United Nations

2025

Positioning the Future Geospatial Information Ecosystem

Positioning the Future Geospatial Information Ecosystem

United Nations

© 2025 United Nations

All rights reserved worldwide

Requests to reproduce excerpts or to photocopy should be addressed to the Secretariat of the United Nations Committee of Experts on Global Geospatial Information Management (UN-GGIM)

All other queries on rights and licenses, including subsidiary rights, should be addressed to:

Email: ggim@un.org

Website: ggim.un.org

Publication issued by

Secretariat United Nations Committee of Experts on Global Geospatial Information Management

Statistics Division, Department of Economic and Social Affairs, United Nations

The United Nations Committee of Experts on Global Geospatial Information Management (UNGGIM) is the apex intergovernmental body to discuss, enhance and coordinate global geospatial information management activities by involving Member States at the highest level, to work with Governments to make joint decisions and set directions on the use of geospatial information within national and global policy frameworks, and to develop effective strategies to develop geospatial capacity in developing countries.

UN-GGIM
UNITED NATIONS COMMITTEE OF EXPERTS ON GLOBAL GEOSPATIAL INFORMATION MANAGEMENT

Executive Summary

At a time of rapid digital transformation, positioning the future geospatial information ecosystem as an important enabler within broader digital ecosystems is a strategic imperative, recognizing the expanding role of geospatial information. The United Nations Committee of Experts on Global Geospatial Information Management (UN-GGIM), through its decisions 13/104 and 14/104, mandated the development of a strategic position paper to define the scope, fundamental elements, and guiding principles for the future geospatial information ecosystem.

This position paper presents a vision for the future geospatial information ecosystem: a dynamic, interconnected, and evolving ecosystem where geospatial information seamlessly integrates with emerging technologies, diverse stakeholders, a wide range of data, and inclusive governance models, which constitute an essential element of the fabric of the wider digital ecosystem. The future geospatial information ecosystem positions location-based data as a critical component of the digital public infrastructure required for evidence-based decision-making, innovation, and the advancement of the global development agenda beyond 2030. It recognizes the geospatial information ecosystem as an evolving web of interconnected, interoperable, integrated data, models, and services that can be dynamically queried to answer questions to address society's most pressing challenges - from disaster risk reduction to urban sustainability, health to climate action.

The future geospatial information ecosystem is a strategic perspective on how the geospatial sector is evolving to structure, connect, and organize people, data and digital services to help stakeholders understand, interpret, and analyze information to enable more intelligent, automated, and adaptive decision-making. It looks to a world where data is machine-readable and context-aware, providing the foundation for its integration with artificial intelligence (AI) and next-generation digital ecosystems, without requiring human interpretation at every step.

The future geospatial information ecosystem is seen not as a replacement for existing spatial data infrastructures (SDIs), but rather a complement to them, maximizing their use and extending their relevance. It will foster the integration of local to global authoritative geospatial data with other data sources (business, social, and environmental data) as part of an evolving digital web of data that enables more effective analysis, policy development, decision-making and targeted actions to support the achievement of the Sustainable Development Goals (SDGs) and beyond.

The United Nations Integrated Geospatial Information Framework (UN-IGIF) remains the primary guide to assist countries in strengthening and modernizing their geospatial information management arrangements. However, to support the advancement of the future geospatial information ecosystem, the UN-IGIF needs to be expanded to include additional guidance, orientations, trends and actions to help Member States build dynamic, integrated, and resilient geospatial information ecosystems envisioned for the future. The position paper proposes a non-prescriptive approach, encouraging flexibility, innovation, and inclusion to suit diverse national priorities and developmental pathways, and advocates for ongoing foresight activities to predict, and therefore adapt to the changing digital landscape.

The paper draws extensively from discussions and conclusions of the Bureau and its dedicated writing team. It incorporates insights from audience contributions during webinar consultation sessions held in 2025 and the results of the future geospatial information ecosystem survey, which captured the views of geospatial professionals across diverse knowledge domains and disciplines. These contributions have enriched the understanding of the evolving ecosystem and informed the recommendations and strategic direction set out in this document.

The paper also outlines key concepts underpinning the future geospatial information ecosystem, including system-of-systems thinking, dynamic interoperability, ethical data stewardship, collaboration and continuous training, as well as the recognition of geospatial information as a public good. It presents a set of foundational principles, such as agility, inclusivity, sustainability and collaboration, to guide the development and evolution of national and global geospatial ecosystems and knowledge economies to respond to the changes that are taking place.

Anchored by the nine strategic pathways of the UN-IGIF, the paper identifies future-oriented "Step Changes" required across governance, policy, financing, data, innovation, standards, partnerships, capacity building, and communication to embrace the future geospatial information ecosystem. These Step Changes are intended to help Member States anticipate technological advances, foster equitable digital participation, and ensure that geospatial systems remain resilient, ethical, and fit-for-purpose in a rapidly changing world.

The benefits of the future geospatial information ecosystem are far-reaching: strengthening national resilience, accelerating sustainable development, enhancing societal inclusion, and enabling transformative innovations across social, economic and environmental sectors. Through strategic foresight, collective action, and coordinated leadership, the future geospatial information ecosystem can empower nations and communities to navigate complexity, seize opportunities, and build a more sustainable, resilient, and inclusive future.

Contents

1. Background

Determining the future geospatial information ecosystem was included in discussions at the eleventh session of the Committee of Experts on Global Geospatial Information Management (UN-GGIM) and included in the agenda for its twelfth session following the consideration of the United Nations Integrated Geospatial Information Framework (UN-IGIF). Discussions recognized the importance of the interlinkages of the Framework with other emerging and complementary initiatives that would ultimately extend the Framework's relevance into the future and specifically the future geospatial information ecosystem. The complexity of the future geospatial information ecosystem, and thus the need to give consideration thereto, was highlighted in a background paper entitled "Towards a sustainable geospatial ecosystem beyond spatial data infrastructures".

In 2022, the Report of the Committee on its twelfth session noted that "obtaining a clear understanding of what the future geospatial information ecosystem beyond the Framework (UN-IGIF) might look like, one in which almost all data will relate to a location in some way, may be difficult for some of the sectors involved, especially in developing countries." The substantive report under Agenda item 4 – Determining the future geospatial information ecosystem was accompanied by two background documents entitled "Future Geospatial Information Ecosystem: From SDI to SoS and on to the Geoverse" and the "Future National Geospatial Information Ecosystem." These background documents explored the geospatial landscape to determine the future geospatial information ecosystem with a view to assisting Member States and national geospatial information agencies in their thinking on future geospatial environments in which technological developments will play a crucial role.

The third edition of Future Trends in Geospatial Information Management highlighted the rapidly evolving geospatial landscape, shaped by five key forces: technological advancements, emerging data sources and analytical methods, shifting user requirements, industry restructuring, and changes in the legislative environment. The report identified how trends like artificial intelligence (AI), machine learning, ubiquitous connectivity, and high-resolution Earth observation were poised to become core components of the industry. It also underscored the increasing importance of data integration, big data processing, immersive technologies, and digital twins. Broader trends such as workforce diversity, start-up growth, and evolving consumer expectations were also seen as reshaping the sector. At the same time, growing focus on digital ethics, privacy, cybersecurity, and regulatory modernization highlighted the complex challenges the industry must navigate to unlock future opportunities.

Building on this foundation, the paper Moving Forward Together: The Emergence of the Interconnected Geospatial Ecosystem explores how modern geospatial ecosystems are evolving beyond traditional spatial data infrastructures. Taking the example of the Saudi Arabian National Geospatial Ecosystem, the paper postulates that Geospatial Ecosystems now integrate AI, automation, semantic standards, and flexible governance to enable more adaptive, intelligent, and collaborative responses to complex challenges. A key shift is toward scenario-driven models, where stakeholders coalesce around specific needs and leverage linked data, graph-based systems, and decentralized data spaces that ensure sovereignty, interoperability, and trust. This transformation demands agility, inclusivity, and continuous innovation, with a growing emphasis on AI, cloud computing, and cybersecurity skills. In making decision 12/102, the Committee of Experts acknowledged 'that determining the future geospatial information ecosystem was a timely and strategically important topic to consider […] and to understand how the future ecosystem would link to the work already carried out by the Committee, including the Integrated Geospatial Information Framework.' It further noted that a 'continuing discussion on 'geospatial information ecosystem' was necessary for the global community, with the aim of explaining and expanding the role of geospatial information in technological advancements and society in general.'

At its thirteenth session, the Committee recognized that the future geospatial information ecosystem will be shaped by global trends and challenges, and by how effectively geospatial data and technologies are leveraged to address these challenges and harness emerging opportunities in support of the 2030 Agenda for Sustainable Development and other global development agendas. In making decision 13/104, the Committee 'agreed that the definition and development of future geospatial ecosystems was an opportune activity to undertake but

that it required further scoping and consensus to identify and describe what the foundations of future geospatial ecosystems would encompass within the purview of the Committee […].'

In its report of 2024, the Committee of Experts included principles and fundamental elements on the future geospatial information ecosystem and, in making decision 14/104 at its Fourteenth Session, the Committee concluded it should 'consider the purpose and actors as the main drivers of the future geospatial information ecosystem, to undertake broad global consultation to maximize inputs and views from the Committee and relevant stakeholders, to include diverse perspectives and positions of a future geospatial information ecosystem within the broader digital ecosystem, and to embrace the understanding of a future geospatial information ecosystem as a journey rather than a deliverable.'

In response to the Committee's mandate, the Bureau - supported by its Writing Team - developed this position paper, drawing on extensive dialogue, a global webinar on "Exploring the wider digital ecosystem" with audience participation, and insights from a global survey of professionals from across diverse geospatial, digital, policy, and technology domains. This broad-based collective engagement across the UN-GGIM community has shaped this position paper, ensuring it reflects a wide range of perspectives, experiences and aspirations.

The inputs gathered from Member States and stakeholders during the global webinar and survey on the future of the geospatial information ecosystem reflect a rich and diverse set of perspectives. Of the responses gathered, 41% came from public agencies, directly reflecting on-the-ground implementation challenges. The survey reached 232 stakeholders across six global regions, with over 70% of responses from Africa, Asia-Pacific, and Latin America, ensuring strong representation from the Global South. Voices from the technical, policy, civil, and private sectors collectively shaped the findings.

Key issues that emerged include siloed institutional systems, gaps in legal frameworks, disparities in skills and capacity, barriers to partnerships, and the uneven accessibility of emerging technologies like AI and blockchain. There was a strong consensus on the urgent need for interoperability, legal data standardization, and investment in AI/ML and GIS skills. Respondents emphasized the importance of integrating diverse data types—geospatial, environmental, real-time, and Earth observation—into a responsive, decision-enabling ecosystem.

Responses saw an envisioned future geospatial information ecosystem that should be reliable, interoperable, inclusive, adaptable, and governed by ethical and legal safeguards. It must foster cross-sector collaboration while safeguarding privacy, security, and human rights. Stakeholders called for investment in robust digital infrastructure, capacity building, governance frameworks, open standards, and environmental sustainability. Financial mechanisms such as government and private investment, data cooperatives, philanthropy, and emerging models like tokenization will play a key role in scaling access and capacity. Equitable participation remains a priority, requiring intentional strategies to close connectivity gaps, promote digital literacy, and ensure marginalized voices are heard. Public-private partnerships, open standards, and culturally relevant, user-centric platforms will be vital to building a trusted, transparent, and inclusive geospatial information ecosystem that delivers value and resilience for all communities.

The paper aims to provide a strategic outlook and voluntary guidance for Member States to consider, without imposing frameworks or prescriptive obligations. It sets out forward-looking considerations, and perspectives on the evolving role of geospatial information within the wider digital ecosystem that respects diverse national contexts while fostering collaboration, inclusion and strategic leadership. Finally, it provides approaches that Member States could use to incorporate aspects of the future geospatial information ecosystem into the UN-IGIF pathways in ways that are most relevant to their needs.

