Spatially Enabling the SDGs: The Social, Economic, and Environmental Impacts of Spatial Enablement

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This chapter aims to present the significance of spatially enabling the SDGs and the opportunities it provides for the seventeen goals.

4.1 Introduction

Achieving the Sustainable Development Goals (SDGs) is contingent on a holistic approach that aligns social, economic, and environmental objectives at local, national, and global levels. The significance of the ‘where’ component of the SDGs is, however, often underemphasized. The Global Goals require a transdisciplinary effort to integrate the geospatial aspect into planning and implementation phases, and UNHCR and ESRI's collaborative initiative, *Rohingya Refugee Emergency at a Glance* is a case in point that utilizes geospatial information and technologies to address various dimensions of sustainable development in parallel with changing circumstances. The interactive platform locates health services, disaster risks, shelter congestion, and water accessibility to sustainably aid Rohingya refugees in Bangladesh [29]. This example demonstrates how integrating spatial enablement in SDGs-related initiatives can create resilient and sustainable circumstances for everyone in every location.

The SDGs have emerged in a world where social, economic, and environmental complexities are intertwined across different geographic locations and at a time when technological advancements encourage the proliferation of real-time and location-based information. Spatially enabled societies, governments,

and people can offer a wide range of solutions for complex challenges [23], however how it connects the multidimensional SDGs and its social implications for a comprehensive approach requires further research. The chapter begins by examining the meaning of spatial enablement in the context of the SDGs and is followed by a discussion on how spatial enablement can narrow the SDG connectivity gap. It then investigates the social impact of spatial enablement for the SDGs and ends with a discussion on land, the driving force of spatial enablement for the SDGs.

4.2 Spatially Enabling the SDGs

4.2.1 What Does It Mean to Be Spatially Enabled?

Social, economic, and environmental developments are geospatial processes, because “everything happens somewhere”¹. Moreover, location is “the fourth element of decision-making” [23], therefore recognizing and utilizing geospatial information to localize solutions is essential to progress. This geospatial need prompted the emergence of ‘spatial enablement’, a notion to facilitate localization by cohesively engaging technologies, people, and institutions. In broad terms, to be spatially enabled is the ability to use geospatial information and technology to enhance the interactions within that space [8]. In technical terms, spatial enablement refers to geographical identifiers—e.g. geographically tagging records in a database [7]. The term generally entails the use of geospatial information and technologies to ameliorate the social conditions. However, geospatial experts emphasize that spatial enablement is not merely a technical matter, it is an approach that is concerned with the whole of government and society [32]. To this end, spatial information and technologies serve to spatially enable two main entities: society and government.

A spatially enabled government works towards establishing infrastructures that organize and share spatial information required for decision-making and policies, government services, business transactions and community activities [33]. Integrating spatial data infrastructures (SDIs) and better land administration and management (i.e. land governance, property rights, and land policy) allows governments to utilize spatial information to address social, economic, and environmental challenges adequately [30]. In essence, a spatially enabled government is a facilitator for interactions between organizations, technologies, and people by means of a common language using spatial concepts and technologies, and spatial information management processes

¹This statement is credited to Nancy Tosta in an interview with the Computer World news, GIS: More Than Just A Map. Retrieved from <https://www.computerworld.com/article/2582595/gis-more-than-just-a-map.html>

[7, 9]. Therefore, spatially enabled governments utilize geospatial knowledge and technologies across different domains and sectors to fulfill societal needs.

Similarly, a society is spatially enabled when spatial information, a common good that prompts creativity, efficiency and product development, is available to governments, citizens and businesses to organize and plan their activities [18, 33]. The International federation of Surveyors (FIG) report, *Spatially Enabled Society* [23], defined the term in the context of availability, accessibility, and usability of spatial information. First, spatial information and services must be available to governments, businesses, and citizens in a free, efficient, and comprehensive manner. Second, tools for spatial information sharing, analysis, and management must be accessible to all sectors of society. Third, spatial information must be used to transparently organize economic, legal, environmental, land, and social activities, and contribute to informed decision-making. The ultimate objective of is to provide value-added services and reinforce sustainable development through six fundamental elements: legal frameworks, sound data integration concepts, positioning infrastructures, SDIs, land ownership information, and data and information.

Spatially enabled societies encourage the collection and processing of spatial information at all levels of society to deliver sustainable development objectives [31]. Land administration systems and SDIs use the collected data to underpin evidence-based decision-making to implement sustainable policies and practices [4, 17]. Therefore, the integration of spatial information and technology in sustainable development can facilitate coherent governance, ensures coverage of more geographic territories, and engaging a larger number of citizens in determining the future of their society. While geospatial information offers of social, economic, and environmental benefits, most countries lack the capacity to manage and share geospatial information and systems to advance sustainable development goals [6]. In spite of limitations in geospatial resources and skills, the SDGs generated a new wave of geospatial awareness at a global level.

