The Global Statistical Geospatial Framework: National and Regional Experiences of Implementing the GSGF

Summary

In its decision 10/106, UN-GGIM urged Member States to continue efforts towards the adoption and implementation of the Global Statistical Geospatial Framework and to support institutional coordination and collaboration between national statistical offices, national geospatial information agencies and other relevant stakeholders to support the ongoing implementation of the Framework, especially in the context of the global coronavirus disease (COVID-19) pandemic. The Committee also welcomed the many instances in which the Global Statistical Geospatial Framework had been implemented in Member States and the increased focus on the exchange of knowledge and capacity-building, and suggested that the Expert Group collect national experiences relating to the integration of statistical and geospatial information to further guide Member States in the implementation and operationalization of the Framework.

To practically respond to this mandate, the EG-ISGI sought to capture national and regional case studies of ***how*** the GSGF has been adopted and implemented at the national and regional level. Accordingly, this document consolidates responses from the EG-ISGI's membership, highlighting prevailing good practices arising from the implementation of the GSGF, particularly on how it relates to the response of both the statistical and geospatial communities to COVID-19, global development agendas and national priorities.

Members of the EG-ISGI, both Member States and Regional Commissions were invited to submit how the GSGF has been implemented and operationalised along three main areas of interest:

1) The Overall Implementation of the GSGF
2) The Implementation of the Principles of the GSGF
    i. Elaborated by the GSGF's five principles, one submission per principle.
3) Your National Response to COVID-19
    i. How has the GSGF supported your national response to COVID-19?
    ii. How could the GSGF have supported your national response to COVID-19, if it had been implemented? What were/are the barriers in its implementation?

29 Member States, including Australia, Botswana, Brazil, Canada, Chile, Colombia, Costa Rica, Cuba, Dominican Republic, Ecuador, Egypt, Finland, Germany, Ghana, Honduras, India, Indonesia, Kenya, Kuwait, Malawi, Mexico, Namibia, New Zealand, Panama, Peru, Senegal, Sierra Leone, South Africa and Uruguay provided their national experiences, representing contributions of how the GSGF is implemented within, and by, NSOs, NGIAs individually and also collaboratively. Complementing these contributions from Member States are case studies from the Americas (provided by the Regional Committee of United Nations Global Geospatial Information Management and the United Nations Economic Commission for Latin America and the Caribbean) and Africa (provided by the Regional Committee of United Nations Global Geospatial Information Management for Africa and the United Nations Economic Commission for Africa[1]).

[1] UNECA submitted on behalf of Botswana, Ghana, Kenya, Malawi, and Sierra Leone, drawn by a desk review. Documents that drew on these contributions included Census Preparedness: Preliminary Report on the Status of Country Preparedness for the 2020 Round of Population and Housing Census in Africa (https://repository.uneca.org/handle/10855/23997) The Usefulness of Geo-referenced Dwelling Frames for Census Cartography during the 2010 Round of Population and Housing Census in Africa (https://repository.uneca.org/handle/10855/23999) Manual on

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Standard Guiding Principles on a Global Statistical and Geospatial Framework for the Integration of Statistical and Geospatial Information in Africa (under editing and translation) Study on National Mapping Agencies (NMA's) in Africa responds to the COVID-19 Crisis (under editing and translation)

Experiences at the National Level

Australia

Name of Agency: Geoscience Australia / Australian Bureau of Statistics
Submission From: Combined NGIA/NSO

The Overall Implementation of the GSGF

Australia developed the Statistical Spatial Framework, which formed the basis of the GSGF. The SSF is referenced directly and indirectly in a range of national initiatives and activities, and has been critical in the thinking in the recently announced Australian Government initiative the Digital Atlas of Australia.

The Implementation of the Principles of the GSGF

Principle 1: Use of fundamental geospatial infrastructure and geocoding

Australia has a range of fundamental data under the Foundation Spatial Data Framework that is used for statistical activities, including geocoding. In particular, the Geocoded National Address File I available for open use and is used extensively in geocoding datasets and supporting statistical activities, including maintaining the ABS Address Register which is used as the dwelling frame for household survey and censuses. A single geocoding technology is however not use, with a range of commercial providers supplying solutions to organisation undertaking geocoding – this is likely to continue.

Principle 2. Geocoded unit record data in a data management environment

The ABS conducts all of its geocoding and other data processing in a secure data management environment. ABS also supports other organisations conducting geocoding to protect data through the use of secure environments and good geocoding results through the application of best practices.