2. Navigating the uncharted digital territory and its future

The world is experiencing unprecedented transformation driven by rapid digital and societal shifts. This change is marked by the convergence of several key factors: a pervasive digital environment, increasing interconnectedness, and exponential growth in the volume of data. As highlighted in the 2024 report, the rapid development of machine learning, large language models (LLMs), deep learning, cloud computing, and AI is accelerating this transformation and exerting a profound, lasting influence on the broader digital ecosystem – an ecosystem that forms the foundation of the evolving geospatial information landscape. In parallel, the urgency of addressing global challenges demands science-based, data-driven decision-making supported by vast quantities of data and advanced analytics.

The geospatial community and national geospatial information agencies must proactively adapt to emerging trends, manage and integrate a broader array of data sources, and harness rapid technological developments to generate insights that support national development priorities, global agendas, and efforts to close the geospatial digital divide.

Navigating this future requires strategic foresight, inclusivity, resilience and strong collaboration across government, the private sector, academia, and civil society. It also calls for the geospatial community to redefine its role within the broader digital ecosystem - acknowledging that geospatial information is no longer a standalone domain but increasingly embedded within multi-sector digital infrastructures.

In this context, defining and positioning the future geospatial information ecosystem is vital. It represents a continuous process of aligning geospatial information management with the pressing need to address global challenges, support evidence-based decision-making for governments and communities, and respond to rapidly evolving technologies in the wider digital ecosystem. This includes integrating and interconnecting with an ever-increasing volume and range of data services that form the fabric of the digital world, and ensuring this digital public infrastructure and its services are available to everyone – helping to bridge the digital divide.

At its core, the future geospatial information ecosystem is inherently dynamic - a “moving target” that requires continual adaptation and the integration of new ideas, innovations, and methodologies, as the role of geospatial information becomes increasingly embedded within the broader digital ecosystem. As the ecosystem will be shaped by global circumstances, it is imperative to consider how geospatial data and technologies can help societies overcome shared challenges and unlock new opportunities. Looking ahead - just five years away from the conclusion of the 2030 Agenda - the future geospatial information ecosystem must also be purpose-driven, resilient and positioned to support future global priorities and challenges facing humanity and future development agendas.

The future geospatial information ecosystem needs to be seamlessly integrated with emerging technologies and governance models and structured in a way that enables machines and systems to interpret, reason, and act autonomously. This evolution will allow geospatial data to be dynamically queried, connected and analyzed in real time - enabling more intelligent, adaptive decision-making, strengthening resilience and accelerating progress toward national and global development goals.

3. The future geospatial information ecosystem

Emerging technologies, such as AI, the Internet of Things (IoT), digital twins, and blockchain, are reshaping how geospatial data is generated, managed, and used. These advances offer new opportunities to transform geospatial information into actionable knowledge that supports smarter decision-making. At the same time, however, they raise important challenges around ethics, interoperability, equity, and trust that must be addressed to ensure responsible and inclusive implementation.

In this evolving context, geospatial information has shifted from a specialized technical asset to a foundational element of a digital infrastructure - enabling authoritative, integrated data flows that support purpose-driven, evidential and inclusive governance that contributes to

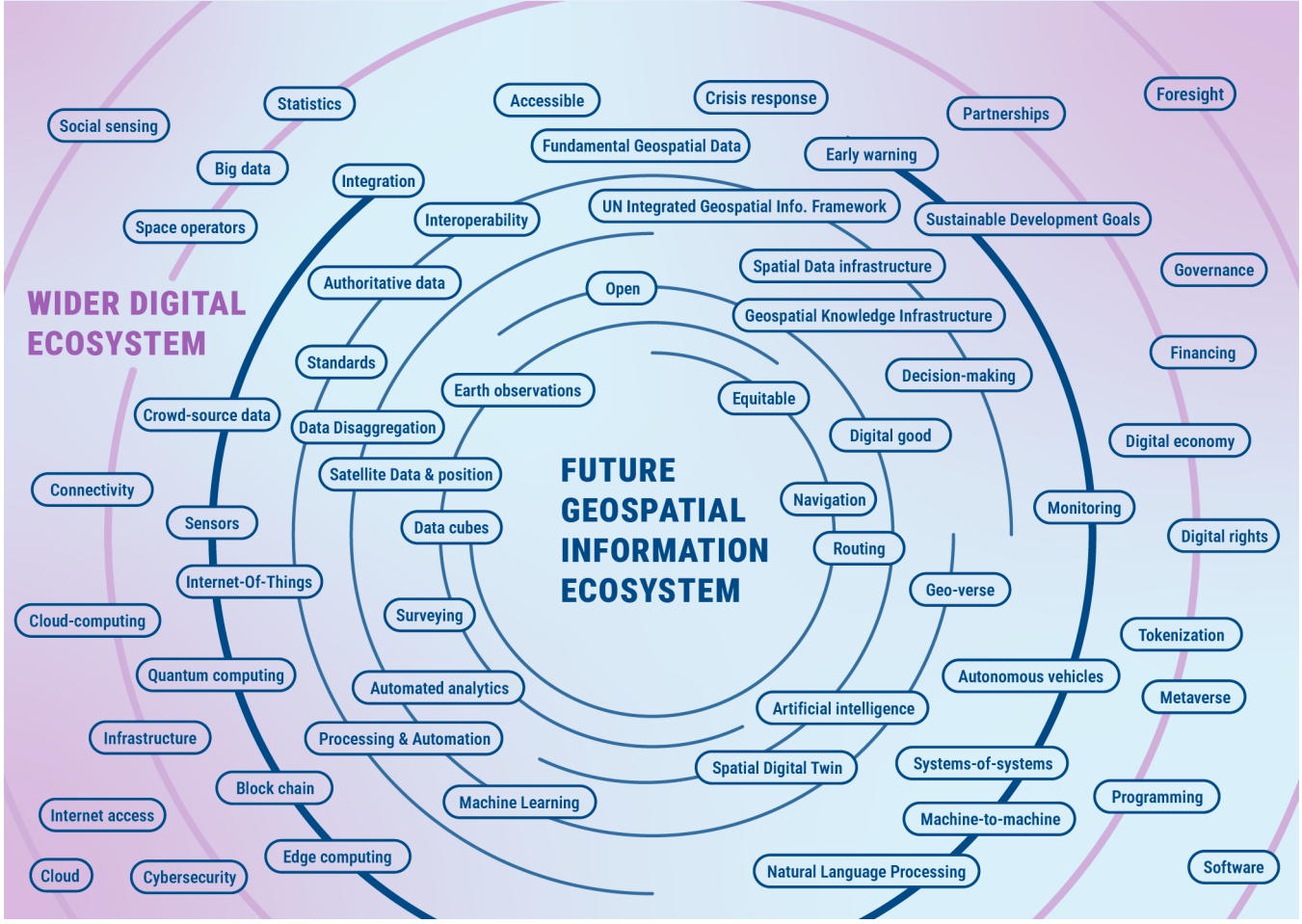

Figure 1: The future geospatial information ecosystem and the wider digital ecosystem

sustainable development, disaster resilience and climate action. The future geospatial information ecosystem is not static; it is dynamic, adaptive, and continually evolving. It must integrate diverse data sources, leverage advanced technologies, and respond to societal needs in real time. This transformation requires rethinking traditional geospatial models - moving beyond static spatial data infrastructures toward systems that are intelligent, predictive, inclusive, and trusted.

Addressing, global challenges, such as climate change, pandemics, forced migration, and economic inequality, require integrated location-based insights to support evidence-based policymaking and equitable resource allocation. The future geospatial information ecosystem must be equipped to meet these demands, ensuring that geospatial systems contribute meaningfully to the Sustainable Development Goals and future development agendas.

The future geospatial information ecosystem represents a transformative evolution in the management, integration, and utilization of geospatial information in an increasingly complex, interconnected world. The future geospatial information ecosystem is envisioned as a live, inclusive network of interconnected systems - spanning Spatial Data Infrastructures (SDIs), advanced platforms, sensors, applications, and cutting-edge technologies such as AI, machine learning, and blockchain (Figure 1).

Looking forward, the future ecosystem will deepen the role of geospatial information by linking data, metadata, ontologies, algorithms, advanced analytics - enabling intelligent systems to interpret information, gather insights and act autonomously. This is not a fixed end state, but a forward-looking approach to reposition and continuously adapt geospatial information management, ensuring its relevance and impact within the wider digital ecosystem to address emerging societal challenges. The United Nations Integrated Geospatial Information Framework (UN-IGIF) remains the central guide for Member States, offering a foundation to strengthen, enhance and modernize national geospatial information arrangements, with the current paper offering approaches to how the changes envisioned in the future geospatial information ecosystem can be incorporated within its pathways.

3.1 From Spatial Data Infrastructures to the Future

Spatial Data Infrastructures (SDIs) are foundational to national geospatial capabilities, providing the authoritative, standardized and trusted data layers that underpin all government functions and drive innovation. The future geospatial information ecosystem will not replace existing SDIs; rather, it builds upon and extends their relevance within an increasingly complex and interconnected digital landscape. The emerging technologies and approaches that we see are - creating a living, connected web of information that will fuel future knowledge economies.

At the heart of this evolution is the need for reliable, accurate and well-managed geospatial data. Without high-quality data, the ecosystem cannot deliver the trusted insights and informed decisions that societies need to respond to complex global challenges. Strengthening national data assets is therefore essential to ensuring that the ecosystem delivers meaningful knowledge, supports equitable outcomes, and advances sustainable development.

A key dimension of this shift is the emergence of **System-of-Systems,** an environment where independent but interoperable systems collaborate dynamically across domains such as smart cities, climate resilience, transportation, health, and disaster management. These systems-of-systems interact in real time, allowing for the seamless exchange of data, models, and analytical capabilities.

Looking ahead, rapid advances in dynamic ontologies, machine learning, and automated algorithmic integration, may see some countries leapfrog traditional stages of geospatial development - transitioning. directly from foundational SDIs to participation in the future geospatial information ecosystem. In such settings, interconnectivity and reasoning between datasets occur on-the-fly through machine-readable semantic structures, even in the absence of fully developed system-of-systems architectures.

Critically, semantic interoperability - across datasets, metadata, ontologies, and services - lays the foundation for intelligent automation. It enables data to be machine-readable, discoverable, and readily integrated, creating the conditions necessary for training advanced AI models within the future geospatial information ecosystem. This deep level of semantic interoperability transforms static data repositories into dynamic, machine-actionable knowledge ecosystems.

The future geospatial information ecosystem represents the next phase in this evolution - an expansive, knowledge-centric ecosystem where geospatial information is dynamically linked, semantically reasoned, and acted upon in real-time. It powers predictive analytics, adaptive decision-making, and actionable insights to address society's most pressing challenges.

3.2 Core concepts of the future geospatial information ecosystem

At its core, the future geospatial information ecosystem is shaped by the following interconnected characteristics that are fundamental to creating a responsive, inclusive, and continuously evolving digital infrastructure (Figure 2).