4.2.2 Sustainable Development Goals in an Interconnected World

In recent decades, the global community has become interconnected across different geographies, scales, and sectors, driving us into the age of sustainable development [19]. The universality and complexity of our challenges brought together the largest international gathering at the UN Conference on Sustainable Development (Rio+20) in 2012. The Rio+20 outcome document declared that sustainable development goals should be action-oriented, consider different national realities and capacities, and utilize geospatial information for policymaking, programming, and project operations [10]. As a result, the SDGs were put into effect in 2015 to mobilize a transformative course of action towards a sustainable future for people and the planet. The 2030 Agenda

requires data-driven action, evidence-based analysis, implementation, monitoring [20] and capacity building that is linked across different sectors [22].

Geospatial analysis, mapping, and modeling, geopolitical policy, and integrative frameworks can fortify networks of capacity building and decision-making practices needed for sustainable development issues [25]. In other words, spatial enablement offers the knowledge and tools needed to spatially connect stakeholders, policy makers, and people to sustainability challenges, resources, and solutions. Thus, integrating geospatial information in the global agenda promotes a holistic approach to measuring and monitoring the SDGs. The collective success of the global community depends on a holistic framework and transdisciplinary action plan that spatially enables the SDGs to deliver social well-being, economic growth, environmental vitality, and good governance.

4.2.3 Integrating Spatial Enablement Into the SDG Framework

The 2030 Agenda is one of the first global frameworks that recognizes the role of geospatial information in sustainable development [21]. The 2016 SDGs Report noted that geospatial information is important for the production of some indicators [12] and falls short of providing any details. The 2017 SDG Report reiterated the same statement without providing further information [13]. Progress was made in the 2018 SDG Report, it called for open and transparent access to integrated geospatial and statistical data, collaboration on the production and dissemination of geospatial and statistical data, and visualizing SDG statistical data within a geospatial context [14]. While the importance of geospatial information is recognized in the framework, there are missing links between spatial enablement and the SDGs.

The Inter-agency and Expert Group on Sustainable Development Goal Indicators (IAEG-SDGs) Working Group on Geospatial Information has examined the SDGs with a “geographic location lens” and proposed that geospatial information has direct contribution to fifteen indicators and supporting contribution to eight indicators [27]. The list of indicators does not, however, encompass all indicators that are geospatially relevant. Target 3.3, for example, intends to end the epidemics of communicable diseases, and geospatial data is necessary for tracking and analyzing disease outbreaks [1]. This indicates that the role of spatial enablement in social, economic, and environmental phenomena has not been comprehensively researched. Therefore, this chapter proposes spatial enablement creates three key opportunities for the SDGs:

Inclusive coverage of SDGs. ‘Leaving no one behind’ is the key pillar of the SDGs, which requires the integration of where people are and where events occur with demographic data in order to provide geospatial services that are accessible and consistent [24]. Twenty-one of the SDG targets intend to increase access to basic services, land, housing, and other resources, all of

which, require spatial data (remote sensing data, satellite data, etc.) to ensure that ‘accessibility’ is for everyone in all localities.

Participatory implementation of the SDGs. A local-to-global outlook towards the SDGs can incorporate more people in localizing action plans. Spatial enablement and literacy put all members of society in contact with geospatial information and services, consequently engaging more people and data in reaching the SDGs [21]. Citizens are producers and users of spatial data, however, if spatially enabled, they can utilize spatial information to devise solutions and contextualized implementation methods at local, national and global levels.

Comprehensive monitoring of the SDGs. Measuring and monitoring socio-economic SDG indicators, specifically land-related indicators, require spatially enabled datasets (data collected through surveys, crowdsourcing, and censuses) to achieve the SDGs at local and national levels [3]. Statistical and geospatial data are also critical for comprehensive decision-making across different scales of governance [15]. Monitoring the SDGs requires cross-national, cross-sectoral, and cross-scale monitoring, which can be accelerated by incorporating spatial data and technologies.

Spatially enabling the SDGs is the process of uniting the various features of spatial enablement with the SDG framework by employing spatial information, technologies, and services as a common force to confront social, economic, and environmental challenges everywhere. However, the SDGs will not reach everyone if there is a gap in connecting the social, economic, and environmental aspects of challenges, stakeholders and societal actors, resources, and technologies across local, national, and global scales.

