Future Geospatial Information Ecosystem

From SDI to SoS and on to the Geoverse.

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Presented by Dr Lesley Arnold

Outline

- Why we need to move ‘Beyond SDIs’
- What we mean by knowledge
- The drivers for change
- The future geospatial information ecosystem
- Making the step change

Clarification of terms

Ecosystem

Evolves

An environment consisting of component parts that interact with one another

Infrastructure

Built

The physical and organizational structures and facilities needed for an operation

Framework

Guides

A conceptional structure of ideas, conditions and assumptions that guide an approach

Blueprint

Instructs

A design that can be followed

Current SDI Capabilities

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

SDI Limitations

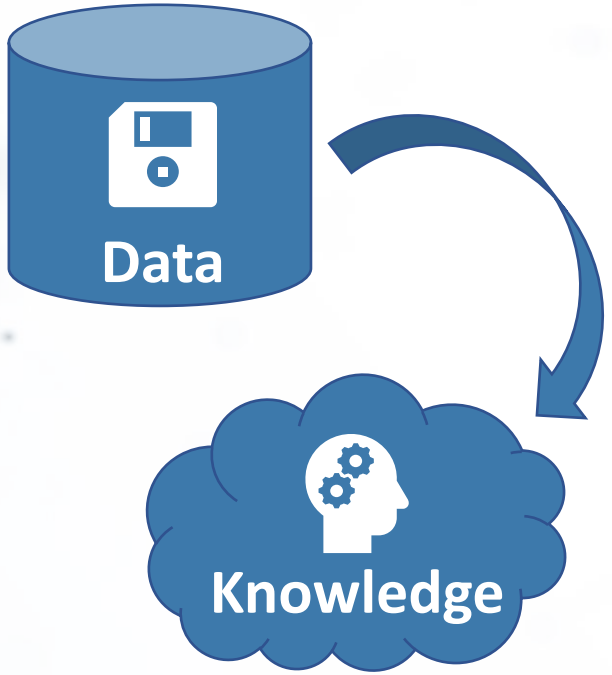
- Human accessible
- Knowledge Delay
- Push data vs get answers
- Limited integration
- Professional users only
- Lack opportunity

SDI Catalogues are not machine friendly

Beyond SDIs -What experts are saying!

A shift from data to insight, knowledge and understanding enable by:

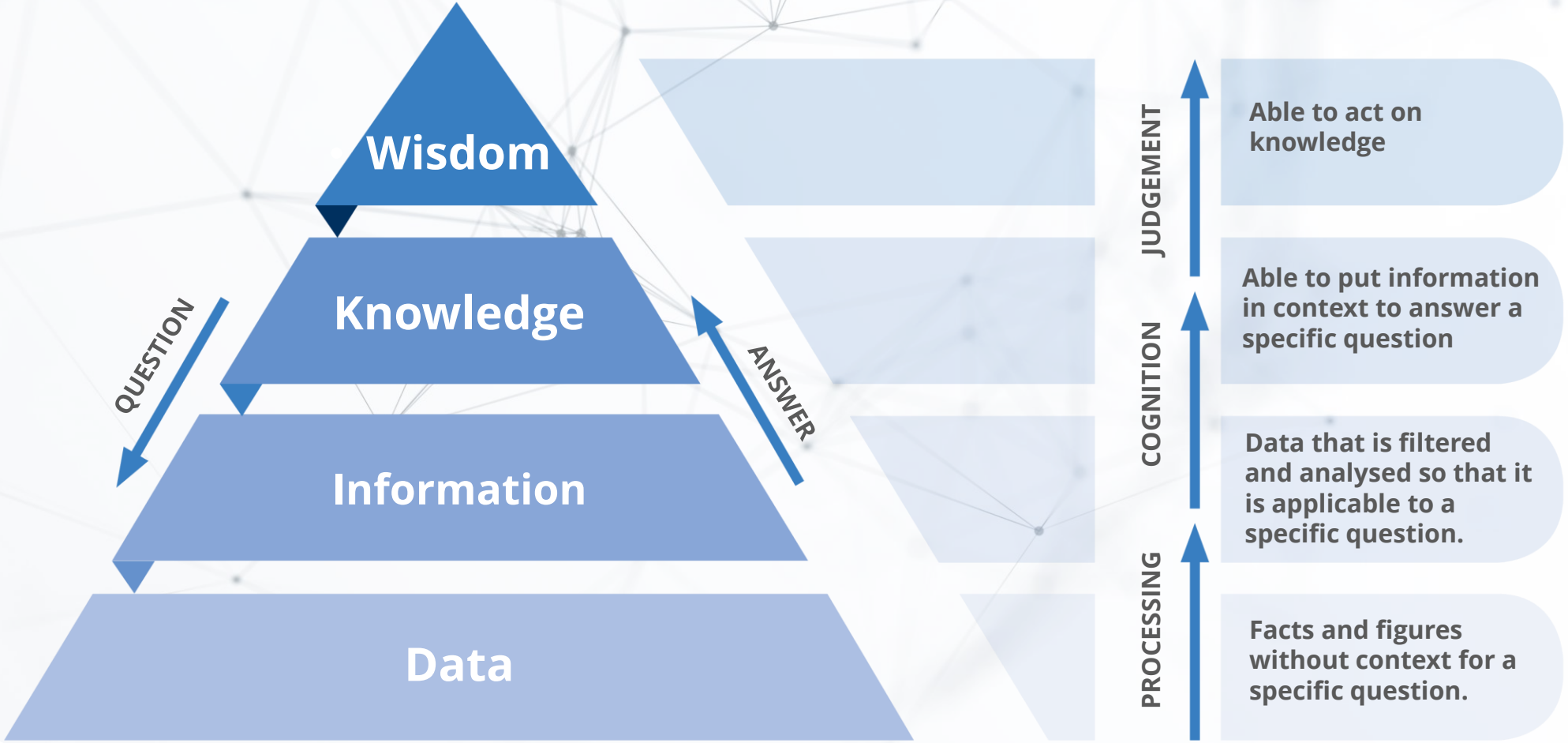
- A digital world - interconnected through flows of information
- Total convergence of digital and human worlds
- Democratize Knowledge
- 4IR technologies enabling unprecedented advances in data collection and geoanalytics