- **Knowledge-Centric Design**: Focus shifts from static data storage to the dynamic generation of actionable knowledge, leveraging AI, analytics, and real-time processing to support better decisions in service delivery, disaster response, and governance.
- **Data as Foundational Infrastructure:** Geospatial data is recognized as essential public infrastructure - underpinning economic opportunity, environmental protection, and delivery of services that improve people's lives.
- **Ecosystem thinking:** The concept of an ecosystem - rooted in biology - emphasizes the deep interdependence, interlinkages and continuous adaptation of geospatial systems within the wider digital and societal ecosystem.
- **Community engagement:** The ecosystem is shaped by a diverse community, including planners, statisticians, AI experts, surveyors, and local voices - ensuring that its design responds to real-world needs and lived experiences.
- **Systemic reciprocity:** The future ecosystem functions as a mutually reinforcing system that supports continuous feedback loops, emergent learning, and shared value among data users, institutions, and technologies. This principle aligns with the Data-Knowledge-Action Network (DAKAN) model

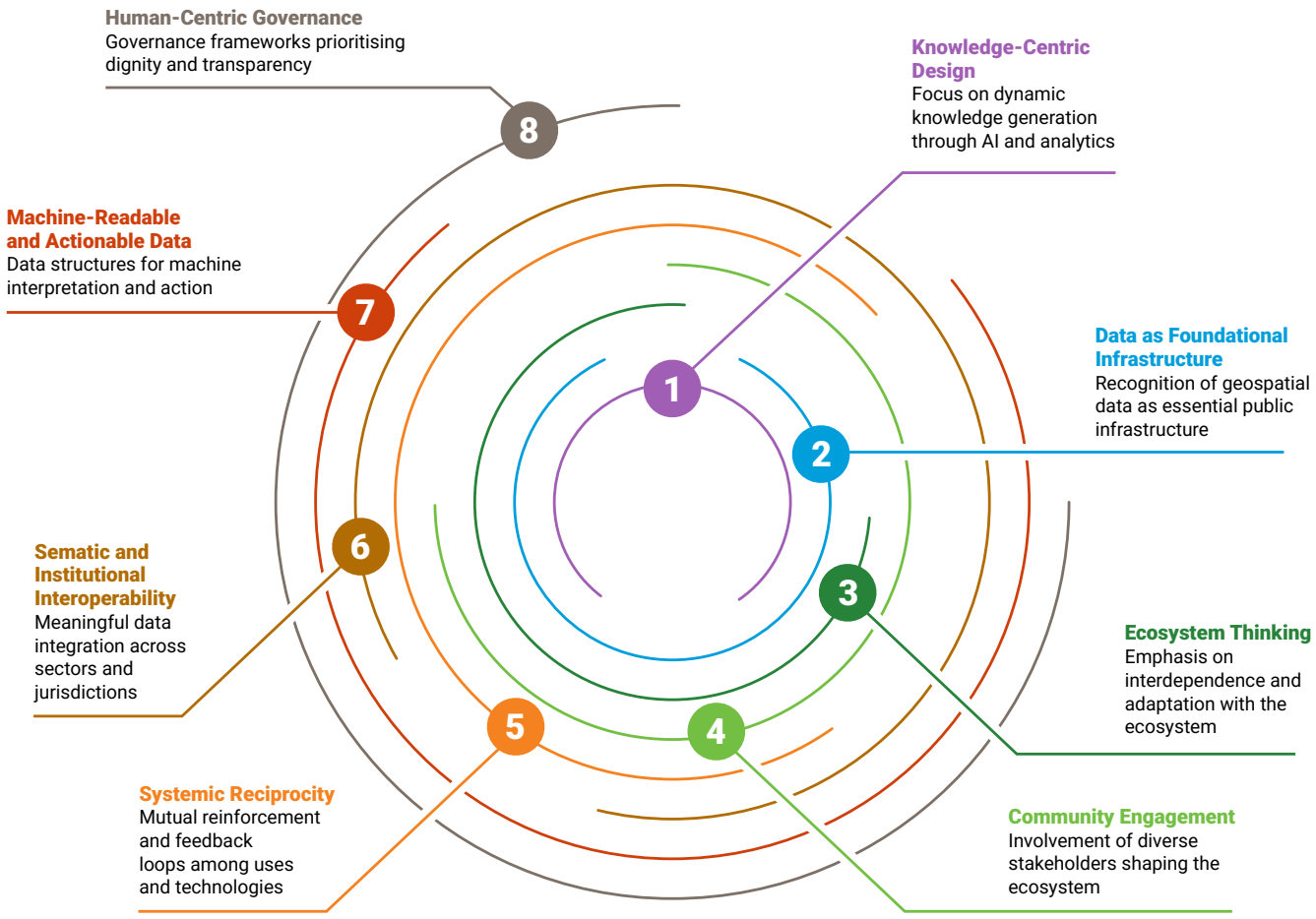

Figure 2: Core concepts of the future geospatial information ecosystem

(CODATA, 2023), which emphasizes a virtuous cycle linking data, knowledge, action, impact, and evaluation.

- **Semantic and institutional Interoperability:** The ecosystem supports meaningful data integration across sectors and jurisdictions - enabling coordinated action in health, housing, education, biodiversity, environmental protection, and more.
- **Machine-readable and Actionable by Design:** Data is structured for machines to interpret and act on - enabling real-time alerts, predictive services, and automated responses that improve how communities are protected and served.
- **Human-Centric Governance:** Governance frameworks prioritize dignity, transparency, and rights - ensuring technology remains accountable to people and promotes inclusive, ethical public outcomes.

3.3 Positioning the future geospatial information ecosystem within the wider Digital Ecosystem

The future geospatial information ecosystem is not an isolated construct. It is an embedded, interdependent part of the broader digital ecosystem - integrating geospatial data with domains such as data governance, artificial intelligence, digital infrastructure, the digital economy, and emerging global frameworks like the Global Digital Compact[1].

1 The **Global Digital Compact** is part of the **UN Pact for the Future**, but it has its own preparatory process and consultations. It focuses **specifically on digital cooperation**, while the Pact covers a **broader spectrum** of global priorities.

Positioning geospatial information as a foundational pillar of digital transformation ensures that it delivers measurable public value - fostering innovation, strengthening resilience, and advancing the SDGs across sectors and communities. By embedding geospatial thinking into digital governance, countries can unlock more inclusive, responsive, and future-ready systems of decision-making. Member States are therefore encouraged to adopt an ecosystem-thinking approach - recognizing the interlinkages between geospatial systems and broader societal, economic, environmental, and technological infrastructures. This includes investing in foundational enablers such as strong spatial data infrastructures (SDIs), interoperable platforms, and trusted, authoritative data to build a resilient, inclusive, and digitally empowered geospatial future.

The future geospatial information ecosystem represents a paradigm shift in how geospatial data is conceived, collectively governed, and used as a digital public good in an increasingly complex and interconnected world. Its scope extends beyond traditional geospatial infrastructures - encompassing a dynamic and evolving network of systems, technologies, institutions, and collaborative processes that span multiple sectors. Conceptualized as an adaptive learning system, the future geospatial information ecosystem evolves in real time in response to technological advances, community needs, environmental pressures, and governance imperatives. It is not a singular platform or system, but a distributed environment that links data, metadata, ontologies, and algorithms - enabling automated reasoning, intelligent services, and machine-supported decision-making.

This ecosystem is characterized by deep interoperability, dynamic data integration, and open, inclusive innovation. It positions geospatial information not only as critical public digital infrastructure, but as a key enabler of sustainable digital futures - supporting societies to act with greater precision, transparency, and agility in an age of uncertainty.

4. Rationale for Change and Commitment

The development and realization of the future geospatial information ecosystem emphasizes a fundamental truth: global challenges necessitate global collaboration. No single entity, nation or sector can independently harness the full potential of geospatial information to address the complex and intertwined issues facing humanity today, from climate change and environmental degradation to urbanization, disaster resilience, and sustainable development. The future geospatial information ecosystem represents not just a technological or informational leap forward, but rather a paradigm shift in how we conceive and act upon the common interconnectedness of our world.

The call for global collaboration is not merely a call for shared resources or data; it is a call for shared vision, shared responsibility and shared commitment to leveraging the power of geospatial information for the common good. It recognizes that the collective wisdom, expertise and capabilities of governments, the private sector, academia, and civil society are exponentially greater when combined. This collaborative spirit is essential for overcoming the silos that have traditionally hindered the flow of information and innovation.

Moreover, global collaboration in the context of the future geospatial information ecosystem emphasizes the importance of inclusivity and equity. It fosters accessibility to the benefits of geospatial information for all, particularly those in underserved and vulnerable communities. By working together, we can bridge the digital divide, democratize access to vital information, and empower every corner of the globe to make informed decisions that enhance resilience and promote sustainability.

4.1 Strategic imperatives

The role of geospatial information is driven by strategic imperatives that reflect the profound shifts in technology, governance, society and the environment. These imperatives outline the compelling need for strategic foresight and collective action.

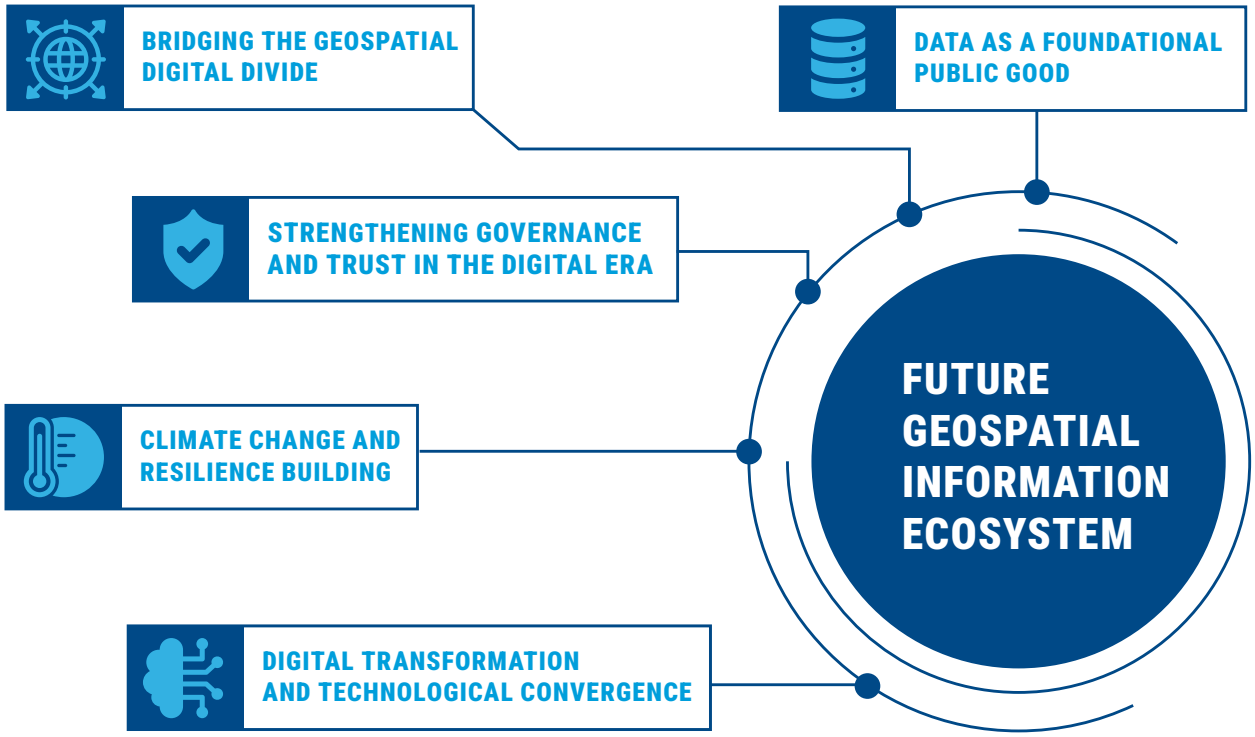

Figure 3 – Strategic imperatives and shifts in technology, governance, society and the environment

- **Bridging the Geospatial Digital Divide:** Despite technological progress, significant disparities in geospatial capabilities persist between countries and regions. The future geospatial information ecosystem must prioritize inclusiveness, capacity development and equitable access to technologies and data, ensuring that all Member States, especially developing countries and small island developing States, can participate in and benefit from the evolving ecosystem.
- **Digital Transformation and Technological Convergence:** Rapid advancements in digital technologies, including AI, IoT, cloud computing, and advanced analytics, are transforming how data is created, managed and utilized. Geospatial information must evolve to remain an integral component of this wider digital transformation, enabling real-time decision-making, predictive modeling and dynamic service delivery.
- **Climate Change and Resilience Building:** Climate change presents an urgent global challenge requiring immediate, coordinated action. Location-based data is fundamental to understanding climate impacts, managing risks and building resilient societies. The future geospatial information ecosystem must empower decision-makers with integrated, geospatially enabled insights to drive mitigation, adaptation and resilience efforts.
- **Data as a Foundational Public Good:** Geospatial information increasingly underpins critical public services, from health and transportation to disaster response and resource management. Recognizing geospatial data as a foundational public good promotes equitable access, fosters ethical use, and advances broad societal benefit, strengthening the role of national and global data infrastructures.
- **Strengthening Governance and Trust in the Digital Era:** As data ecosystems become increasingly complex, maintaining public trust, upholding ethical governance and safeguarding data sovereignty are emerging as critical imperatives. The future geospatial information ecosystem must embed strong governance frameworks that prioritize transparency, accountability, inclusivity, and the protection of human rights, building and sustaining trust in the management and use of geospatial information.