Principle 3. Common geographies for the dissemination of statistics

The ABS produces the Australian Statistical Geography Standard for the productions, dissemination and analysis of statistics and other data. It used for all ABS statistical releases and is also used widely in socio-economic datasets across government, business and the community. ABS and Geoscience have also collaborated on the establishment of a default Discrete Global Grid System definition to support the release and analysis of grid data.

Principle 4. Statistical and geospatial interoperability

Recently ABS and Geoscience have been collaborating on encouraging interoperability of data through the use and application of metadata and other standards. The Location Index project has been building shared infrastructure to enable the transformation of data between different spatial referencing systems. The Australian Climate Service collaboration, which also involves the Bureau of Meteorology and CSIRO (national science institution), is undertaking several initiatives to ensure data is accessible and interoperable within government, and the Digital Atlas program is expected to extend that more broadly.

Principle 5. Accessible and usable geospatially enabled statistics

ABS has a long history of using innovative methods to make geospatially enabled statistics available to users, including providing statistical data with open access licences. Recent work with partners in the Australian Climate Service and, in coming years, with the Digital Atlas program, is modernising this process to encourage the use of "linked open data" (web) services and building platforms to facilitate access and analysis of a wide range of geospatial and location information.

Your National Response to COVID-19

How has the GSGF supported your national response to COVID-19?

Having a wide range of existing geospatial enable statistics (from the ABS) and other data (in other government organisations) enabled rapid location-based analysis and responses to COVID-19, including analysis of at-risk populations. Having strong geospatial capability (workforce and technical infrastructure) allowed rapid response to geospatially enabling new data sources, which allowed more timely information to examine localised employment impacts from business shutdowns.

How could the GSGF have supported your national response to COVID-19, if it had been implemented? What were/are the barriers in its implementation?

More comprehensive implementation of GSGF principles in other organisations would have allowed for more effective integration of data from different sources, for example some health sector data was "geocoded" to postcodes, which is not a good common geography to enable integration with other datasets. This points to the need to take the GSGF principles beyond NSOs.

Botswana

Name of Agency: Stats Botswana

Submission From: Desk Review from ECA

The Overall Implementation of the GSGF

The Overall Implementation of the GSGF

Botswana is still to develop the National vision for the implementation of GSGF. Components of GSGF, were implemented during the 2021and the Demographic and Health Surveys (DHS) Ghana: 2019, 2017, 2016, 2014, 2011, 2008, 2007, 2006, 2003, 2002, 1998, 1993 and 1988. Geocoding and other principles of GSGF was extensively deployed during the above-mentioned operations.

The Implementation of the Principles of the GSGF

Principle 1: Use of fundamental geospatial infrastructure and geocoding

Statistics Botswana collaborated for the automation of census cartographic exercise 2021 with GeoSpace International. The collaboration offers technical assistance, support and the implementation of a smart census application for the mapping of the 2021 census in Botswana.

To give a unique code to each enumeration region it was essential to design a coding system. The system for coding was sufficiently flexible and organized to include new and future administration divisions, which represent administrative hierarchy. A systematic program of coding was followed in order to guarantee consistency and clarity of the numeric Identifications (IDs). In this method, each

administrative hierarchy contains the geographic units. The geo-coding suggested corresponded to the geographic census framework.

The Enumeration Areas (EAs) boundaries used in 2011 acted as the foundation for the creation of the Frame (DU) for housing. The DU framework composed of residential units and points of interest (POI). Geocoding of Housing unit location (Dwelling Frames, Housing Footprints), collective living quarter locations (Dwelling Frames, Housing Footprints) a set of digital enumeration area maps or derived dissemination units, which are designed to enable the production of all output products that will be disseminated to government departments and the general public.

Geocoding of Geographic boundary files in a digital format for all statistical reporting units for which census indicators will be tabulated. Listings of all statistical and administrative reporting units, including towns and villages, their variant names and geographic coordinates. Geocoding of Geographic equivalency files that indicate how current reporting units relate to those used in previous censuses, or how one set of reporting units relates to another set as well as the Geocoding of vector layers containing feature data, such as landmarks, roads, schools, hospitals and clinics, which can be used when analysing population data spatially. Geocoding was used to determine the Centroid files that provide a representative geographic point reference for each reporting unit. It also provided for gazetteers that provide geographic coordinates for all population settlements and other important geographic features in the country. Geocoding: DHS GPS Datasets

Principle 2. Geocoded unit record data in a data management environment

Smart Census which is a WEB-based, client-server GIS viewing and data capturing application specifically developed for census mapping by GeoSpace in collaboration with Hexagon Geospatial were deployed. The latest updated version of the software based on Hexagon Geospatial M.App Enterprise platform were included in modules for Enumeration and Dissemination that helped in Geocoded unit record data in a data management environment.

