

# Analysis of stakeholder roles in the Integrated Geospatial Information Framework (IGIF) and spatial data infrastructures (SDIs)

Antony K Cooper<sup>a,b,\*</sup>, Iwona Kaczmarek<sup>c</sup>, Kathryn Arnold<sup>a</sup>, Joep Crompvoets<sup>d</sup>, Harold Moellering<sup>e</sup>

<sup>a</sup> Smart Places, CSIR, Pretoria, South Africa. {acooper, karnold}@csir.co.za

<sup>b</sup> Department of Geography, Geoinformatics & Meteorology, University of Pretoria, Pretoria, South Africa

<sup>c</sup> Department of Systems Research, Wrocław University of Environmental and Life Sciences, Poland. iwona.kaczmarek@upwr.edu.pl

<sup>d</sup> Public Governance Institute, KU Leuven, Leuven, Belgium. joep.crompvoets@kuleuven.be

<sup>e</sup> Ohio State University, Columbus, OH, USA. geohal+@osu.edu

\* Corresponding author

**Keywords:** IGIF, Integrated Geospatial Information Framework, SDI, spatial data infrastructure, formal model of SDI, stakeholder

## Abstract:

In 2015, the United Nations General Assembly adopted a resolution for *Transforming our world: the 2030 Agenda for Sustainable Development* [UNGA 2015]. This introduced the 17 Sustainable Development Goals (SDGs) and 169 targets [UN 2025a] that built on the Millennium Development Goals (MDGs) [UN 2015]. The SDGs are “a plan of action for people, planet and prosperity” and they also seek “to strengthen universal peace in larger freedom” [UN 2015]. “The SDGs are highly dependent on geospatial information and Earth Observations (EO) as the primary data for relating people, economy and the environment to a location and place, and to measure ‘where’ progress is, or is not being made, particularly at ‘disaggregated’ sub-national and local levels” [UN-GGIM 2022a]. Progress towards measuring and monitoring the SDGs has brought the need for harmonised spatial data of increasing quality, accuracy, currency and granularity to the forefront of global, regional and national agendas.

Established in 2011, the United Nations Committee of Experts on Global Geospatial Information Management (UN-GGIM) is the official consultative mechanism for the UN on global geospatial information management. UN-GGIM provides a forum for member states, the UN and other international organisations, and proposes work-plans to promote and harmonize interoperability, a global framework, shared principles, policies, guidelines and standards [UN 2025b]. UN-GGIM aims to address global challenges, such as the SDGs.

UN-GGIM began developing the concept of the *Integrated Geospatial Information Framework (IGIF)* in 2017. Integrating geospatial and statistical information is one of the most effective ways to maximise its value. The IGIF is aimed at overcoming problems with accessing and reusing data and integrating various data sets together to improve evidence-based decision-making and policy development, particularly to achieve the SDGs and to address other global challenges [UN-GGIM 2022b]. The IGIF expands on the concept of a *spatial data infrastructure (SDI)*, introduced in the early 1990s. One or more SDIs are needed first to provide the data governance frameworks, geospatial policy, laws, technology and standards needed for the IGIF [UN-GGIM 2022b].

The former Commission on SDI & Standards (and its predecessors) of the International Cartographic Association (ICA) have developed formal models of an SDI [Hjelmager *et al* 2008; Cooper *et al* 2011; Cooper *et al* 2012]. These models include six types of stakeholders: policy maker, producer, provider, broker, value-added reseller (VAR) and end user. A stakeholder can be an individual, a group, a committee or an organisation and each entity can take on multiple stakeholder roles [Hjelmager *et al* 2008]. These six types consist of 39 specializations, subtypes or special cases [Cooper *et al* 2011]. These models have been widely used [Cooper *et al* 2023].

The IGIF has nine strategic pathways, each of which can be broken down further into four key elements. Unsurprisingly, various stakeholders are recognised explicitly and implicitly in these 36 elements. These include the Leadership element within the Governance and Institutions pathway, the Community of Practice element within the Standards pathway, the Stakeholder and User Engagement element within the Communication and Engagement pathway, and all four elements

within the Partnerships pathway: Cross-sector and Interdisciplinary Cooperation, Private Sector and Academia Collaboration, International Collaboration, and Community Participation [UN-GGIM 2022b]. Furthermore, cartography intersects with all IGIF pathways, albeit with varying levels of visibility [Arnold 2025].