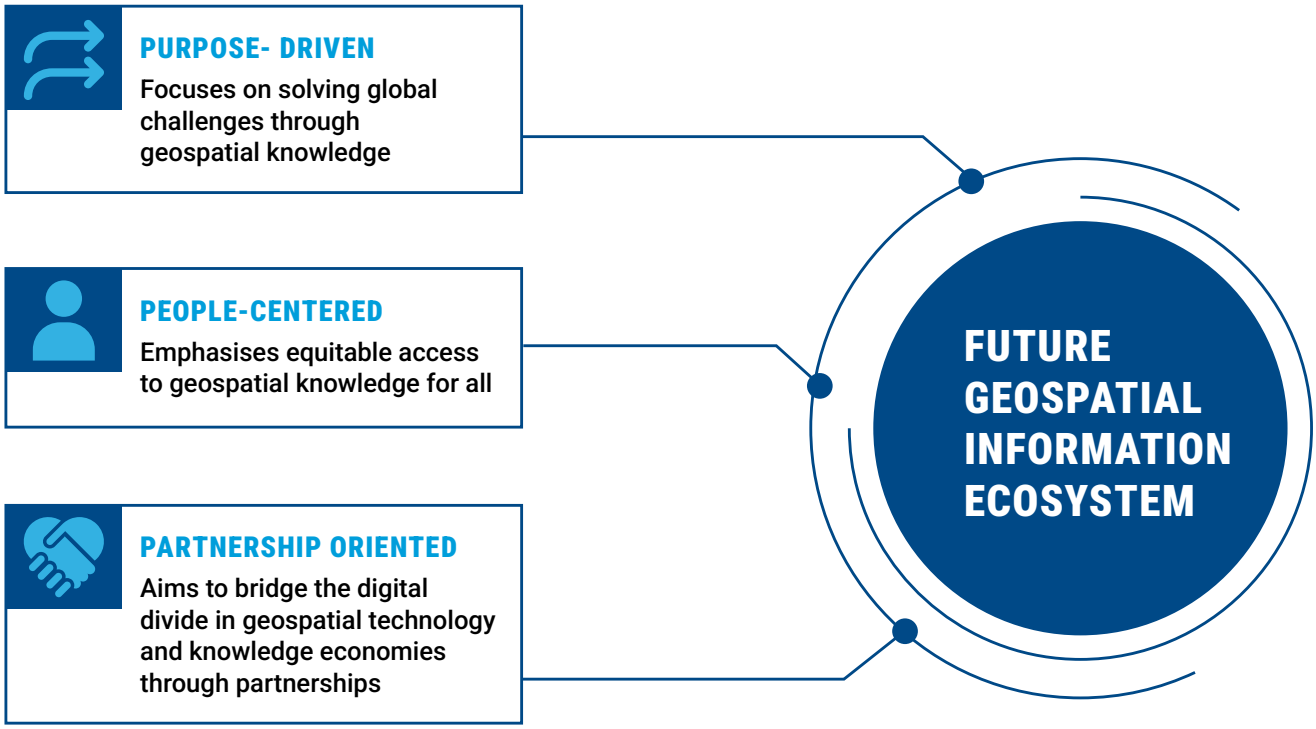

Figure 4: Future geospatial information ecosystem, Pillars of Change

Collectively, these strategic imperatives highlight the future geospatial information ecosystem needs to be adaptive, forward-looking and fundamentally inclusive, positioning geospatial information as a critical enabler of sustainable development, decision-making at all levels of societies, and digital cooperation in an increasingly complex world.

4.2 Pillars of Change

Building on these strategic imperatives, the future geospatial information ecosystem is driven by three fundamental pillars of change: **Purpose, People and Partnerships** (Figure 4). These pillars represent the core motivations driving the evolution of the future geospatial information ecosystem; the urgent need to solve global challenges, the imperative to ensure equitable access to knowledge, and the commitment to digital cooperation with a wide range of actors across countries and sectors, bridging the geospatial digital divide.

Together, they define the pathway toward an inclusive, resilient and knowledge-driven future geospatial information ecosystem, where technology acts as an enabler of collective progress rather than as an end in itself.

- **Purpose-driven | Solutions to Global Challenges:** The world stands at a critical juncture, facing the compounding impacts of climate change, political instability, economic disruptions, and the lingering effects of COVID-19. The 2024 Sustainable Development Goals (SDG) Report highlights an alarming stagnation in global progress, with only 17% of goals on track (UN, 2024). Accelerating progress toward the 2030 Agenda demands collective solutions, deeper collaboration across the digital and data community, and the integration of geospatially enabled knowledge to inform decision-making, resilience, and sustainable development.
- **People-centered | Equitable Access to Knowledge:** The expansion of the digital economy has improved access to data and information, enabling their reuse across multiple sectors to create insights and value. However, ensuring equitable access to geospatially

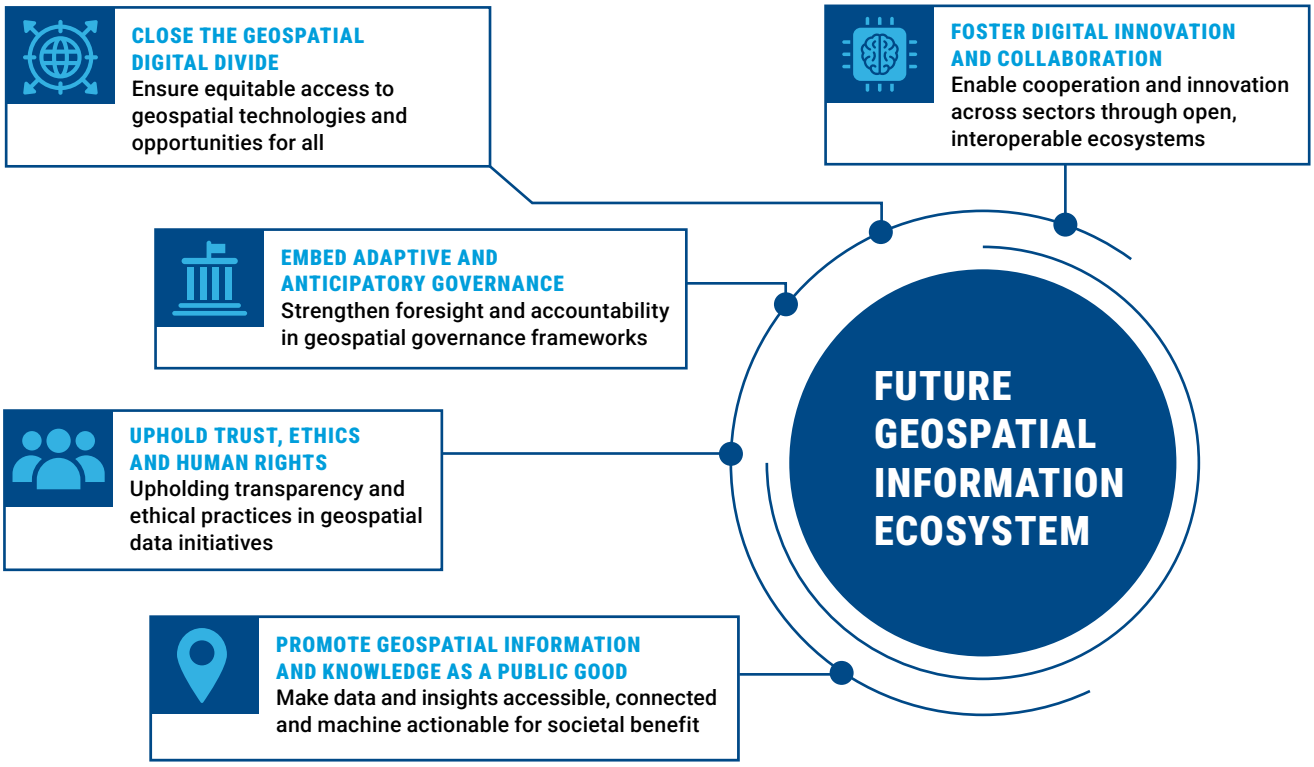

Figure 5: Goals towards the future geospatial information ecosystem

integrated knowledge remains essential. Unlocking the full value of geospatial information requires empowering individuals - including life-long learning/ training -, organizations, and governments with the ability to create, understand, and act upon data-driven insights, enhancing relevance across all domains of society and empowering individuals with actionable knowledge.

- **Partnership-oriented | Digital cooperation and bridging the divide:** The recognition of the critical role of partnerships is widely recognized, including in the 2030 Agenda for Sustainable Development. The future geospatial information ecosystem is in its nature recognizing the importance of interactions across sectors, actors and Member States for common action. It also recognizes the importance of cooperation for ensuring access to the benefits of geospatial technologies. Bridging this digital divide is central to leaving no one behind, ensuring that all Member States can fully participate in and benefit from the evolving geospatial information ecosystem.

5. Goals and principles

5.1 Goals towards the future geospatial Information ecosystem

GOAL 1 Promote Geospatial Information and knowledge as Public Good

GOAL 2 Foster Digital Cooperation and Innovation

GOAL 3 Bridge the Geospatial Digital Divide

GOAL 4 Embed Adaptive and Anticipatory Governance

GOAL 5 Uphold Trust, Human Rights, and Ethical Stewardship

5.2 Principles

A set of ten guiding principles underpin the desired future geospatial information ecosystem[2]. The principles provide a common reference point against which all decisions, initiatives and actions should be considered. Alignment with these principles ensures that the future geospatial information ecosystem will remain inclusive, sustainable, transformative, and fit-for-purpose. Actions that do not reflect or uphold these principles may risk undermining the broader vision and therefore should be reconsidered or adapted to maintain coherence, trust and long-term success.

The guiding principles are:

1. **Transformative:** Embrace innovation, emerging technologies, and the power of data to drive transformational change, strengthen geospatial capacities, and bridge the digital divide.
2. **Agile:** Adapt dynamically to technological advances, societal needs, and the evolving role of geospatial information within the wider digital ecosystem
3. **Interoperable:** Enable seamless data exchange and compatibility across systems, platforms, applications, and jurisdictions to foster collaboration and maximize the utility of geospatial information.
4. **Sustainable:** Develop practices, capacities and systems that ensure efficient resource investments and sustainable efficiency gains.
5. **Automated:** Leverage automation to enhance efficiency, accuracy, and scalability in geospatial information management.
6. **Inclusive:** Value and incorporate diverse perspectives, ensuring universal and equitable access to geospatial data, services, and knowledge that empower all communities.
7. **Reliable:** Promote authoritative sources and reliable data, services, metadata, knowledge, insights and foresight, and an open, safe and secure ecosystem for the public good.
8. **Ethical and rights-based:** Uphold transparency, accountability, human rights, and ethical stewardship in the generation, sharing and use of geospatial information.
9. **Collaborative:** Foster cooperation and partnerships across sectors and stakeholders, promoting a participatory, multi-stakeholder approach to the development and sharing of geospatial services and knowledge.
10. **Integrated:** Prioritize interconnectivity and integration across systems and ecosystems, weaving together services and capabilities for mutual benefit and shared value.

These principles provide a common foundation for Member States and stakeholders to shape the future geospatial information ecosystem in ways that are locally relevant, globally coherent and resilient to future disruptions.

6. Evolving Strategic Pathways

The transition to the future geospatial information ecosystem represents a significant evolution in how Member States govern, manage, and use geospatial information. This evolution builds on the foundational strength of the United Nations Integrated Geospatial Information Framework (UN-IGIF), which continues to serve as a robust guide for national geospatial development.

As digital transformation accelerates, the strategic pathways of the UN-IGIF remain relevant but must now be extended to reflect the realities of a dynamic, intelligent, and interconnected ecosystem. The future geospatial information ecosystem introduces future-focused perspectives - emphasizing real-time knowledge generation, semantic interoperability, automation, and ethical governance - that call for transformational shifts across all pathways. Through these proposed enhancements, investment in each pathway is future-proofed through the lens of the future geospatial information ecosystem to support the transition toward a dynamic knowledge-centric ecosystem. Through these proposed enhancements, investment in each pathway is also future-proofed to

2 The set of ten principles were originally presented at the fourteenth session of the Committee of Experts on Global Geospatial Information Management (E/C.20/2024/8/Add.1), the principle 'purpose-driven' was removed as an inherent core concept driving the future geospatial information ecosystem.

strengthen geospatial information management to serve as a critical enabler of broader strategic goals: sustainability, digital equity, resilience, and global cooperation.