4IR Technology are ready to be leveraged

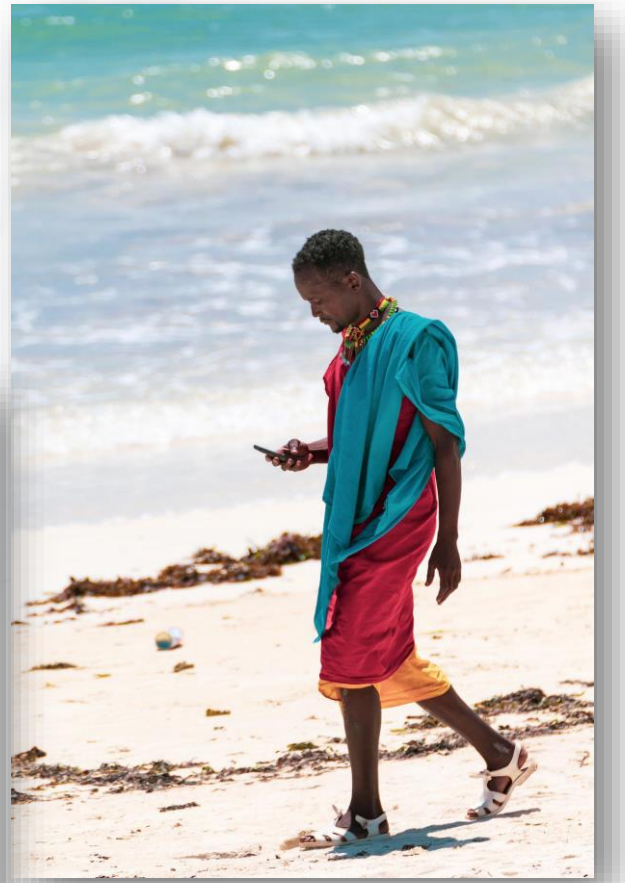
- Artificial Intelligence
- Machine learning / deep learning
- Natural Language Processing
- IoT – smart devices collect and share data
- Intelligent algorithms – insights from disparate BIG data
- Blockchain – distributed ledgers
- Digital identities
- Cloud and edge computing
- Autonomous vehicles
- 5G Network powerful cellular networks
- Quantum computing

Knowledge – an aspirational goal



Acquiring Knowledge

New knowledge-based services will evolve to operate via a range of commands (voice, touch, keyboard) and devices.



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

Knowledge needs to be individualized


Emergency Responder


Home Buyer


Insurance Broker


Urban Planner

Will this property be flooded?

People have similar questions of data content…..asked in different contexts

Drivers for Change

Unified solutions to global problems

- Harness geospatial intelligence from a local to global level
- Integrated solutions to address common challenges
- benefit of ripple effect
- Leverage global Innovation

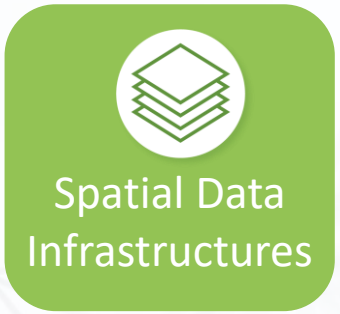
Equitable access to knowledge on-demand

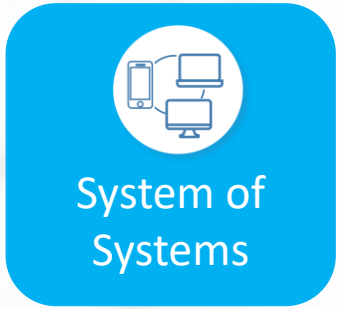
- Societal expectations for knowledge on-demand
- Designed for general users
- Innovation will require data to can be processed and contextualised for the individuals in real time.