4.3 Narrowing the Connectivity and Spatial Gap

There are clear overlaps between spatial enablement and the SDGs: engaging all members of society, addressing the social, economic, and environmental layers of problems, using spatial information to locate events, implement solutions, and monitor progress. However, the SDGs are often examined in silos, overlooking the social, economic, and environmental interlinkages embedded in each SDG [2]. Drawing from the main entities of spatial enablement identified in [7] and the sustainable development data flow outlined in [21], Figure 4.1 illustrates the interlinkages of spatially enabled SDGs. Incorporating these links in research or implementation strategies can narrow the connectivity gap by promoting transdisciplinary planning, cross-sectoral mobilization, and transnational partnerships:

Transdisciplinary planning: the SDGs cover a wide range of issues pertaining to social, economic, environmental, political, technological, and other areas of development. Incorporating the middle layer of Figure 4.1 includ-

FIGURE 4.1
Integration of spatial enablement in the SDGs

ing data, technologies and systems, infrastructures and platforms, policy, and standards connects people with the tools, methods, and strategies needed to tackle the multidimensional challenges of the SDGs. This connection is created across different scales, sectors, and domains, enabling the continuous and consistent path through transdisciplinary research and action plans.

Cross-sectoral mobilization: the SDGs require all members of society with different socio-political and socio-economic responsibilities to be involved in achieving the goals. Spatially enabling the SDGs engages citizens and breaks the government, private sector, academic, and non-profit silos to facilitate cross-sectoral cooperation to comprehensively address the social, economic, environmental, and governance layers of the SDGs. Therefore, mobilizing sectors and members of society in spatial enablement and sustainable development (inner layer of Figure 4.1) can result in more efficient and effective efforts towards meeting the SDGs.

Transnational partnership and collaboration: poverty, clean energy, water and sanitation, equality and justice, education and other social, economic, and environmental problems in the 2030 Agenda are present, to different degrees, in developed, developing, and underdeveloped nations (outer layer of Figure 4.1). Financial markets rivers, forests, and other natural recourses transcend national borders. Therefore, to fulfill all the SDGs for everyone in

all localities requires multinational partnership and collaboration to muster resources, technologies, and people needed to achieve the goals in all nations.

The integration of spatial enablement in the SDGs results in forming connections between the human, technical, and sustainability layers of society order to contextualize all dimensions of a Goal in its local, national, and global circumstances. One of the implications of narrowing the connectivity gap is understanding that the interlinkages within the SDG framework reveal how people and the social aspect are at the core of spatial enablement and sustainable development, and technological aspect is a tool that facilitates progress.

4.4 The Social Impact of Spatially Enabling the SDGs

The SDGs hold different social, economic, and environmental weight and can benefit from spatial enablement in different capacities. In this framing, UNG-GIM and the World Bank, 2018 have identified some of the social, economic, and environmental benefits of integrating a geospatial information framework. Building on their analysis, Table 4.1 explains how spatial enablement can socially impact the SDGs and strengthen community resilience.

TABLE 4.1: Social impact of spatial enablement characteristics on the SDGs

SDG	Social impact of spatial enablement
Goal 1	Poverty mapping and engaging citizens in the process can help stakeholders alleviate poverty. Moreover, land tenure security and knowledge of land rights can affect income levels; land is a source of income, food, and shelter.
Goal 2	SDIs can manage and share information about food resources and agriculture to reduce food insecurity among communities and improve agricultural production. Land tenure security improves accessibility to agricultural land as well.
Goal 3	Spatial assessment of disease outbreaks can help governments and international organizations track and prevent the spread of communicable diseases. Spatial platforms can also increase access to medical facilities and supplies.
Goal 4	Integrating spatial literacy and awareness in school curricula can step up citizen involvement in decision-making and implementation phases, in addition to increasing knowledge of land rights, particularly for vulnerable members of society.

Goal 5	Mapping gender inequalities and social phenomena that exacerbate them can support policies that enrich women's welfare. Spatial literacy and knowledge of land rights can empower women and reduce the adverse effects of economic and environmental shocks.
Goal 6	Water management requires geo-referenced information, particularly for location-specific decision-making. Locating trans-boundary water ecosystems and land management also effects community access to clean water and water resources.
Goal 7	Spatial assessment of resources can identify regions that lack access to clean energy and locate different energy resources. Lack of land tenure can also affect the development of energy infrastructures and access to energy.
Goal 8	Analyzing the spatial distribution of economic activities, gaps, and needs can raise employment rates. Moreover, utilizing geospatial services to enhance access to social services and land information can increase economic growth.
Goal 9	Spatial data can advance soft and hard infrastructures, including SDIs, by connecting transport, energy, financial, health, educational and other services to communities. Secure land tenure will allow the efficient development of physical infrastructures.
Goal 10	Knowledge of the spatial distribution of socio-economic inequalities can contribute to forming laws, policies, and practices that promote equality and equal access to rights, services, and resources.
Goal 11	Authoritative and citizen-generated spatial data can reduce crime rates, identify safe public transport stops, upgrade and transform informal settlements. Securing land tenure can also foster the development of inclusive urban infrastructures and housing.
Goal 12	The spatial tracking of waste management and efficient use of natural resources can reduce the release of contaminants, pave the way for a safer ecosystem and establish sustainable land use patterns for energy and food production.
Goal 13	Disaster risk models, spatial data sharing systems and land tenure can minimize climate impact, accelerated disaster response and early warning systems, managing safe migration, upgrade hazard mapping, and reduce socio-economic vulnerabilities.
Goal 14	Spatial data on fisheries and natural resources can assist with halting illegal marine activities and boost tourism. In addition, information regarding land-based activities can affect marine ecosystems.