To guide this transformation, a series of **step changes** are proposed for each pathway. These define the key shifts Member States could consider in modernizing their geospatial systems to align them with the demands of the wider and rapidly evolving digital ecosystem. The Step Changes emphasize anticipatory governance, inclusive innovation, ethical AI integration, and cross-sector collaboration - elements critical to realizing the future geospatial information ecosystem vision.

The following sections provide a deeper look at each of the nine strategic pathways; explaining their evolving role within the future geospatial information ecosystem and outlining the future-oriented Step Changes that will help unlock their full potential.

6.1 Governance and Institutions: Leading the Paradigm Shift

6.1.1 SHAPING FUTURE GOVERNANCE FOR A KNOWLEDGE-CENTRIC ECOSYSTEM

The transition to the future geospatial information ecosystem calls for a fundamental rethinking of how geospatial data and knowledge are governed. Traditional NSDI governance models - often centralized, hierarchical and government-led - are no longer sufficient in a globally interconnected and intelligent ecosystem. To be effective, governance must now evolve to become adaptive, anticipatory and inclusive.

Adaptive governance refers to the ability to adjust quickly to emerging technologies, data flows, risks, and opportunities. Anticipatory governance means institutions actively scan the horizon for what's next - integrating foresight, ethics and AI-readiness into strategic decision-making. Inclusive governance ensures that geospatial leadership reflects diverse stakeholders and perspectives - opening the system to broader societal participation and benefit.

In this context, governance is no longer a static administrative function; it becomes the backbone of a living ecosystem that must generate knowledge on demand, support global sustainability goals, and ensure that innovation serves the public good. Achieving this shift requires systemic changes in leadership behaviors, institutional mandates and governance structures - all grounded in collaboration, openness and strategic foresight.

6.1.2 EXPANDING THE GOVERNANCE MODEL

To lead this transformation, national geospatial governance arrangements need to be expanded. This can be achieved by:

- Linking national strategies with global governance frameworks that promote universal ethical data practices, cross-border knowledge exchange, and shared stewardship of the digital commons.
- Building inclusive, non-hierarchical, multi-actor governance structures that integrate the private sector, academia, Indigenous communities and civil society into strategic decision-making.
- Embedding governance mechanisms across all levels - local, regional, national and global, to support cross-sector dialogue, knowledge creation and digital cooperation.
- Moving from data governance to knowledge governance, where the focus shifts from providing access to data to providing equitable, affordable access to actionable insights.

This reimagined governance model must also account for the rise of intelligent, machine-actionable systems. Governments must be ready to oversee, audit and guide the ethical use of AI, ensuring that these technologies are transparent, explainable and aligned with human rights and societal values.

6.1.3 GOVERNANCE AS A BRIDGE BETWEEN LOCAL REALITIES AND GLOBAL PRIORITIES

To function effectively, the future geospatial information ecosystem will require governance that connects national needs with global coordination mechanisms. A shared Global Geospatial Knowledge Governance Framework, co-developed and endorsed by Member States, would be essential. A Global Geospatial Knowledge Governance Framework would provide:

- Common principles for open, inclusive, and ethical data and knowledge management,
- Guidelines for the equitable design and use of algorithmic and AI systems,
- Structures for transnational collaboration on geospatial strategies, and
- Mechanisms to reduce the digital divide and democratize knowledge access.

Without such global alignment, disparities in geospatial capacity will persist, widening the digital divide and limiting the ability of developing nations to participate fully in the data economy.

6.1.4 STEP CHANGE: GOVERNANCE AND INSTITUTIONS

CURRENT FOCUS

Strengthening leadership, legal mandates and institutional frameworks for geospatial information management.

FUTURE STATE

Agile, inclusive and anticipatory governance frameworks aligned with national and global digital ecosystems.

6.1.5 STRATEGIC SHIFTS REQUIRED

To support the evolution of governance in the future geospatial information ecosystem, several transformative shifts are needed to move beyond 'data-centric' governance models to 'knowledge-centric' models of stewardship (Figure 6).

- **From Static Structures *to* Adaptive Ecosystems:** Evolve governance models to be flexible, responsive, and capable of continuous adaptation to emerging technologies, societal needs, and digital developments.
- **From Siloed SDI Mandates *to* Integrated Digital Governance:** Broaden the scope of geospatial governance to intersect with AI, cybersecurity, open data, and digital economy domains.
- **From Top-Down Models *to* Multi-Stakeholder Collaboration:** Establish inclusive governance that engages civil society, Indigenous communities, academia, private sector, and citizen voices in strategic decision-making.
- **From Risk Management *to* Anticipatory Governance:** Embed foresight, scenario planning, and AI-readiness into institutional processes to proactively identify and respond to future challenges.
- **From Access to Data *to* Equitable Access to Knowledge:** Shift the value proposition from simply sharing data to delivering meaningful, affordable, and machine-actionable insights that empower all communities.
- **From National Isolation *to* Global Alignment:** Link national governance arrangements with global frameworks, including the Global Digital Compact, to ensure consistency, cooperation and shared stewardship of the digital commons.

CHARACTERISTIC	DATA-CENTRIC GOVERNANCE	KNOWLEDGE-CENTRIC GOVERNANCE
STRUCTURE	Static Structures	Adaptive Ecosystems
MANDATES	Siloed SDI Mandates	Integrated Digital Governance
MODEL	Top-Down Models	Multistakeholder Collaboration
FOCUS	Risk Management	Anticipatory Governance
VALUE	Access to Data	Equitable Access to Knowledge
ALIGNMENT	National Isolation	Global Alignment

Figure 6: Evolving Governance Structures

EXAMPLE ACTION:

One way to operationalize these shifts is to develop a **National Geospatial Governance Strategy** that fully integrates the future geospatial information ecosystem principles. This strategy would reframe governance from a focus on data administration to knowledge stewardship and ethical innovation. This could include the establishment of a high-level, cross-sector Geospatial Futures Council to lead and coordinate national geospatial efforts across government, private sector, academia and civil society. The council would ensure alignment with broader digital transformation agendas, embed global ethical frameworks and promote participatory governance. Key components would include mechanisms for algorithmic transparency, proactive stakeholder engagement, and targeted investment in institutional capacity to support adaptive, anticipatory and inclusive governance.

6.2 Policy and Legal Frameworks: Enabling Rights-based Innovation and Trust

6.2.1 RETHINKING LEGAL FRAMEWORKS FOR THE FUTURE GEOSPATIAL INFORMATION ECOSYSTEM

The rapid evolution of digital technologies, artificial intelligence and globally interconnected data ecosystems has outpaced many existing geospatial policies and legal instruments. Traditional legal and policy structures risk becoming constraints unless they are designed to adapt and evolve.

Within the future geospatial information ecosystem, policies and legal frameworks must move beyond supporting just data access and sharing. They must safeguard rights, enable trust, and govern the ethical integration of geospatial information into a wide range of intelligent automated systems.

In the future ecosystem, policies and laws are not just compliance mechanisms - they are enablers of equity, innovation and public good. Policy and legal frameworks must address how data is generated, linked and used across platforms and jurisdictions to ensure transparency, accountability and legal interoperability at every stage. This requires a shift toward adaptive, rights-based, and anticipatory policy and legal environments that uphold human rights law[3], support innovation, and remain agile in the face of accelerating technological change.

6.2.2 POLICY EVOLUTION FOR A KNOWLEDGE-CENTRIC ECOSYSTEM

Current policy and legal arrangements often reflect the needs of static SDIs - governing custodianship, standards, access and use of official datasets. While these remain important, the future geospatial information ecosystem requires a broader legal lens; one that addresses algorithmic processing, AI governance, platform accountability and knowledge generation.

To support the future geospatial information ecosystem, policy and legal environments must:

- Be principles-based, enabling flexibility and responsiveness across technologies, use cases and communities.
- Promote machine-actionable, cross-border data interoperability, including legal frameworks for data portability and trusted exchange.
- Ensure open data practices are paired with rights-based safeguards, including privacy, consent and transparency.
- Embed accountability and explainability into the design and operation of geospatial AI systems and knowledge services.
- Provide legal support for decentralized, federated and public-private models of geospatial data governance.

As the geospatial domain becomes more tightly coupled with national digital transformation agendas, legal frameworks must also integrate with broader laws on cybersecurity, digital identity, competition, consumer protection, data licensing and digital public infrastructure.

6.2.3 POLICY AND LEGAL AS FOUNDATIONS FOR DIGITAL TRUST AND EQUITY

Trust in the future geospatial information ecosystem will not be achieved through technical measures alone. It must be underpinned by clear, enforceable policies and laws that reflect ethical obligations, societal values, and the rights of individuals and communities. This includes:

- Legal protections against surveillance, misuse, or discriminatory application of location-based services and AI-driven spatial analytics.
- Mechanisms to recognize and protect Indigenous data rights, community-level data governance, and culturally appropriate knowledge practices.
- Legal clarity on accountability for AI-generated insights used in public policy, planning, disaster response and service delivery.

3 The **Global Digital Compact** is firmly anchored in international human rights law, emphasizing that the same rights individuals enjoy offline must also be protected online. This includes freedoms such as expression, privacy, and protection from discrimination. The Compact commits governments to uphold these rights in digital spaces, ensuring that digital technologies are developed and used in ways that respect human dignity and promote equity, and address challenges such as misinformation, digital surveillance, and algorithmic biases.

Such frameworks are essential to build the public confidence needed to foster digital inclusion and to ensure the future geospatial information ecosystem supports human-centered, equitable innovation.

6.2.4 STEP CHANGE: POLICY AND LEGAL

CURRENT FOCUS

Traditional regulatory approaches focused on data access, custodianship, access and use within national jurisdictions.

FUTURE STATE

Agile, rights-based legal ecosystems that support responsible data innovation, algorithmic transparency, and cross-border coordination in a knowledge-centric environment.

6.2.5 STRATEGIC SHIFTS REQUIRED

To support this transition, policy and legal frameworks must undergo strategic shifts that reflect the complexity and pace of change in the future geospatial information ecosystem - replacing static, technology-specific regulations with dynamic, rights-based approaches that foster trust, inclusion and innovation (Figure 7).

- **From Static Regulatory Models *to* Adaptive, Principles-Based Frameworks:** Laws and policies should be flexible, enabling long-term relevance in a fast-evolving digital landscape.
- **From Data Control *to* Enabling Responsible Innovation:** Legal instruments must protect rights while allowing the ethical use and reuse of data and technologies.
- **From National Silos *to* Globally Coordinated Frameworks:** Legal and policy cooperation across jurisdictions will be essential as data flows become increasingly transnational.
- **From Risk Containment *to* Anticipatory Risk Governance:** Frameworks should proactively address future risks related to AI, privacy, and data misuse through foresight and agile response mechanisms.
- **From Custodianship *to* Knowledge Stewardship:** Shift from regulating data ownership to enabling equitable access, transparent use, and the ethical governance of knowledge systems, including AI and automated decision-making.

SHIFT	FROM	TO
REGULATORY MODELS	Static Regulatory Models	Adaptive, Principle-based Frameworks
DATA HANDLING	Data Control	Enabling Responsible Innovation
SCOPE	National Silos	Globally Coordinated Frameworks
RISK MANAGEMENT	Risk Containment	Anticipatory Risk Governance
DATA MANAGEMENT	Custodianship	Knowledge Stewardship

Figure 7: Evolving Policy and Legal Frameworks

EXAMPLE ACTION:

A practical step forward is to develop a **National Geospatial Policy and Legal Reform Roadmap** aligned with future geospatial information ecosystem principles. This roadmap would begin with a comprehensive audit of existing geospatial and digital legislation to identify gaps in areas such as AI governance, data ethics, privacy, block chain, and cross-border interoperability. It would then outline a staged approach to reform, incorporating principles-based legal drafting, multi-stakeholder consultations, and the use of regulatory sandboxes to safely test innovative models. The roadmap would be designed to align with international frameworks such as the UN Global Digital Compact, ensuring both national relevance and global coherence in the evolving legal landscape.