Bridge the geospatial digital divide

- An ecosystem accessible and usable to all
- Knowledge' available to everyone
- Design the future ecosystem with a priority on putting developing nations at the centre of everything we do

Unique starting points





Paper

Production of maps by hand

GIS

Geospatial data compiled, analyzed and formatted into a virtual image

Data Hub

An infrastructure for organising and making data and services accessible

Network

Systems that interoperate and consume geospatial data

Ecosystem

Global ecosystem permitting intelligent interactions between data and services

Future Ecosystem – 3 concepts

SDI: A server-based geoportal for organising and making geospatial data and services available and consumable.

System of Systems (SoS): A collection of systems that consume geospatial from SDI data catalogues or from other sources available on the Web. Each system is capable of independent operation, but also interoperates with other systems to achieve additional capabilities.

Geoverse: An aspirational globally interconnected geospatial information ecosystem; one that permits intelligent interactions between SDI web portals, systems, sensors, applications and devices etc. using machine facilitated technologies such as AI, ML, NLP, data mining, virtual assistants, digital identities, blockchain and a broad range of communication interfaces etc.

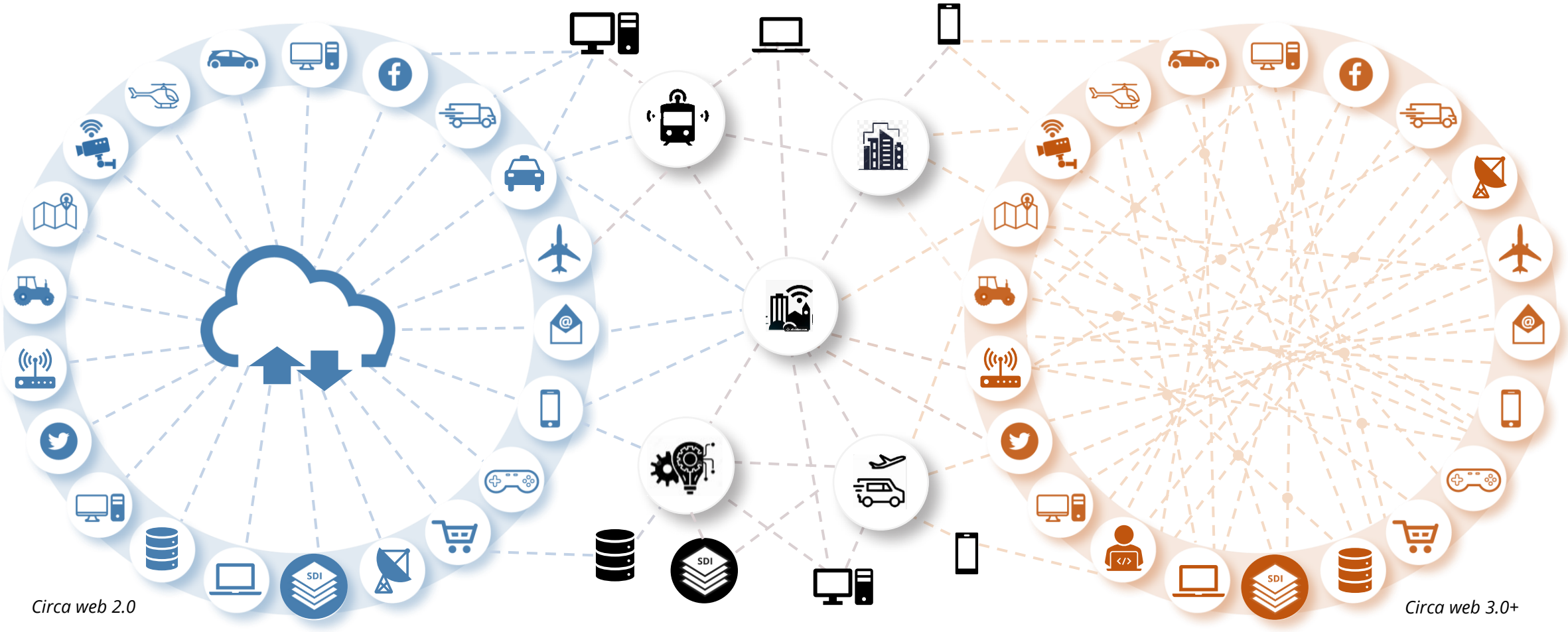
Geoverse belongs to everyone

SDI will be part of the future ecosystem

- SDIs are an important step in the evolutionary process
- SDI will exist in the future ecosystem with SoS
- SDIs crucial to strengthening geospatial information management
  - data governance frameworks
  - enact geospatial policy and laws
  - implement data technology and standards
- IGIF provides the guidance