Given the diverse stakeholder elements within IGIF's structure, there is an opportunity to evaluate them through the lens of established stakeholder models. The aim of this study is to identify and analyse all stakeholders in the Integrated Geospatial Information Framework (IGIF) and evaluate the applicability of the existing SDI stakeholder model to the new IGIF framework. The research employs documentation analysis of IGIF to identify explicit and implicit stakeholders, comparison with the six-type SDI stakeholder model, and assessment of the existing model's adequacy for IGIF. The results of this study will contribute to a better understanding of roles and relationships between stakeholders in IGIF, which is crucial for effective framework implementation and achievement of SDGs. We will identify all the stakeholders (explicit and implicit) in the IGIF, and we will examine to what extent the SDI stakeholder model is applicable to the IGIF. Based on the analysis, recommendations will be put forward. For example, there is a variety of Policy Maker stakeholders that could contribute to IGIF, such as the UN and its agencies; ISO/TC 211, Geographic information/Geomatics, the Open Geospatial Consortium (OGC), the International Data Spaces Association (IDSA) and others for standards; and in Europe, INSPIRE.

## References

- Arnold, K.A., 2025. Building the road to AI – how cartography links data integration, meaning and geospatial knowledge transmission. Draft Workshop Report. *EuroCarto 2024 Pre-Conference Workshop*, 8 September 2024, Vienna University of Technology (TU Wien), Austria.
- Cooper, A.K., Coetzee, S., Moellering, H., Rapant, P., Cromptvoets, J., Hjelmager, J., Delgado, T., Iwaniak, A. and Kaczmarek, I., 7 Aug 2023. A Review of the ICA Model of Stakeholders in a Spatial Data Infrastructure (SDI). *Advances in Cartography and GIScience of the ICA*, 4:1–8. <https://doi.org/10.5194/ica-adv-4-5-2023>.
- Cooper, A. K., Rapant, P., Hjelmager, J., Laurent, D., Iwaniak, A., Coetzee, S., Moellering, H. and Duren, U., 2011. Extending the formal model of a spatial data infrastructure to include volunteered geographical information. *25th International Cartographic Conference (ICC 2011)*, Paris, France. [https://icaci.org/files/documents/ICC\\_proceedings/ICC2011/Oral%20Presentations%20PDF/B2-Ontology%20and%20data%20mining%20for%20integration/CO-120.pdf](https://icaci.org/files/documents/ICC_proceedings/ICC2011/Oral%20Presentations%20PDF/B2-Ontology%20and%20data%20mining%20for%20integration/CO-120.pdf)
- Cooper, A. K., Moellering, H., Hjelmager, J., Rapant, P., Delgado, T., Laurent, D., Coetzee, S., Danko, D. M., Duren, U., Iwaniak, A., Brodeur, J., Abad, P., Huet, M. and Rajabifard, A., 2012. A spatial data infrastructure model from the computational viewpoint. *International Journal of Geographical Information Science* 27(6), pp. 1133– 1151.
- Hjelmager, J., Moellering, H., Delgado, T., Cooper, A. K., Rajabifard, A., Rapant, P., Danko, D., Huet, M., Laurent, D., Aalders, H. J. G. L., Iwaniak, A., Abad, P., Düren, U. and Martynenko, A., 2008. An initial formal model for spatial data infrastructures. *International Journal of Geographical Information Science* 22:1295–1309.
- UN, 2015. *United Nations Millennium Development Goals*. United Nations. <https://www.un.org/millenniumgoals/>
- UNGA, 2015. *Transforming our world: the 2030 Agenda for Sustainable Development*. Department of Economic and Social Affairs, United Nations. <https://sdgs.un.org/2030agenda>
- UN, 28 Jun 2024. *The Sustainable Development Goals Report 2024*. United Nations. <https://unstats.un.org/sdgs/report/2024/>
- UN, 2025a. *Sustainable Development Goals (SDGs)*. Sustainable Development: Make the SDGs a reality. United Nations. <https://sdgs.un.org/>
- UN, 2025b. *UN-GGIM* (United Nations Committee of Experts on Global Geospatial Information Management). United Nations. <https://ggim.un.org/>
- UN-GGIM, 2022a. *The SDGs Geospatial Roadmap*. United Nations Committee of Experts on Global Geospatial Information Management, New York, NY, USA. <https://ggim.un.org/documents/SDGs-Geospatial-Roadmap.pdf>
- UN-GGIM, 2022b. *Future Geospatial Information Ecosystem: From SDI to SoS and on to the Geoverse*. United Nations Committee of Experts on Global Geospatial Information Management, New York, NY, USA. [https://ggim.un.org/meetings/GGIM-committee/12th-Session/documents/Future\\_Geospatial\\_Information\\_Ecosystem\\_Discussion\\_Paper\\_July2022.pdf](https://ggim.un.org/meetings/GGIM-committee/12th-Session/documents/Future_Geospatial_Information_Ecosystem_Discussion_Paper_July2022.pdf)