Principle 3. Common geographies for the dissemination of statistics

The Smart Census product came as a direct result of years of experience in census projects where GeoSpace and Statistic Botswana developed mobile field data capturing applications with integrated data transfer functionality that complimented our usual GeoMedia desktop GIS solutions.

Principle 4. Statistical and geospatial interoperability

Dashboard were used enabling integrated reporting system enables real-time reporting at all levels of the project and within the organisation. Management (even senior management) can access the application through the Internet/Intranet with their allocated Username / Password to generate live status reports per phase of project as and when desired. Smart Census application enabled seamless statistical and geographical interpolation of data in an office as well as field environments.

Principle 5. Accessible and usable geospatially enabled statistics

Smart Census which is a WEB-based, client-server GIS viewing and data capturing application specifically developed for census mapping by GeoSpace in collaboration with Hexagon Geospatial were deployed for accessible and usable geospatially enabled statistics.

Brazil

Name of Agency: IBGE

Submission From: Combined NGIA/NSO

The Overall Implementation of the GSGF

The implementation of the GSGF in Brazil is ongoing. In 2019, IBGE made the Geographical Reference Framework for the production, analysis and dissemination of statistics available to the public (PT-BR: Quadro Geográfico de Referência para Produção, Análise e Disseminação de Estadisticas *). In this reference publication you can find information about the geographies produced by IBGE and the functional and legal geographies. All geographies contain a form with basic information (update cycle, reference date, number of units, publication / reference legislation etc.), definition, geocoding, relationship with other geographies and map. The publication marked the beginning of a more ambitious project that aims to integrate existing systems and standardize the incorporation of new geographies present in Brazil, thus strengthening the integration between Statistics and Geography with a view to making spatially comparable and integrated available. The Geographic Reference Framework was inspired by the GSGF and the initiatives of other countries. The publication refers to global efforts to integrate statistical and geospatial information. Currently, the Brazilian initiative is in the stage of maturing its workflows and building an integrated database with an annual update that will be made available to the public. An update of the reference publication and a web application is expected in 2022. It is important to note that, since 2008, Brazil has had a spatial data infrastructure, the National Spatial Data Infrastructure (PT-BR: Infraestrutura Nacional de Dados Espaciais - INDE).

The Implementation of the Principles of the GSGF

Principle 1: Use of fundamental geospatial infrastructure and geocoding

The National Spatial Data Infrastructure - INDE (PT-BR: National Spatial Data Infrastructure - INDE). of Brazil was established by Decree no. 6,666 of November 27, 2008. INDE was conceived with the objective of cataloging, integrating and harmonizing the geospatial data produced or maintained by Brazilian government institutions, so that they can be easily located, explored with their characteristics and accessed by the most diverse purposes by any user with access. The cataloging of geospatial data is carried out through the respective metadata by the producers and / or data managers. In 2019, IBGE made the Geographical Reference Framework for the production, analysis and dissemination of statistics available to the public (PT-BR: Quadro Geográfico de Referência para Produção, Análise e Disseminação de Estadisticas) with the objective of implementing the GSGF in Brazil. IBGE updates the information on addresses, the nature of homes and buildings in the National Register of Addresses for Statistical Purposes (PT-BR: National Register of Endereços for Statistical Purposes - CNEFE). Created in 2005 from the systematization of the data collected by the 2000 Census, this registry today includes information on households and establishments throughout the country. In each Demographic Census it is fully updated, also passing through a continuous process of occasional updates according to the demand of other surveys. Brazilian censuses are collected through a mobile device using address locations (mainly in urban areas) and coordinates (mainly in rural areas). The biggest gaps in geospatial information are those related to cadastral parcels and the location of buildings whose competence belongs to other

agencies of the federal government (rural areas) and municipalities (urban areas), therefore, the data is very dispersed and heterogeneous.

Principle 2. Geocoded unit record data in a data management environment

Since 1988, IBGE has had a cadastral reference database for the division of the national territory, the Bank of Territorial Structures (PT-BR: Banco de Estruturas Territoriais - BET). This database contains information on the genealogy of the geographies, their territorial hierarchy and also their geocoding. The bank is used for IBGE's census operations and investigations. The next step in the implementation of the GSGF at the national level is the integration of this database and others (addresses, coordinates, grid, scattered geographies / not registered in BET) with the Geographical Framework database. Currently, the feeding processes of the Geographical Framework database are carried out manually. In the near future, it is expected that the Geographic Framework will be automatically fed through the communication or integration of the different databases.