> *SDIs are the foundation for the step change required to move to an ecosystem centred on delivering knowledge.*

Geospatial Information 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

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

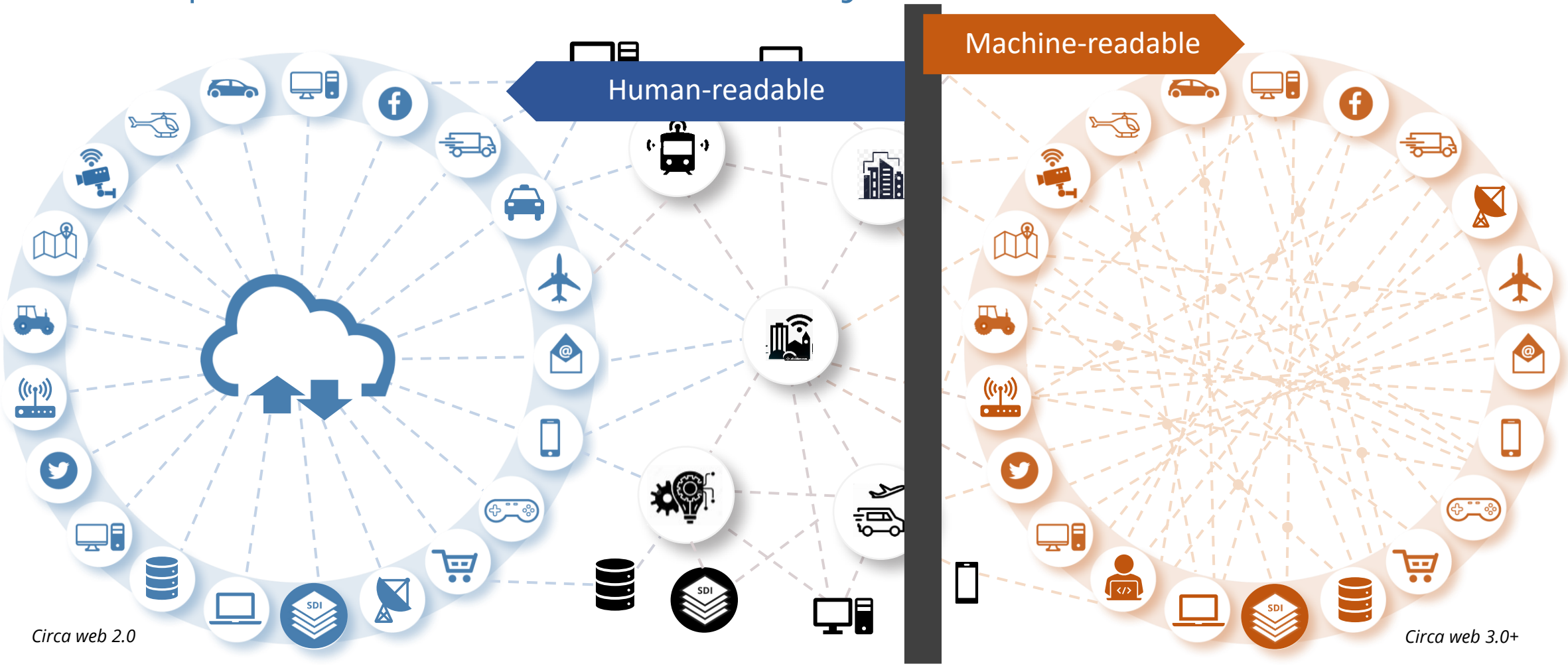
Characteristics of the Geoverse

- Multimodal and distributed - interaction between devices, users, and services
- Block chain – secure peer to peer communication
- Data belonging to the user will be protected - smart contracts, digital identities
- Machines read data and also process and interpret data
- AI used translate human language into machine understandable language

Circa web 3.0+

Geoverse

Geospatial Information Ecosystem



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Why Geoverse?

- Geoverse is NOT a new name for SDI and NSDI – all coexist in the future information ecosystem
- Geoverse is not a business name; it is a dictionary meaning
- Need a brand to attract new workforce and start conversations, and for all to get behind the 'change journey'
- Many 'web' digital ecosystems exist (e.g. libraries, health, encyclopedias, shopping) but have no recognisable name
- Geoverse leverages the metaverse brand, but is more than the metaverse
  - Integrate geospatial information – 2D to 4D
  - Predictive analytics
  - Integrated data from a wide-range of disciplines – no finite boundary
  - Delivery of real-time knowledge in all its forms
- A name must endure the journey - Geoverse will not happen overnight