6.3 Financial: Innovating for Sustainable and Equitable Investment

6.3.1 RETHINKING FINANCE IN A KNOWLEDGE-CENTERED ECOSYSTEM

The transition to the future geospatial information ecosystem is not just a technical or governance challenge; it is fundamentally a financial one. As the ecosystem becomes more intelligent, responsive and knowledge-centric, it demands sustainable, long-term financing strategies that go beyond traditional funding mechanisms.

Conventional approaches, such as intermittent public budgets or donor-funded projects, are often too fragmented and short-lived to support the continuous innovation, integration and scaling that the future geospatial information ecosystem requires. Instead, a new financial architecture is needed; one that supports not only SDIs and geospatial data creation, but also the applications, algorithms, platforms and governance that turn data into actionable insight.

This evolution calls for financing models inspired by the digital economy, where value is increasingly created through services, insights and user experiences. In the future geospatial information ecosystem, the value proposition shifts toward applications that analyze and interpret geospatial data to generate real-time knowledge, such as systems that answer questions automatically, provide situational intelligence, or support predictive policymaking. These tools are monetized, not by the sale of raw data, but through micro-payments for insight delivery, enabled by a transparent, safe and efficient digital marketplace.

6.3.2 UNLOCKING NEW FINANCING MODELS FOR THE FUTURE GEOSPATIAL INFORMATION ECOSYSTEM

To unlock this future, financing must be reimagined across several dimensions by:

- Prioritizing investment in AI capabilities, semantic technologies, and data integration layers that enable intelligent applications to transform geospatial data into actionable knowledge.
- Moving beyond static and episodic funding cycles toward dynamic financing models that support continuous innovation, ethical data use, real-time system maintenance, and integration into decision-making.
- Facilitating fair and transparent financial participation across the ecosystem, using blockchain technologies, token-based incentive systems, and smart contracts to support trust and reward contributions.

For example, a token-based ecosystem could compensate authoritative data contributors, such as mapping agencies, Indigenous groups or scientific institutions, each time their data is used in a knowledge-generating application. This could be as simple as a small fee per query, or insight generated, enabling a low-cost but sustainable flow of funds. Users benefit from low-barrier access to rich data and answers, while contributors receive ongoing value for their investment in data stewardship.

In this model, data is open, but not necessarily free. Access is affordable and inclusive, but accompanied by mechanisms for fair compensation, digital rights management, and data provenance tracking. Smart contracts and decentralized identifiers enable transparency, protect contributors and facilitate trusted interactions among all parties.

These micro-transactions, facilitated via blockchain, create a token economy that incentivizes quality, encourages reuse, and promotes innovation in applications that serve both commercial and public-good purposes. They enable a future where semantic web technologies automatically connect users to relevant datasets, and where multimodal applications generate machine-readable insights on demand, integrating sensor data, maps, models and AI algorithms into cohesive services.

6.3.3 BUILDING A CASE FOR INVESTMENT

To mobilize sustained financing for the future geospatial information ecosystem, the value of geospatial information must be communicated in terms that resonate with both public and private investors. This includes:

- Demonstrating cost savings in infrastructure planning, disaster response and public service delivery.

- Highlighting the role of geospatial insights in national digital transformation strategies and sectoral goals (e.g. agriculture, health and energy).
- Articulating how investment in data-driven decision-making can accelerate progress toward the SDGs.
- Emphasizing the broader returns of knowledge creation (social equity, climate resilience, public trust) beyond purely economic metrics.

Crucially, the investment case must also address governance and capacity-building. The long-term success of the future geospatial information ecosystem depends on a well-managed, inclusive system that ensures accountability, algorithmic transparency and equitable access to geospatial skills and knowledge.

6.3.4 STEP CHANGE: FINANCIAL

CURRENT FOCUS

Project-based or infrastructure-centric funding with limited long-term sustainability or innovation incentives.

FUTURE STATE

Adaptive, inclusive and innovation-focused financial ecosystems that leverage emerging technologies and enable equitable participation in the knowledge economy.

6.3.5 STRATEGIC SHIFTS REQUIRED

To support the transformation toward a financially resilient future geospatial information ecosystem, several paradigm shifts are required (Figure 8):

- **From Infrastructure Grants *to* Ecosystem Investment:** Support not only data infrastructure, but also applications, governance and knowledge services.
- **From Central Budgets *to* Blended Finance:** Mix public funds with private investment, development finance and digital philanthropy.
- **From Cost Centers *to* Value Platforms:** Position geospatial systems as service layers that generate economic, social and environmental returns.
- **From Passive Spending *to* Incentive-Based Models:** Introduce rewards for data sharing, innovation, and ethical AI integration via token or credit systems.
- **From National Focus *to* Global Integration:** Align with regional digital commons strategies, climate funds and multilateral investment platforms.
- **From Free Data Access *to* Fair and Transparent Pricing:** Use digital rights management, micro-payments, and smart contracts to ensure equitable, safe and sustainable access.

CHARACTERISTIC	OLD PARADIGM	NEW PARADIGM
FUNDING FOCUS	Infrastructure Grants	Ecosystem Investment
FUNDING SOURCE	Central Budgets	Blended Finance
SYSTEM ROLE	Cost Centers	Value Platforms
SPENDING TYPE	Passive Spending	Incentive-Based Models
SCOPE	National Focus	Fair and Transparent Pricing

Figure 8: Evolving Financial Ecosystem

EXAMPLE ACTION:

A practical starting point is the creation of a **National Geospatial Investment Strategy** aligned with future geospatial information ecosystem principles. This strategy should identify and map diverse funding streams, including national digital transformation budgets, tax incentives, climate adaptation funds, and international development finance; and define mechanisms for blending public, private and philanthropic capital. It should propose innovative instruments such as data cooperatives, impact bonds, and tokenized incentive systems that reward data sharing, insight generation and inclusive participation. The strategy must also consider the legal and institutional frameworks needed to support blockchain-based micro-payments, digital rights management, and cross-border value exchange. Importantly, it should prioritize investment in knowledge infrastructure, including AI tools, semantic integration layers, and public-good applications to ensure long-term value, equitable access and financial sustainability.

6.4 Data: Building a Foundation for Knowledge

6.4.1 REFRAMING DATA FOR THE FUTURE GEOSPATIAL INFORMATION ECOSYSTEM

In the future geospatial information ecosystem, data is no longer just a static product, it is a living asset - continuously evolving, interpreted and reused to generate real-time knowledge. Good data leads to good decisions. As the geospatial landscape becomes increasingly automated and interconnected, data must be machine-readable, ethically governed, and enriched with metadata, ontologies and standards that make it discoverable, understandable and interoperable across platforms and systems.

The future geospatial information ecosystem will depend on data that is both FAIR (Findable, Accessible, Interoperable, Reusable) and CARE (Collective Benefit, Authority to Control, Responsibility, and Ethics). These principles ensure that data serves not only technical needs but also societal values, supporting inclusive development, knowledge equity and digital trust.

6.4.2 ENHANCING DATA QUALITY, INTELLIGENCE, AND INTEROPERABILITY

Data quality remains foundational to the future geospatial information ecosystem. Without accurate, timely and consistent data, intelligent systems cannot deliver trusted insights. Artificial intelligence and machine learning offer new methods for improving data quality by detecting anomalies, filling gaps and automating validation processes. However, high-quality data must also be contextually intelligent. This is achieved through ontologies, which are formal data models that define and link concepts across domains, enabling machines to reason with data, generate new knowledge and respond to complex queries.

Bias is another critical concern. In the future geospatial information ecosystem, datasets must be assessed and refined to minimize algorithmic and structural bias. Techniques such as bias audits, training data diversification, and explainable AI will become essential tools for ensuring equitable knowledge generation.

To support this, data governance must evolve to ensure that geospatial data is:

- Structured for machine-actionability and real-time analysis.
- Enriched with semantic metadata and linked data models.
- Subject to continuous quality assessment.
- Free from harmful or exclusionary biases that distort insights.

6.4.3 FROM DATA TO KNOWLEDGE: ENABLING INTELLIGENT USE

As the future geospatial information ecosystem matures, value will increasingly come not from the data itself but from the ability to turn data into meaningful knowledge. Applications and platforms will be expected to answer complex spatial questions in natural language, generate predictions, and support high-stakes decision-making. This shift requires geospatial data to be:

- Linked across domains using shared ontologies.
- Discoverable and usable by both humans and machines.
- Governed through ethical standards that ensure transparency, accountability and inclusion.

Investing in the data infrastructure also means investing in the governance, stewardship and semantic modelling[4] needed to transform raw data into reliable, reusable knowledge.

4 Semantic modelling, also referred to as ontological design, refers to the structuring of data concepts and relationships.

6.4.4 STEP CHANGE: DATA

CURRENT FOCUS

Improving access to fundamental datasets and strengthening data quality and management practices.

FUTURE STATE

Dynamic, ethical, real-time and semantically integrated data ecosystems that underpin inclusive knowledge creation and AI-powered decision-making.

6.4.5 STRATEGIC SHIFTS REQUIRED

To support this transformation, data systems must undergo strategic shifts that prepare them for intelligent use and equitable reuse in the future geospatial information ecosystem (Figure 9):

- **From Static Data Holdings *to* Real-Time, Context-Aware Data Flows:** Enable dynamic and responsive data integration across sectors.
- **From Siloed Datasets *to* Linked and Interoperable Knowledge Graphs:** Use shared ontologies to connect data and generate meaning.
- **From Open Access Alone *to* FAIR and CARE Data Stewardship:** Govern data according to principles that respect both technical utility and social values.
- **From Manual Quality Assurance (QA) *to* AI-Assisted Data Quality Improvement:** Apply intelligent tools to improve completeness, accuracy and timeliness.
- **From Metadata Description *to* Semantic Integration:** Structure metadata in a way that enables machine reasoning and predictive analytics.
- **From Human-Only Interpretation *to* Hybrid Human-Machine Insight:** Design data ecosystems that support both expert and AI-driven knowledge production.

CHARACTERISTIC	FROM	TO
DATA STATE	Static Data Holdings	Real-Time, Context Aware Data Flows
DATA STRUCTURE	Siloed Datasets	Linked and Interoperable Knowledge Graphs
DATA GOVERNANCE	Open Access Alone	FAIR and CARE Data Stewardship
QUALITY ASSURANCE	Manual QA	AI-Assisted Data Quality Improvement
METADATA	Metadata Description	Semantic Integration
DATA INTERPRETATION	Human-Only Interpretation	Hybrid Human-Machine Insight

Figure 9: Evolving Data Ecosystem

EXAMPLE ACTION:

Launch a **National Data Enrichment and Trust Program** that applies AI and machine learning to improve the quality, interoperability and semantic structure of national geospatial datasets. This program would implement standard ontologies, link datasets across domains, and support the use of FAIR and CARE principles. It would also include a national framework for bias detection and mitigation, ensuring equitable data practices and enabling the development of intelligent applications that transform raw data into actionable insights for all.

6.5 Innovation: Driving Transformational Knowledge-Enabled Technologies

6.5.1 REFRAMING INNOVATION IN THE GEOSPATIAL KNOWLEDGE ERA

Innovation in the future geospatial information ecosystem is not simply about technology; it is about using that technology to democratize knowledge. For governments, this means supporting innovation that improves the quality of data, enables intelligent systems, and delivers insights to all, including those with limited resources or technical literacy.

In the future geospatial information ecosystem, innovation must be people-focused. It must support the co-creation of applications that interpret and transform geospatial data into real-time context-aware knowledge services. These services must be accessible to the public through low-cost devices and intuitive interfaces, empowering everyone to make informed decisions, not just data experts.

Governments have a vital role to play in creating the conditions for innovation to thrive by removing barriers, enabling partnerships and investing in digital transformation that serves public good.

6.5.2 FOSTERING INNOVATION ECOSYSTEMS FOR PUBLIC INSIGHT

To meet the needs of a diverse society, the innovation agenda must prioritize:

- Support for tools that generate insight from data, using AI and geospatial reasoning to answer everyday questions.
- Designing applications that deliver geospatial knowledge in natural language, visualizations and other accessible formats for non-specialists.
- Engage startups, academia and industry in public-private innovation labs to develop and test scalable solutions.
- Promote low-cost platforms and open-source software that allow public servants and citizens alike to use geospatial insights for local decision-making.