Principle 3. Common geographies for the dissemination of statistics

The common Geographies for the dissemination of statistics are established in the Geographic Reference Framework for the production, analysis and dissemination of statistics. The geographies are updated annually considering changes in the limits and nomenclature of the municipalities. The inflows and outflows of geographies of the Geographic Framework are also established. Part of these geographies are incorporated into IBGE's main statistics dissemination tool, the IBGE Automatic Recovery System - SIDRA.

Principle 4. Statistical and geospatial interoperability

Recently (2019), Brazil created the Central Data Governance Committee - (PT-BR: Comitê Central de Governança de Dados - CCGD; https://www.gov.br/governodigital/pt-br/governanca-de-dados / comite-central-de-governanca-de-dice) to govern the exchange of data within the federal public administration. Resolution CCGD / ME n. 5, of January 12, 2021 instituted the Address Database and the standardization of addresses. The resolution also prohibited the creation of new address databases by the Data Consumer Agencies, unless authorized by the Address Database Management Body. The geocoding of the IBGE municipalities was incorporated into the standardization of addresses. This geocoding is widely used by public organizations and private institutions in the country. IBGE recently responded to the Executive Secretariat of the Central Data Governance Committee, which approved the proposed Agreement with the CCGD with the aim of sharing data sets of countries, political-administrative division, regions and geographical typologies of IBGE, to the constitution of Basic Registries (Reference Register) - which will be instituted by means of a Resolution approved within the scope of the CCGD.

At IBGE, part of the geographies of the Geographic Framework are incorporated into IBGE's main statistics dissemination tool, the IBGE Automatic Recovery System (PT-BR: Sistema de Recuperação Automática do IBGE - SIDRA), the other geographies are Developing. Advances are needed in service-based access and especially in machine-readable mechanisms (eg via API).

Principle 5. Accessible and usable geospatially enabled statistics

It is expected that, in the publication of the results of the 2022 Census - compiled by addresses and coordinates - progress will be made in the provision of geospatially enabled statistics. Studies and

advances have been made to make the data available in web services in different geographies, including addresses and coordinates, respecting confidentiality. IBGE already has experience with web services (Statistical Grid - http://mapasinterativas.ibge.gov.br/grade/default.html; Interactive Geographical Platform- https://www.ibge.gov.br/apps/atlas_nacional/ , Status; Environmental Information Bank-BDIA - https://bdiaweb.ibge.gov.br/#/home) that will be improved for the dissemination of the Census results. More recently, tests and advances were made in geodashboards for the dissemination of data to combat the COVID-19 pandemic (https://covid19.ibge.gov.br/paineis-sintese/).

Your National Response to COVID-19

How has the GSGF supported your national response to COVID-19?

IBGE took the initiative to develop interactive panels that integrate geographies with COVID-19 cases (accumulated, weekly and daily), data on vulnerable populations, health infrastructure and other indicators produced by the Institution. Three geographical levels were used to present the information: that of the municipality, that of the Federation Unit and that of the Region in search of health services of low and medium complexity (https://covid19.ibge.gov.br/).

How could the GSGF have supported your national response to COVID-19, if it had been implemented? What were/are the barriers in its implementation?

What has already been implemented in the Geographic Framework served to support the construction of tools to combat COVID-19. It is understood that for the most effective implementation of the GSGF a greater integration between government institutions and their information systems is necessary. The integration promoted by the IBGE in relation to the fight against COVID-19 was one more step for the geographic information to be communicated with the statistics produced in the institutions. It is considered necessary to carry out work that extends the interoperability of data and systems..

Canada

Name of Agency: Statistics Canada
Submission From: NSO

The Overall Implementation of the GSGF

Different departments are aware of the GSGF.