SDIs, SoS, geoverse, metaverse and global digital ecosystem

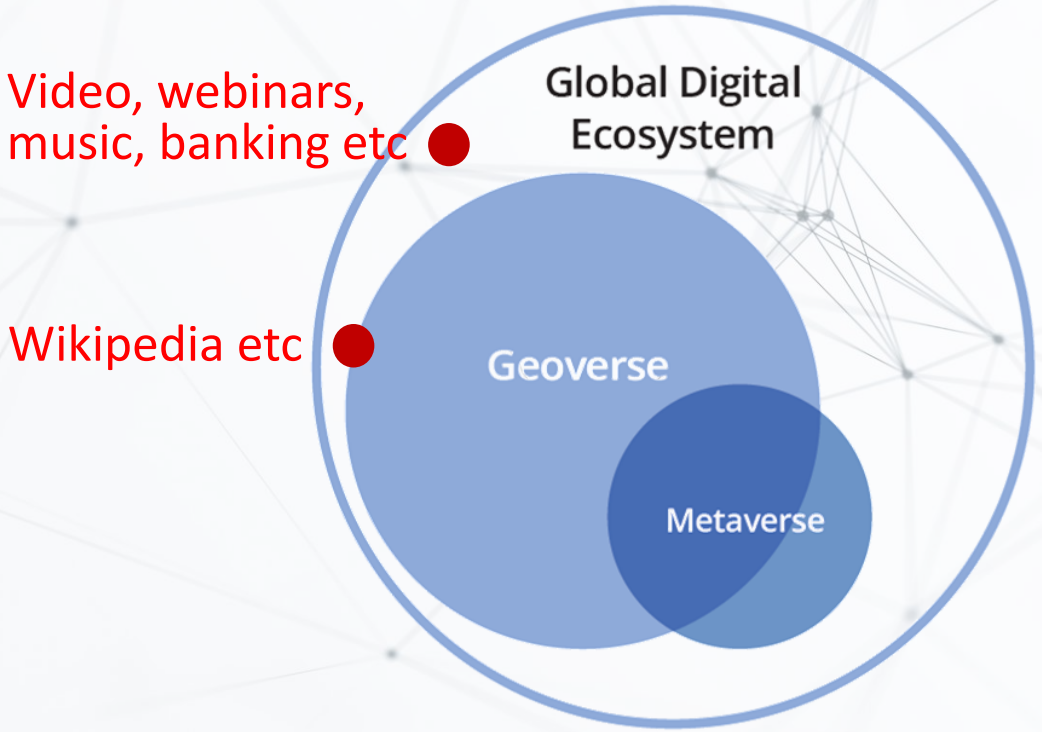
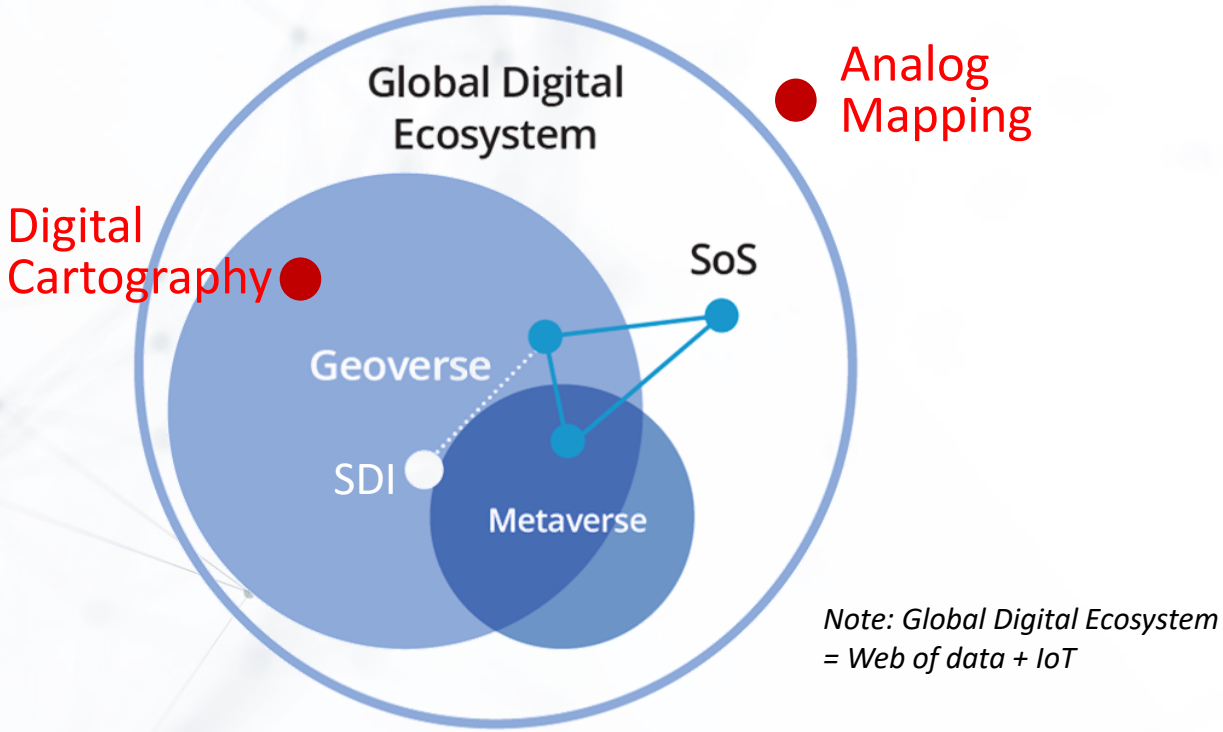


Figure 1: The geoverse is a subset of the global digital ecosystem, and participates in the metaverse. The Geoverse is anything that has or can have a location attribute.