By linking innovation with service delivery, governments enable geospatial knowledge to become a daily utility - powering public safety, climate resilience, health, mobility, education and more.

6.5.3 INNOVATION GOVERNANCE AND SUPPORT MECHANISMS

To participate in the future geospatial information ecosystem, governments should embed innovation into national digital and development agendas by:

- Creating innovation hubs and accelerators dedicated to geospatial AI and application development.
- Supporting experimentation through regulatory sandboxes that allow for agile development and testing of new tools.
- Developing procurement frameworks that reward innovation and co-design with user communities.
- Aligning innovation programs with data quality strategies, ensuring that trusted, machine-readable data fuels intelligent services.

Critically, innovation should also focus on reducing the skills gap through education, digital literacy and capacity-building programs that empower users to participate in and benefit from the future geospatial information ecosystem.

6.5.4 STEP CHANGE: INNOVATION

CURRENT FOCUS

Innovation is project-based, often technology-first, and limited to professional or institutional users.

FUTURE STATE

Innovation ecosystems are user-driven, co-designed and widely accessible - delivering public insight from geospatial data to all citizens, via intelligent low-cost applications.

SHIFT	FROM	TO
FOCUS	Technical Innovation Alone	Societal Value Creation
APPROACH	Pilot Projects	Sustainable Innovation Programs
COLLABORATION	Government-Centric	Multi-Sector Innovation Ecosystems
DESIGN	Specialist Tools	User-Centric Knowledge Applications
SCOPE	Limited Reach	Innovation for All

Figure 10: Innovation Evolution

EXAMPLE ACTION:

Establish a **Geospatial Innovation Fund** that supports co-designed applications delivering geospatial insights for public use. This fund would provide seed grants to partnerships between government, startups and universities to develop tools that answer real-world questions using open data and AI. Applications would be designed to operate on low-cost devices and support natural language interaction, enabling access to geospatial knowledge for citizens, communities and decision-makers alike.

6.5.5 STRATEGIC SHIFTS REQUIRED

Realizing the full potential of innovation within the future geospatial information ecosystem requires a transition from conventional practices toward inclusive, purpose-driven, and user-oriented approaches (Figure 10):

- **From Technical Innovation Alone *to* Societal Value Creation:** Ensure innovations address real-world public needs and equity challenges.
- **From Pilot Projects *to* Sustainable Innovation Programs:** Move beyond proof-of-concept toward scalable, supported innovation pathways.
- **From Government-Centric *to* Multi-Sector Innovation Ecosystems:** Engage communities, academia, and private sector in collaborative knowledge creation.
- **From Specialist Tools *to* User-Centric Knowledge Applications:** Prioritize intuitive, multilingual, and multimodal applications for broad accessibility.
- **From Limited Reach *to* Innovation for All:** Design innovation strategies that explicitly serve marginalized and digitally underserved populations.

6.6 Standards: Enabling Seamless Interoperability

6.6.1 REIMAGINING STANDARDS FOR A KNOWLEDGE-CENTRIC ECOSYSTEM

In the future geospatial information ecosystem, standards are more than just technical protocols, they are enablers of meaningful connection across data, systems and actors. As data becomes more dynamic and applications rely increasingly on semantic reasoning, artificial intelligence and machine-to-machine communication, standards must evolve to ensure that geospatial knowledge flows are seamless, ethical and interoperable.

Standards will need to extend beyond data formats and schemas to include semantic data models, ontologies, algorithmic validation criteria, and machine-actionable metadata. These elements enable automated systems to understand, reason with, and responsibly use geospatial information in real time.

Equally important is the development of mechanisms to assess the *validity* of answers generated by intelligent systems. At present, there is no standardized way to evaluate or rank the quality of output derived from queries. The future geospatial information ecosystem must support the creation of validation frameworks that assess whether authoritative, high-quality and ethically sourced data was used to produce a result. Standards must therefore support not just interoperability but verified knowledge integrity that provides the means to score or flag outputs based on the trustworthiness and authenticity of the data sources underpinning them.

6.6.2 BUILDING TRUST AND INTEROPERABILITY THROUGH STANDARDS

Standards are foundational to building trust in the future geospatial information ecosystem. They ensure that data and knowledge are findable, shareable and usable across jurisdictions and technologies. Future standards must:

- Support ontology-based, machine-readable data structures.
- Enable cross-domain and cross-platform interoperability of knowledge - not just data.
- Embed ethical considerations and algorithmic transparency into design.
- Be developed collaboratively across public, private and civil society actors.

To be effective, standard-setting processes must be inclusive and agile, adapting to new technologies and societal expectations while remaining rooted in public value and international coherence.

6.6.3 FUTURE-PROOFING STANDARDS FOR THE FUTURE GEOSPATIAL INFORMATION ECOSYSTEM

Standards will also safeguard against the risks posed by automated systems by ensuring explainability, fairness and accountability in AI-generated insights. This includes:

- Protocols for validating real-time data and automated outputs.
- Requirements for semantic alignment across domains (e.g., land, environment, health).
- Ethical guardrails for the design and use of intelligent systems leveraging geospatial data.
- By embedding these principles, standards will enable the responsible scaling of the future geospatial information ecosystem.

6.6.4 STEP CHANGE: STANDARDS

CURRENT FOCUS

Traditional focus on data formats, schemas and technical interoperability.

FUTURE STATE

Standards that are open, semantic, machine-actionable and ethically grounded to support cross-sector knowledge integration and trusted automation.

6.6.5 STRATEGIC SHIFTS REQUIRED

To support innovation and equity through standards, several transformative shifts are needed (Figure 11):

- **From Static Specifications *to* Evolving, User-Centric Standards:** Develop standards that are iterative and responsive to changing technology and user needs.
- **From Structural Uniformity *to* Semantic Enablement:** Move beyond structural harmonization to support meaning-rich, ontology-driven standards that enable automated linking and reasoning across domains.
- **From Technical Focus *to* Ethical Integration:** Incorporate values like fairness, transparency, and accountability into every layer of standard design.
- **From Exclusive Design *to* Collaborative Stewardship:** Engage broader communities including industry, academia and Indigenous voices, in standards development.
- **From Basic Interoperability *to* Verified Knowledge Integrity:** Advance from simple data compatibility to enabling systems that can assess and prioritize outputs based on data provenance, quality, and authority so that trusted sources influence decisions and automated responses.

6.7 Partnerships: Catalyzing Collective Action

6.7.1 REFRAMING PARTNERSHIPS FOR THE FUTURE GEOSPATIAL INFORMATION ECOSYSTEM

In the future geospatial information ecosystem, partnerships are no longer limited to traditional institutional collaborations; rather they form the connective tissue of a thriving knowledge-centered ecosystem. As the demand for real-time insights, inclusive services and AI-powered applications grows, partnerships will be essential to transform raw data into usable, trustworthy knowledge accessible to all.

This future depends on diverse actors (governments, private sector, academia, Indigenous communities and civil society) working in concert to co-create geospatial applications, deliver public value, and foster innovation. Public-private collaboration will be particularly important in developing intuitive, low-cost knowledge services for non-technical users, making geospatial intelligence accessible through Apps, voice assistants and community dashboards.

Partnerships in the future geospatial information ecosystem are not transactional; they are long-term relationships that distribute responsibilities, share risks and benefits, and align common values such as ethics, equity, sustainability, and innovation. They help scale up promising ideas, amplify local knowledge, and ensure that the benefits of geospatial intelligence reach everyone, especially those in underserved communities.

6.7.2 EVOLVING THE PARTNERSHIP MODEL

To unlock the full potential of partnerships, collaboration models must expand and mature. This can be achieved by:

- Connecting geospatial capabilities with broader sectoral priorities, such as health, agriculture, climate action and urban planning to support integrated cross-sectoral innovation.
- Creating public-private innovation platforms where startups, research institutions and government agencies co-develop geospatial tools and services.

SHIFT	FROM	TO
NATURE	Static Specifications	Evolving, User-Centric
FOCUS	Structural Uniformity	Semantic Enablement
VALUES	Technical Focus	Ethical Integration
DEVELOPMENT	Exclusive Design	Collaborative Stewardship
OUTCOME	Basic Interoperability	Verified Knowledge Integrity

Figure 11: Evolving Standards Environment

EXAMPLE ACTION:

Collaborate with the international standards community (e.g., ISO/TC 211, OGC, W3C, IHO) to develop a **Framework for future geospatial information ecosystem Standards**. This framework would support the integration of machine-readable data models, linked data principles, and algorithmic validation protocols into mainstream geospatial standards. It would also promote alignment with FAIR and CARE principles, guide the responsible design of AI-enabled systems, and provide pathways for inclusive co-development with underrepresented groups and emerging economies.

- Encouraging the development of applications that go beyond data access to deliver machine-readable insights, situational awareness and predictive intelligence in formats tailored for public consumption.
- Fostering alliances that support digital inclusion, enabling communities and local governments to participate meaningfully in knowledge creation and use.
- Promoting shared responsibility in governance, intellectual property and data stewardship to ensure accountability and mutual benefit.

6.7.3 PARTNERSHIPS AS VEHICLES FOR IMPACT AND INNOVATION

Partnerships in the future geospatial information ecosystem are also instrumental in advancing ethical, sustainable digital transformation. They provide a means to:

- Co-create intelligent geospatial applications using multimodal technologies such as voice, AI, and mobile tools.
- Pilot new approaches to algorithmic transparency, consent-based data sharing, and rights-based innovation.
- Develop interoperable platforms that integrate public and private data while respecting privacy, attribution and benefit-sharing principles.
- Support federated and distributed data governance models that balance local control with global interoperability.
- Scale innovations beyond pilots through shared funding, shared infrastructure and shared value creation.

For instance, a 'geospatial innovation challenge' led by a government agency in partnership with local tech hubs and civil society could generate a suite of mobile apps for disaster risk reduction, each drawing from authoritative datasets and compensating contributors through a transparent token-based model.

6.7.4 STEP CHANGE: PARTNERSHIPS

CURRENT FOCUS

Partnerships primarily focused on national SDIs and institutional coordination within government.

FUTURE STATE

Inclusive, cross-sector and innovation-driven partnerships that power equitable knowledge creation and intelligent public services.

6.7.5 STRATEGIC SHIFTS REQUIRED

To support the evolution of partnerships in the future geospatial information ecosystem, several shifts are needed to build a more collaborative and impactful geospatial ecosystem (Figure 12):

- **From Sector-Specific Agreements *to* Integrated Innovation Networks:** Build alliances that cut across disciplines and sectors to co-design scalable, geospatially enabled solutions.
- **From Government-Centric Models *to* Public-Private Co-Creation:** Enable startups, academia and communities to shape and deliver knowledge applications together with public institutions.
- **From Data Sharing *to* Knowledge Partnerships:** Shift focus from access agreements to the co-development of tools and services that translate data into insight.
- **From Time-Bound Projects *to* Enduring, Value-Aligned Relationships:** Foster partnerships that grow over time, based on shared missions and co-investment in outcomes.
- **From One-Way Engagement *to* Participatory Design and Delivery:** Engage underrepresented voices in all stages of innovation, from ideation to implementation, to enable relevance and trust.

CHARACTERISTIC	OLD WAY	NEW WAY
FOCUS	Sector-Specific Agreements	Integrated Innovation Networks
MODEL	Government-Centric	Public-Private Co-Creation
GOAL	Data Sharing	Knowledge Partnerships
RELATIONSHIP	Time-Bound Projects	Enduring, Value-Aligned Relationship
ENGAGEMENT	One-Way	Participatory Design and Delivery

Figure 12: Evolution of Partnerships

EXAMPLE ACTION:

A practical action would be to launch a **National Geospatial Innovation Partnership Platform** aligned with future geospatial information ecosystem principles. This platform would connect public institutions, startups, universities and civil society to co-create applications that turn geospatial data into user-friendly knowledge tools. It could offer small innovation grants, shared testing environments and open innovation challenges -focused on solving real-world problems in health, agriculture, disaster preparedness and digital inclusion. Crucially, it would embed benefit-sharing models, ethical licensing and data provenance tracking to support fair, scalable, and sustainable collaboration.