The Implementation of the Principles of the GSGF

Principle 1: Use of fundamental geospatial infrastructure and geocoding

Current Status

- Statistics Canada's spatial data infrastructure (SDI) exists and includes some fundamental geospatial data. It contains roads, road names and address ranges from the National Geographic Database (NGD), as well as boundary arcs of standard geographic areas that do not follow roads, all in one integrated line layer. SDI also includes a related polygon layer consisting of basic blocks, boundary layers of standard geographic areas, and derived attribute tables, as well as reference layers containing physical and cultural features (such as hydrography, railroads and power transmission lines) from the NGD;

- Registers and spatial data infrastructure support the creation of high-quality, standardized location references for residential and non-residential addresses, building footprints and other location description;
- An x- and y-coordinate or a geographic area identifier are assigned to addresses, allowing georeferenced of each statistical unit (such as a person, household, business, and building) at the microdata/unit record level. A time and date stamp adds a temporal component to the statistical unit record;
- Common and practical method of address data capture decompose the address in separated fields for geocoding purposes;
- Standardized location references (e.g. x- and y- coordinates or geographic area identifier) of the addresses are stored in registers; and,
- Other fundamental geospatial data layers exist in the spatial data infrastructure such as physical infrastructure, environment, agriculture, health, justice, transportation networks and tourism areas.

What's Next

- The Enterprise Geospatial Platform (EGP) will become Statistics Canada's single-access point for fundamental and authoritative geospatial data in the agency;
- The EGP will replace and integrate the current Spatial Data Platform and National Geographic Database; and deliver geospatial layers as a service and store geo-enabled data in a data lake;
- National Building Layer will be added to Statistics Canada's EGP;
- A spatial file of address points from the National Address Register will be added to Statistics Canada's EGP;
- Spatial layers for Canada's critical and social infrastructure will be added to EGP;
- A near time version of the National Road Network will be part of the EGP; and,
- Statistics Canada will develop new standards for civic addresses and National Road Network that will used in the GOC.

Principle 2. Geocoded unit record data in a data management environment

The Statistical Geomatics Centre of Statistics Canada is responsible for developing corporate geographic files, mapping and address Web services supporting the collection, processing and dissemination activities of the Canadian Census of population, the Census of agriculture, and economic and social surveys.

The geographical reference frame combines data from different sources such as the National Geographic Database (NGD), the National Road Network files, Elections Canada and Statistics Canada business layers, Canada Post, Natural Resources Canada (NRCan) and provincial data suppliers. The geographic files are maintained so they can be referenced by geography vintages, which can be linked over time, and are updated quarterly with the latest available data within a secured data management environment. They include standardized variables, geographic identifiers and coordinates to allow geocoding records at collection or dissemination hierarchy levels, within Statistics Canada geography framework.

The geocoding Web services offered can be described as an address locator. The services allow for an address or partial address, place name, postal code, or section, township, range and meridian fields to

be provided and for which a geographic identifier (or multiple identifiers in the case of a partial address) is then returned. Mapping tools are also maintained from where a location is selected on a visual map and automatically geocoded. The precision of the geocoded results depends on either the specificity of the address fields provided or the identified location on the map, the address attributes in the reference data and the client target geocoding level needs. The database within the services are updated on a regular basis in order to permit the most accurate coding results.

The geocoded units will then allow for further statistical data integration of social and economic aspects towards analysis, data visualization and dissemination products.

Principle 3. Common geographies for the dissemination of statistics

Some of the geographic areas are national in coverage (e.g., federal electoral areas, provinces and territories, census collection units or enumeration areas). Others define a sub-set of the national territory based on regulatory requirements (e.g., provincially defined sub-municipal designated places) or delineation methodologies that define a statistical geography (census tracts, urban areas, census metropolitan areas). Other federal agencies and levels of government make use of the geographic areas maintained by Statistics Canada for statistical purposes, program development, implementation and delivery.

Legal/administrative: Geographies defined in national or sub-national laws or regulations. This type of geographic area is often termed administrative. These include: Provinces and Territories, Federal Electoral Districts, Census divisions (regional or upper tier municipalities), Census subdivisions (local or lower tier municipalities), Designated places. See the Geography Index of definitions for more information on these and other administrative geographies[2]

Geo-statistical: Geographies defined by a set of rules, or a methodology meant to represent a geographic concept (e.g., metropolitan or core-based functional areas, labour market areas outside of metropolitan regions or areas, neighbourhoods, urban, rural, a rural to urban continuum). This type of geographic area is often termed statistical.

Statistical geographies are typically defined by at least one or more statistical characteristics of an area. These include an optimal population count range (e.g., 400 to 700), minimum population concentration and density, or proxy measures as the use of journey to work or commuting data to determine the strength of the relationship between two areas. Census dissemination statistical geographies include: Geographic regions of Canada, Economic regions, Census of agriculture regions, Census metropolitan areas and census agglomerations, Population centres, Census tract, Dissemination areas and Dissemination blocks. See the Geography Index of definitions for more information on these and other statistical geographies[3].