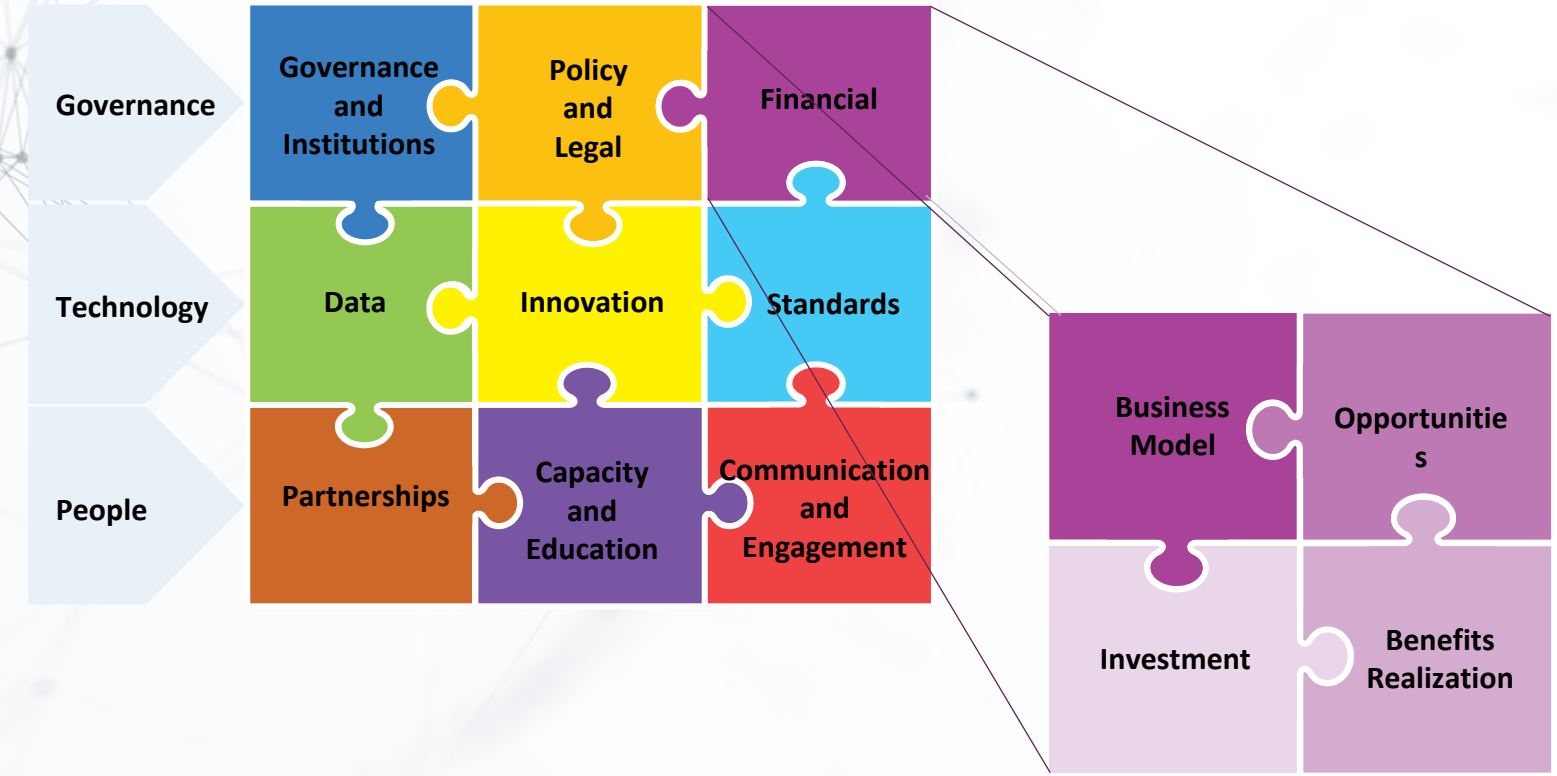
Note: Global Digital Ecosystem = Web of data + IoT

Figure 2: The SDI is a source of data for the geoverse, SoS and metaverse. SoS participate in global digital ecosystem, geoverse and metaverse.

