distributed/federated interconnected systems managed under the control of humans and include advanced machine analytics and AI

Emerging Ecosystem
Machined centered – AI searches, retrieves, processes and analyses data to deliver knowledge direct to a person’s device or another machine.
Web of Data

- Generative AI Apps operate within the Web of Data
- Made up of many ecosystems

Where does geospatial fit?
- Geospatial is a ‘key’ integrator – of this digital fabric.
- Cross-sector and cross-discipline
- It ties together suppliers, users and service providers in real-time
What next?
Integrated Geospatial Information Framework

- Strengthen geospatial information management
- IGIF provides a 360 degree view for what needs to change to move to a future geospatial information ecosystem
- 3 areas of focus
- 9 strategic pathways
- 4 elements in each pathway
- IGIF being rollout across the globe

Future Geospatial Information Ecosystem
Step change to address the Drivers for Change

Drivers for Change
- Equitable and Affordable Access to Knowledge On-demand
- Unified Solutions to Global Problems
- Bridge the Geospatial Digital Divide

Future Geospatial Information Ecosystem

Governance and Institutions
Policy and Legal
Financial
Data
Innovation
Standards
Partnerships
Capacity and Education
Communication and Engagement
Taking control of our destiny

- Global Governance Framework
- Global Use Case Framework to prioritise data and analytics for SDGs
- Partnerships in multimodal ecosystem
- Geospatial Policy and Legal Framework
- Road Map for knowledge-sharing
- Workforce ready skills development framework
- Knowledge representation standards
- Scope new 4IR business models
- Consistent brand and messaging
Future Business Models

- Move beyond the sale of data to knowledge-on demand services
- Move toward more secure digital identities, transactions and content ownership
- Transactions are peer to peer

**Decentralized Apps**
Applications built on Blockchain

**Tokenized Economy**
Digital tokens representing ownership for trading assets

**Peer to Peer Marketplaces**
Transacting directly without intermediaries

**Content Creation Platforms**
Decentralized platforms where user pays for direct access - DRM
Taking control of our destiny

Global Governance Framework

Global Use Case Framework to prioritise data and geoanalytics for SDGs

Partnerships in multimodal ecosystem

Geospatial Policy and Legal Framework

Road Map for knowledge-sharing

Workforce ready skills development framework

Scope new 4IR business models

Knowledge representation standards

Consistent brand and messaging

Future Geospatial Information Ecosystem
# Shaping Ethical and Legal Frameworks

## Future Geospatial Information Ecosystem

<table>
<thead>
<tr>
<th>National Governments</th>
<th>International Organizations</th>
<th>Industry Consortia and Alliances</th>
<th>Regulatory Agencies</th>
<th>Research Institutions</th>
<th>Civil Society and NGOs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Formulating policies and regulations on ethics, privacy, security, societal impact</td>
<td>UN initiatives and <strong>frameworks for AI</strong> governance and ethics. OECD guidelines on AI principles and policies.</td>
<td>Partnership on AI developing <strong>responsible AI practices</strong>. The Global Partnership on AI (GPAI) fostering <strong>cooperation btw countries</strong></td>
<td>Regulations on <strong>consumer protection, competition, data privacy transparency, accountability</strong> and societal well-being</td>
<td>Analyzing the societal impact of AI and advocating for responsible AI practices</td>
<td>Advocating for AI policies that prioritize human rights, fairness, and ethical considerations</td>
</tr>
</tbody>
</table>

*Future Geospatial Information Ecosystem: Maximising your geospatial investment*
“Web 2.0 was a front-end evolution; Web 3.0 is a backend revolution”.
Shermin Voshmgir, Token Economy

- Spatial Data Infrastructures
  Data access won’t change for average users

- Geospatial Information Ecosystem
  The use of Web and 4IR technologies will change how people receive knowledge
Future Geospatial Information Ecosystem

What is the Role of UN-GGIM

A United Nations Initiative

Thank you

Dr Lesley Arnold (FSSSI)
Director, Geospatial Frameworks
Adjunct Associate Professor, Curtin University
Non-Executive Director, AuScope
Non-Executive Director, Australian Urban Research Innovation Network (AURIN)
Board Member, Geoscience Australia Location Program