[2] https://www12.statcan.gc.ca/census-recensement/2016/ref/dict/az2-eng.cfm?topic=az2
[3] https://www.tbs-sct.gc.ca/pol/doc-eng.aspx?id=16553

Future objectives – improving and expanding common geographies within the national statistical system:

- With the increasing use of integrated administrative data and geospatial information, we foresee reducing the needs for a collection geography by the Census and other programs that continue to use field survey collection methodologies.
- Research and development of new geographies and revision of existing geographies in order to meet national and international partners and stakeholders needs and national and international reporting commitments (e.g., Census, SDGs reporting, Sendai Framework): further classification of the rural to urban continuum – e.g., DEGURBA, index or remoteness, review of the metropolitan area delineation methodology with the focus on the use of other indicators or proxy measures (e.g., mobile data), rural and remoteness index, Indigenous geographies and additional small area geographic areas)
- Statistics Canada is considering a review of the grid-based approach (e.g., the Discreet Global Grid System) and its future integration into and use by the national statistical system. This latter point is key to ensuring that the advantages of a grid-approach are consistent with the evolving objectives of the Agency. The timing of this review is still to be determined.

Principle 4. Statistical and geospatial interoperability

Statistics Canada applies statistical metadata standard, the Generic Statistical Information Model (GSIM), referencing data in Statistical Data and Metadata Exchange (SDMX) for macrodata and Data Documentation Initiative (DDI) mechanisms for microdata (for external users such as researchers):

- Harmonized ISO 19115 - 2003 North American Profile (HNAP) metadata is a standard for geospatial data created by the Government of Canada[4]. This metadata format is a Canadian variant of the North America Profile of ISO 19115 2003, which has a defined XML schema that supports federal government requirements. Statistics Canada applies this standard.
- A Dissemination Geography Unique Identifier (DGUID) code[5] is used within Statistics Canada's Common Output Database Repository (CODR). The DGUID is a skeleton key for linking geospatial data and statistical data. It facilitates linking every geographic area maintained by Statistics Canada with data tables.
- Statistics Canada disseminates geographic boundary files are available as a Web Map Service[6], a standard developed by the Open Geospatial Consortium (OGC).

The use of geospatial data and methods in the statistical production process occurs at all the phases of the GSBPM.

Principle 5. Accessible and usable geospatially enabled statistics

Statistics Canada produces statistics that help Canadians better understand their country—its population, resources, economy, society and culture. In addition to conducting a Census every five years, there are about 350 active surveys on virtually all aspects of Canadian life. In Canada, providing statistics is a federal responsibility. As Canada's central statistical office, Statistics Canada is legislated to serve this function for the whole of Canada and each of the provinces and territories.

[4] Ibid
[5] https://www150.statcan.gc.ca/n1/pub/92f0138m/92f0138m2019001-eng.htm
[6] https://www.ogc.org/standards/wms

Objective statistical information is vital to an open and democratic society. It provides a solid foundation for informed decisions by elected representatives, businesses, unions and non-profit organizations, as well as individual Canadians. As a member of the United Nations Statistical Commission, Statistics Canada endorses the Fundamental principles of official statistics.

Statistics Canada applies the Directive on Open Government. The Open License governs the use of most data products and other materials that are published by Statistics Canada. This license allows users to use Statistics Canada information without restrictions on sharing and redistribution, for commercial and non-commercial purposes. We at Statistics Canada are committed to protecting the confidentiality of all information entrusted to us and to ensuring that the information we deliver is timely and relevant to Canadians.

On Statistics Canada web sites, there is Census geography covers a wide range of geographic areas—from provinces and territories down to blocks. These geographic areas have boundaries, names, and other information that make it possible to locate them on the ground and relate census data to them. For some products, information is available for current and previous censuses. These products are:

- Boundary Files depicting boundaries of standard geographic areas established for the purpose of disseminating census data and providing a framework for mapping and spatial analysis;
- The Road Network File depicts the digital road line coverage for Canada and provides a framework for mapping and spatial analysis;
- Interactive mapping applications that make it easy to find many places in Canada, see them on a map, and get geographic and demographic data for those places;
- Interactive thematic mapping applications;
- Tool used for data retrieval, query and tabular output that allows users to explore the links between all standard levels of geography; and,
- A system developed to allow census users to define their own custom areas (place of residence or place of work) and retrieve census data for it.

Statistics Canada geo-enabled statistics (Census and non-Census data) are now easily accessible on the public website using the new Canadian Statistical Geospatial Explorer (CSGE and CSGE hub). CSGE improves the discovery, access, analysis and visualization of geospatial enabled statistics (using a dynamic linkage between geospatial boundary files and data), and support analysis for decision-making. Users can easily explore Statistics Canada's data, visualize statistics spatially on maps, create their own custom maps, and download geo-enabled data into their own tools.