6.8 Capacity and Education: Empowering the Future Workforce

6.8.1 REFRAMING CAPACITY DEVELOPMENT FOR THE FUTURE GEOSPATIAL INFORMATION ECOSYSTEM

The evolution to the future geospatial information ecosystem introduces a new learning imperative. It is no longer sufficient to train individuals solely in traditional geospatial skills such as cartography, GIS operations or remote sensing. In the future geospatial information ecosystem, capacity development must expand to include data science, AI, machine learning, blockchain, knowledge engineering and semantic technologies - fields that are increasingly intertwined with geospatial practice.

The ability to govern, interpret and innovate with geospatial data now depends on multidisciplinary fluency. Professionals must understand not only how to create and manage data, but also how to use algorithms to derive insight, how to assess AI outputs for fairness and transparency, and how to work across domains with health, agriculture, climate and finance experts.

Equally important is the empowerment of citizens, communities and decision-makers. In the future geospatial information ecosystem, education must democratize access to knowledge - not just tools - enabling users at all levels to interact with intuitive applications, ask complex geospatial questions in natural language, and critically evaluate the trustworthiness of geospatial outputs.

6.8.2 BROADENING THE SCOPE OF SKILLS AND LEARNING MODELS

To meet the demands of a knowledge-centric ecosystem, capacity building must be reimagined along several dimensions:

- Embed AI, data ethics, semantic integration and algorithmic transparency into geospatial education programs at all levels.
- Shift from one-off training events to continuous learning ecosystems supported by open educational resources, mentorship networks and digital micro-credentials.
- Build collaborative programs that bridge geospatial science with broader digital transformation efforts, such as cybersecurity, digital identity and public service AI.
- Support localized capacity development that enables underserved communities and governments to participate in and benefit from intelligent data ecosystems.
- Equip decision-makers with the ability to ask geospatial questions, interpret AI-generated insights, and incorporate them into planning and policymaking.

6.8.3 A NEW ECOSYSTEM FOR CAPACITY DEVELOPMENT

In the future geospatial information ecosystem, capacity is not built through traditional pipelines alone, it grows through networks, open platforms and real-world collaboration. National, regional and global initiatives should create environments where learners can:

- Collaborate on open-source AI projects using geospatial data.
- Participate in virtual labs that simulate the use of blockchain and semantic web technologies in public administration.
- Contribute to ethical reviews of automated decision systems using location data.
- Learn through participatory workshops that reflect real societal challenges.

Private sector partnerships, innovation hubs and civic tech communities will all have a role to play in bringing in new skillsets, new audiences and new ways of learning.

6.8.4 STEP CHANGE: CAPACITY AND EDUCATION

CURRENT FOCUS

Technical training focused on GIS software, spatial data infrastructure, and government data management systems.

FUTURE STATE

Multidisciplinary, inclusive capacity ecosystems that integrate emerging technologies and promote continuous, community-driven knowledge development.

CHARACTERISTIC	OLD STRATEGY	NEW STRATEGY
SKILL FOCUS	Technical Training	Knowledge Fluency
COMPETENCIES	Geospatial-Only Skills	Cross-Domain Competencies
LEARNING STRUCTURE	Centralized Learning	Distributed Capacity Ecosystems
LEARNING CADENCE	Periodic Training	Lifelong Learning
USER SKILLS	Access to Tools	Critical Insight Literacy

Figure 13: Evolving Capacity and Education Needs

EXAMPLE ACTION:

A practical step would be to develop **national geospatial education and professional development programs** that incorporate emerging technologies such as artificial intelligence, semantic data integration and block-chain. These programs should be designed for both formal education and workplace upskilling, ensuring that current and future professionals are equipped to operate within intelligent, knowledge-centered ecosystems. Training should promote interdisciplinary collaboration and critical thinking, while supporting ongoing learning through accessible modular formats.

6.8.5 STRATEGIC SHIFTS REQUIRED

To enable effective participation in the future geospatial information ecosystem, education and capacity development strategies must embrace the following shifts (Figure 13):

- **From Technical Training *to* Knowledge Fluency:** Teach how to think spatially across domains and technologies, not just how to operate specific tools.
- **From Geospatial-Only Skills *to* Cross-Domain Competencies:** Integrate AI, ethics, data science and blockchain into capacity programs.
- **From Centralized Learning *to* Distributed Capacity Ecosystems:** Support learning through open platforms, networks and innovation hubs rather than solely through national training institutes.
- **From Periodic Training *to* Lifelong Learning:** Promote ongoing skills development with modular learning, mentorship and digital certification systems.
- **From Access to Tools *to* Critical Insight Literacy:** Educate users to question, interpret and challenge geospatial insights, particularly when delivered through automated systems.

6.9 Communication and Engagement: Fostering Participation in a Knowledge-Centric Ecosystem

6.9.1 REFRAMING COMMUNICATION FOR THE FUTURE GEOSPATIAL INFORMATION ECOSYSTEM

In the future geospatial information ecosystem, communication is not merely about public awareness, it is a core function that shapes how people understand, access and engage with geospatial knowledge. Traditional models of engagement, which often rely on technical language, static reports or one-way dissemination, are no longer sufficient in a landscape defined by real-time data, AI-generated insights and multimodal digital platforms.

To be effective, communication strategies must evolve to be interactive, inclusive and tailored to a diverse range of users - from policymakers and planners to everyday citizens. This includes leveraging modern channels, such as mobile applications, social media, dashboards and voice interfaces to deliver geospatial insights in accessible and engaging formats.

In parallel, strategic branding of the future geospatial information ecosystem is essential to clearly articulate its relevance, build recognition beyond the geospatial domain, and foster cross-sector understanding and collaboration.

6.9.2 SOCIALIZING THE FUTURE GEOSPATIAL INFORMATION ECOSYSTEM

The future geospatial information ecosystem is a new concept - one that reimagines how data becomes knowledge and how that knowledge serves society. Because of this, broad public understanding and buy-in cannot be assumed. Socializing the future geospatial information ecosystem means making its purpose, value and relevance visible and relatable to a wide range of stakeholders.

This is critical for several reasons:

- To build trust in how data and algorithms are used to support decisions that affect daily life.
- To inspire participation from sectors and communities who may not have previously engaged with geospatial information.
- To empower individuals and organizations to use the future geospatial information ecosystem to solve real-world problems.
- To create a shared identity and narrative that unites disparate contributors (data providers, developers, institutions, and end users) around a common vision.

Without intentional communication and socialization, the future geospatial information ecosystem risks being seen as an abstract or overly technical initiative. With it, the future geospatial information ecosystem can become a dynamic, recognizable public good - anchored in transparency, inclusion and shared value.

6.9.3 STEP CHANGE: COMMUNICATION AND ENGAGEMENT

CURRENT FOCUS

One-way communication, technical reporting, and limited user interaction.

FUTURE STATE

Interactive, transparent and inclusive communication approach, supported by clear branding to enable participation, build trust and promote the responsible use of geospatial knowledge

6.9.4 STRATEGIC SHIFTS REQUIRED

To support meaningful engagement in the future geospatial information ecosystem, communication practices must shift from technical dissemination to participatory, inclusive and strategically branded knowledge-sharing (Figure 14):

- **From One-Way Communication *to* Dialogue-Based Engagement:** Encourage interactive communication models that facilitate community input, user feedback and ongoing discourse.
- **From Technical Language *to* User-Centered Narratives:** Translate complex geospatial data into clear, contextualized stories tailored to diverse audiences.
- **From Static Reports *to* Real-Time Insight Delivery:** Use dashboards, chatbots, Apps and other digital tools to provide geospatial knowledge when and where it's needed.
- **From Informing *to* Empowering:** Design communication strategies that build data literacy and promote informed decision-making, particularly among underrepresented communities.
- **From Fragmented Messaging *to* Cohesive Ecosystem Branding:** Develop and maintain a strong ecosystem brand identity to promote visibility, clarity and alignment across sectors and stakeholder groups.

SHIFT	FROM	TO
FOCUS	Technical Innovation Alone	Societal Value Creation
APPROACH	Pilot Projects	Sustainable Innovation Programs
COLLABORATION	Government-Centric	Multi-Sector Innovation Ecosystems
DESIGN	Specialist Tools	User-Centric Knowledge Applications
SCOPE	Limited Reach	Innovation for All

Figure 14: Communication and Engagement Revolution

EXAMPLE ACTION:

Develop a national **Communication and Engagement Strategy** that includes both outward-facing branding and inward-focused community-building. This strategy should include the design of a visual identity and messaging framework, integration with digital and social platforms, and the rollout of interactive storytelling campaigns that show the future geospatial information ecosystem in action. It should also prioritize outreach to non-technical sectors, such as health, education and local governance to build relevance, trust and sustained use.

7. Next Steps: Advancing the Future Geospatial Information Ecosystem

The future geospatial information ecosystem presents an opportunity for Member States to collectively shape geospatial information management for a purpose-driven, people-centric and partnership-oriented future to address both today's and tomorrow's challenges. Advancing the future geospatial information ecosystem will require coordinated action, continuous dialogue, adaptive leadership, and an ongoing forward-looking approach to shape its role and action within the wider digital ecosystem. It will be a continuous process as new technologies and approaches emerge.

The following next steps are proposed for consideration:

- **Ongoing foresight and future-looking journey:** Ensure foresight and future-facing activities as part of the geospatial journey to remain at forefront of digital transformation and to remain nimble to rapidly evolving digital landscape and agile in adapting the role of geospatial information management within it.
- **Deepen Engagement and Dialogue:** Continue fostering discussions among Member States, regional committees, and functional groups to refine its perspectives, strategic imperatives, evolving and foundational elements to continue to position the future geospatial information ecosystem.
- **Align with broader global digital agendas:** Position the future geospatial information ecosystem as a key enabler of broader international initiatives, including the 2030 Agenda for Sustainable Development, the Global Digital Compact, data strategies, and future global agendas.
- **Enhance Cross-Sector Collaboration:** Promote broader engagement with digital economy sectors, smart infrastructure initiatives, emerging technology communities and civil society actors to ensure an integrated approach.
- **Pilot Innovative Approaches:** Encourage pilot projects that apply future-oriented practices, such as machine-readable SDIs, tokenization, decentralized funding models, AI-driven data ecosystems and participatory, rights-based governance models that prioritize transparency, accountability and public trust.
- **Strengthen Capacity and Knowledge Sharing:** Establish platforms for Member States to share lessons learned, good practice and innovation experiences, particularly emphasizing support for developing countries.
- **Develop Priority Use Cases:** Identify and promote use cases that demonstrate how the future geospatial information ecosystem can deliver real-time knowledge, support decision-making, and address pressing public policy, and environmental and societal challenges.

8. References

1 Ordnance Survey (2020). Future trends in geospatial information management: the five-to-ten-year vision. Third Edition.

2 Coetzee, Serena & Gould, Michael & McCormack, Bruce & Mohamed Ghouse, Zaffar & Scott, Greg & Kmoch, Alexander & Alameh, Nadine & Strobl, Josef & Wytzisk, Andreas & Devarajan, Thirumalaivasan. (2021). Towards a sustainable geospatial ecosystem beyond SDIs. https://doi.org/10.13140/RG.2.2.22555.39203

3 UN-GGIM (2022). Discussion paper: Future Geospatial Information Ecosystem: From SDI to SoS and on to the Geoverse Making the Step Change Using the Integrated Geospatial Information Framework.

4 UN-GGIM (2022). Discussion paper: Development of contextual understanding, information, and analytics towards determining the national geospatial information ecosystem.

5 UN-GGIM (2023). The Future Geospatial Ecosystem: What is the Role of UN-GGIM? Online global webinar proceedings.

6 UN-GGIM (2025). Exploring the wider digital ecosystem. Online global webinar proceedings.

7 Alsayel, M. Y., Simonis, I., Mohamed-Ghouse, Z. S., AlGhamdi, A. (2025). Moving Forward Together: The Emergence of the Interconnected Geospatial Ecosystem. DOI: https://docs.ogc.org/techpaper/25-017.pdf

8 UN (2024) The Sustainable Development Goals Report 2024: The-Sustainable-Development-Goals-Report-2024.pdf (page 3)

www.un.org