The Step Change

IGIF provides a 360 degree view for what needs to change to move to a future ecosystem

- 3 areas of focus
- 9 strategic pathways
- 4 elements in each pathway

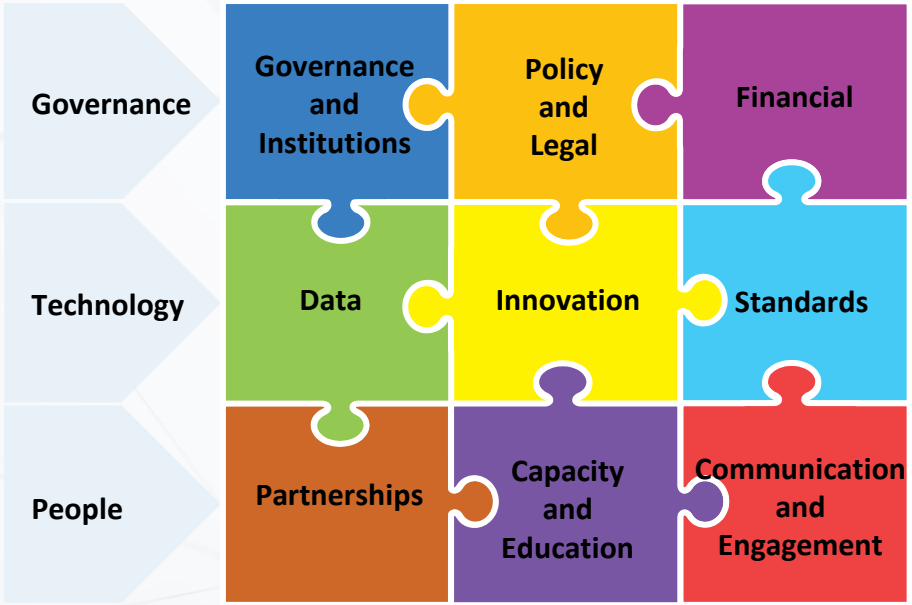


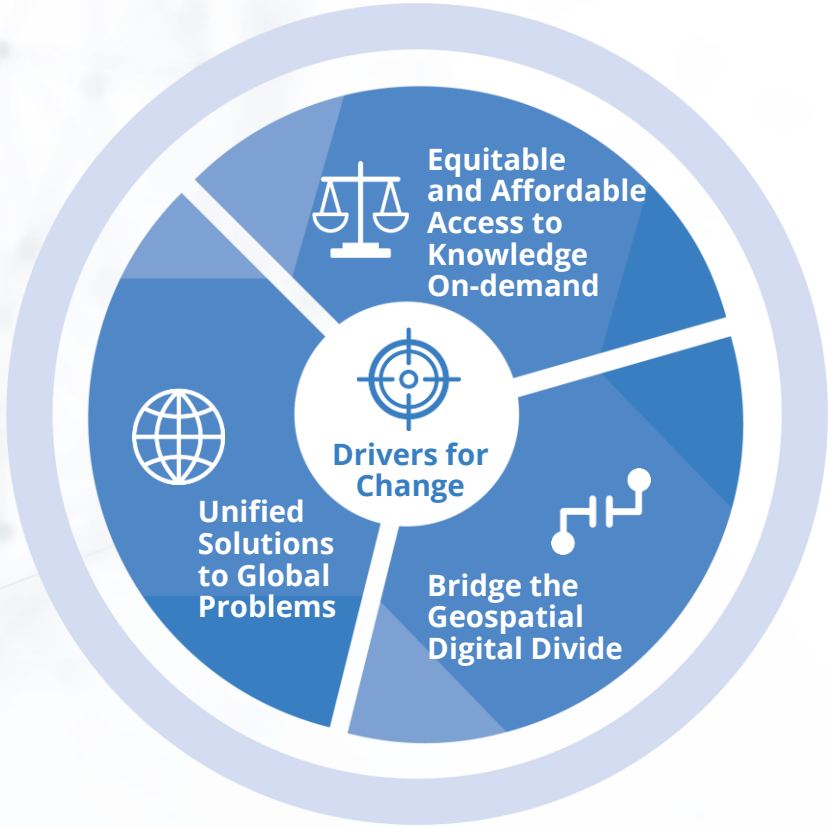
Governance and Institutions

The Step Change is described and illustrated in the discussion paper

Strategic Pathway Elements	Spatial Data Infrastructures	Future Geospatial Information Ecosystem
Leadership	Strategies and plans on geospatial data management	Global interconnectivity to leverage knowledge creation opportunities
Institutional Arrangements	Traditional hierarchical SDI governance arrangements	Agile non-hierarchical inclusive multi-actor governance configurations
Value Proposition	Access to fundamental data	Affordable and equitable access to knowledge
Governance Model	SDI data governance models	Global Geospatial Knowledge Governance Framework

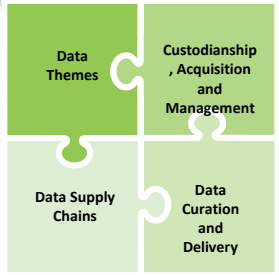
Step Change in relation to Drivers for Change





The following slides capture the major strategic actions (centred on the nine IGIF strategic pathways), which are required to make the step change needed to address the drivers for change.