Your National Response to COVID-19

How has the GSGF supported your national response to COVID-19?

The integration of statistical and geospatial data is a crucial element to inform and facilitate data-driven and evidence-based decision-making during a pandemic. The maturity level of the GSGF in Canada allowed the national statistical office to support the national response to Covid-19 in a timely and responsive way.

Statistics Canada (Statistical Geomatics Centre - SGC) has co-leaded a multi-departmental geomatics task force to augment Public Health Agency of Canada geospatial and statistical data, tools and expertise capacity. This initiative was led by Public Health Agency of Canada (PHAC), Natural Resources Canada (NRCan) and Statistics Canada.

Through this collaboration a wide variety of public and internal products that integrated data from various sources were delivered.

Chile

Provided responses from both the NGIA and NSO.

National Geospatial Information Agency

Institution: Ministry of National Assets-SDI CHILE

Submission From: NGIA

The Overall Implementation of the GSGF

The Global Geospatial Statistical Framework has been implemented within the framework of the existing coordination between the National Coordination System of Territorial Information, equivalent to the Geospatial Data Infrastructure of Chile (SDI-Chile), and the National Institute of Statistics of Chile (NSO).

The Implementation of the Principles of the GSGF

Principle 1: Use of fundamental geospatial infrastructure and geocoding

Within the framework of the Road Axes Working Group coordinated by SDI Chile, a unique and public cartography of road axes with geocoding capacity has been developed. This collaborative work began in 2018, Project where it was possible to develop a methodology agreed between different public bodies, to obtain digital cartography of road axes. Thus, in 2019, 63 communes with geocoding capabilities were obtained, which are available with their respective metadata[7]. This year 2021, 16 new layers with geocoding capabilities have been added[8]. The participating institutions of this Working Group are:

- National Institute of Statistics (NSO);
- Ministry of Economy, Development and Tourism;
- Ministry of Public Works;
- Ministry of Housing and Urbanism;
- Ministry of Social Development;
- Internal Revenue Service (SII); and,
- Chilean Investigative Police (PDI)

Principle 2. Geocoded unit record data in a data management environment

This principle is implemented from the Political Administrative Division (DPA) of the country, which has a legal character, and the Census Division, which is operational in scope and allows to obtain a microdata level disaggregation.

[7] https://www.ide.cl/index.php/planificacion-y-catastro / item / 2041-street-master-2018
[8] https://www.ide.cl/index.php/planificacion-y-catastro/item/2027-maestro-de- streets-16-communes

(a) Political-administrative division: it is divided into smaller regions territorial units, which are divided, in turn, into provinces and finally, into communes. According to the current DPA, the country is made up of 16 regions, 56 provinces and 346 communes.

(b) Census division: for operational purposes, the communes are subdivided into smaller territorial units that allow the statistical survey to be better organized. The limits defined by the INE are supported and framed within the limits of the DPA according to the following:

i. Census district: it is an operational census division defined by the NSO. It is defined as the part into which the communal territory is divided and which constitutes the 7 largest basic unit for census field operations and statistical samples. The sum of the census tracts in the country is 2,771, which can be urban, rural and mixed. For the division of the districts, the general criterion is the number of dwellings in the urban area and the surface in the rural part;

ii. Geographic area (urban/rural): corresponds to the division within the districts between urban and rural areas that is expressed territorially through the Urban Census Boundary (LUC);

iii. Urban entity: an urban entity is understood to be a human settlement with continuity and concentration of buildings in a regular neighborhood with a population greater than 2,000 inhabitants, or between 1,001 and 2,000 inhabitants where less than 50% of the population that declares to have worked is engaged in activities primary;

iv. Rural entity: a rural entity is understood to be a human settlement with a population of less than or equal to 1,000 inhabitants, or between 1,001 and 2,000 inhabitants where more than 50% of the population that declares to have worked is engaged in primary activities. In addition, rural is defined as a smaller set of entities that meet the population criteria to be defined as urban, but not the requirements of blockage, continuity or concentration of buildings;

v. Census area: correspondence to the division of the urban census district and the urban area of the mixed census districts, formed by a conglomerate of blocks, whose purpose is to facilitate the organization, control and conducting of the census;

vi. Locality: corresponds to a geographical area with its own name of generalized knowledge. For purposes of a census database, it corresponds to the division of the rural census tract and the rural areas of the mixed census tracts. Both in the census zones and in the localities there is a lower disaggregation of population corresponding to blocks and entities respectively; and,

vii. Census blocks: basic geographic unit for statistical purposes that make up census zones in urban areas. It contains a group of adjoining or separate dwellings, buildings, establishments and / or properties, delimited by geographical, cultural and natural features.