Goal 15	Earth observation and geospatial data can map, measure, and monitor land use and natural resource management to improve the conservation of terrestrial ecosystems, which reduces economic loss and secure social and ecological sustainability.
Goal 16	Institutions across different sectors and scales can elevate inclusivity by reforming land administration and land rights, geospatial infrastructures, systems, standards, and policies.
Goal 17	The development of geospatial technologies, availability of spatial data for citizens, industry, and governments, and integration of geospatial frameworks in the SDGs requires cooperation at all levels of government and multi-stakeholder partnerships.

Many of the social elements of the SDG framework in [Table 4.1](#) are connected to land and land administration. Inclusive land management and administration is a requirement for sustainable development [\[23\]](#). Land-related information, therefore, makes spatial enablement at the government level more inclusive, while empowering communities by creating social equity and economic opportunities [\[32\]](#). With 68 percent of the world's population living in urban areas by 2050 [\[14\]](#), land information is essential for SDG 11, which tackles both cities and urban communities facing poverty, disaster shocks, housing crisis, and other inequalities. Therefore, land ownership information is fundamental to spatial enablement which can sustainably manage people's relationship to land.

4.5 Land: The Driving Force of Spatial Enablement for the SDGs

Rising urbanization, natural disasters, increasing inequalities, and poverty are some of the pressing global risk of our time [\[5\]](#), which cause severe setbacks for urban communities, land use, and land related activities. Land ownership information, one of the six elements of spatially enabled society, can significantly strengthen the resilience of urban communities by managing and monitoring the multidimension effects of land on urban growth. To foster social cohesion in urban settings, land ownership information significantly contributes to dealing with SDG 1, SDG 5, and SDG 13:

Poverty alleviation (SDG 1): effective documentation of land rights and parcel information can be used to manage land disputes, policy and decision making, and support formal land markets that provide the means to reduce poverty [\[26\]](#). Community members can get involved in these practices by providing volunteered information where authoritative data is not

available [16]. Subsequently, land ownership directly affects income levels and economic growth [11].

Gender equality (SDG 5): ownership and control over land can empower women by reducing dependency on men for financial assistance and increase opportunities for economic and social activities [28]. Registration systems make secure land rights and ownership possible, which in turn facilitates equal access to economic resources, health services, inheritance and other socio-economic advantages. Therefore, equitable access to land, housing, and basic services through land administration functions such as securing and transferring land rights make sustainable urban development more inclusive [26].

Disaster risk reduction (SDG 13): with more frequent and intense disasters, land ownership information is of utmost importance; disasters can destroy land and land records, kill title-holders and erase physical land boundaries. Community participatory methods and satellite imagery can indicate ownership and property location after the occurrence of a disaster [34], which strengthens community resilience to disasters. Therefore, secure land rights can protect community access to shelter, food and other services, when people are most vulnerable after a disaster.

Impediments to even urbanization and secure land rights can have long-term effects that transcend time and location. Land information can strengthen the resilience of our ecosystems by facilitating infrastructure development, cohesive decision-making on best policies, the establishment of just institutions, and disaster prevention strategies that meet community needs. To fulfil these needs by 2030 for everyone, we need to have a comprehensive understanding of the complexity and links between social, economic, environmental, political, spatial, and cultural layers of present and future needs.

4.6 Conclusion

The disturbances inflicted by natural and human-induced events affect the interactions between social, economic, environmental, and governance sectors. Integrating a geospatial framework in sustainable development can reinforce the inclusivity principles of the SDGs by locating, monitoring and overcoming the challenges we face. Further research is needed to identify localized spatial applications and their impact on each of the SDGs. However, realizing the role of spatial enablement in the 2030 Agenda and understanding the impact of spatial enablers such as land administration and management will enable a holistic approach to effective, efficient and innovative solutions for delivering the SDGs.

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