Data



Unified solutions to global problems

- SDGs require pathway to knowledge
- Need for prioritisation
- Use case frameworks – data and geoanalytics

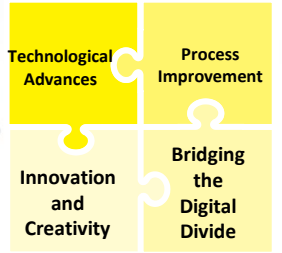
Equitable access to knowledge on-demand

- Machine readable data registries and metadata catalog
- Broker interactions with communication interfaces of software/devices

Bridge the geospatial digital divide

- Machine readable data enables leapfrog opportunities

Innovation



Unified solutions to global problems

- Data hubs participate in geoanalytics ecosystem
- Able to harness increased amount of real time data

Equitable access to knowledge on-demand

- Knowledge representation
- Convert knowledge into computer understandable form
- User context and individual preferences

Bridge the geospatial digital divide

- Knowledge creation processes are shareable
- Opensource development
- Leverage global Innovation

Standards

Unified solutions to global problems

- Knowledge representation standards – data vocabularies and ontologies

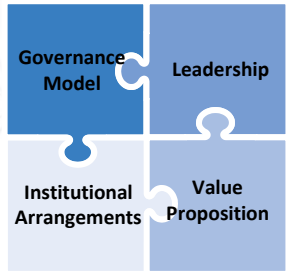
Equitable access to knowledge on-demand

- Data Publishing standards - FAIR.
- Communication of trust.
- Machine-human interfaces e.g. NLP

Bridge the geospatial digital divide

- Share semantic data models
- Mitigate semantic interoperability issues

Governance and Institutions



Unified solutions to global problems

- Global knowledge management framework

Equitable access to knowledge on-demand

- Agile non-hierarchical multi-actor configurations
- Harness geospatial intelligence from a local to global level

Bridge the geospatial digital divide

- Strategy - Global interconnectivity
- Private sector will be a key stakeholder

Policy and Legal

Unified solutions to global problems

- Geospatial policy and laws interoperable with wider government digital policy and knowledge management frameworks.

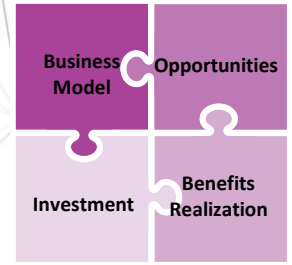
Equitable access to knowledge on-demand

- Use of technology to enforce geospatial policy
- Ethical challenges of information bias, digital identities, usage and cybersafety

Bridge the geospatial digital divide

- Global Policy and Legal Framework as guidance for national frameworks

Financial



Unified solutions to global problems

- Investment in machine-readable data to enable participation in global digital connectivity

Equitable access to knowledge on-demand

- Decentralized business models – tokenized networks
- Closed-loop business models
- The smart economy business models – new ROI

Bridge the geospatial digital divide

- Data/free economy business model
- Freemium models
- Geospatial Asset Sharing

Partnerships

Unified solutions to global problems

- Data integration – local to global level
- Content tribe – crowd economy

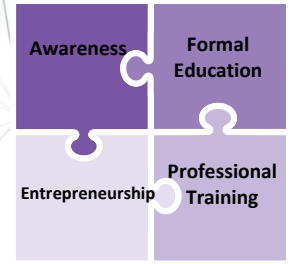
Equitable access to knowledge on-demand

- Maximise system integration issues and value activities within supply chains

Bridge the geospatial digital divide

- Decentralized network lends itself to partnerships

Capacity and Education



Unified solutions to global problems

- Cross discipline professional development
- Deep subject expertise and computing fundamentals

Equitable access to knowledge on-demand

- Internet science and 4IR technologies

Bridge the geospatial digital divide

- Workforce ready skills development framework
- New curricula

Communication and Engagement

Unified solutions to global problems

- Knowledge value proposition to influence policy makers
- Strategic, targeted and impactful communications

Equitable access to knowledge on-demand

- Career of choice
- Conversation starters
- Messaging to keep pace with changing times

Bridge the geospatial digital divide

- Broad spectrum, diverse and inclusive

What can be down now!

- Strengthen integrated geospatial information management nationally
- Make geospatial data available in a machine-readable form to stimulate innovation in knowledge creation straightaway
- Share knowledge representations, rule bases and geoanalytics to support reuse and local to global adoption
- Broaden stakeholder engagement to consider diversity of views and needs

Summary

- Global Knowledge Management 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

Thank you

Dr Lesley Arnold