Principle 3. Common geographies for the dissemination of statistics

This principle has been implemented through the definition of census blocks, which correspond to basic geographic units for statistical purposes, and which make up the census zones in the urban area.

In the case of a human settlement that is located within a locality (rural area), the entities are defined, which receives a proper name recognized by its inhabitants, and they differ from each other by the characteristics of their settlement (categories), their denomination and the functions that they carry out in the territorial scope.

In the search for more citizen territorial units that allow communities to understand and use statistical information, the NSO has developed a platform with 2017 census information and urban facilities at the NEIGHBORHOOD UNIT level, which are disseminated on the NEIGHBORHOOD DATA PLATFORM[9].

Principle 4. Statistical and geospatial interoperability

This principle is applied in some initiatives coordinated by IDE Chile:

- Geonodo Tool: open source web and mobile application, developed by the SNIT Executive Secretariat to create, publish, share, analyze and use territorial information. The objective of this tool is to be a provider node and thus increase the diversity of territorial information available to users and decision makers of SDI Chile. It should be noted that the current version considers statistical and geospatial interoperability; and,
- Multisectoral Working Group for Territorial Information in the Management of Emergencies, Disasters and Catastrophes (GTM): initiative whose objective is the coordination of territorial information to make it available to the participating actors, and in this way support the different actions within the framework of an emergency. It should be noted that this instance has considered statistical and geospatial integration and interoperability in the different events in which the group has been activated.

Principle 5. Accessible and usable geospatially enabled statistics

The NSO has statistical information represented through maps, which is available on the "Maps Portal" site[10]. Here are available various maps with statistical, census and quality of life information, their distribution and behaviour in the national territory, in addition to the download of data published in different formats and documentation of different types, useful for consultation, analysis and taking decision making.

Your National Response to COVID-19

How has the GSGF supported your national response to COVID-19?

The existing initiatives within the GSGF in our country have allowed statistical information to contribute to the epidemiological management of the COVID-19 pandemic. The collection and access to demographic data have supported decision-making for the planning, implementation, and evaluation of measures implemented by the health authority, with the aim of establishing a policy for the prevention and control of the pandemic.

Another important aspect to highlight has been the contribution of statistical information for the programming, prioritization of the different age groups and the projection of the vaccination process against COVID-19 in our country, which has been very highlighted for its successful progress.

[9] https://ine-chile.maps.arcgis.com/apps/opsdashboard/index.html#/ee7c8fc3d7aa421eb75380492809dceb
[10] https://www.ine.cl/herramdamientos/portal-de-mapas

How could the GSGF have supported your national response to COVID-19, if it had been implemented? What were/are the barriers in its implementation?

The implementation of the GSGF would have contributed to having more updated statistics, disaggregated and known by all public institutions, to support the design and implementation of the different public policies that have been established during the pandemic period. Contributing to the efficiency and effectiveness in the use of resources.

National Statistical Office

Institution: Instituto Nacional De Estadísticas (Ine)

Submission From: NGIA

The Overall Implementation of the GSGF

The implementation from the Statistical Office has been developed through the strategic project of the institution called "MULTIPURPOSE GEOSTATISTIC PLATFORM", whose objective is to implement a computer platform that allows the integration of statistical and geographic information, its governance and dissemination to the different levels of the state and the general public. The specific goals are:

Objective 1: Propose a technological infrastructure that supports the proposed platform;
Objective 2: Define standards and protocols for: the gathering, processing and dissemination of geographic information;
Objective 3: Build and have a street name and address nomenclator, and a georeferenced frame of buildings;
Objective 4: Build and have an information geolocation tool based on information from the NSO;
Objective 5: Build a web tool that allows the generation of automated cartography for the national employment survey and household surveys;
Objective 6: Improve and add functionalities to web map tools to disseminate digital cartography; and,
Objective 7: Diversify the integration of administrative records from external institutions as an input for the continuous updating of the cartography.

The Implementation of the Principles of the GSGF

Principle 1: Use of fundamental geospatial infrastructure and geocoding

After the 2017 census, an infrastructure has been implemented whose core is based on the location of buildings, with the basic attribute of addresses, whose normalizations are based on a relational database structure standard at three levels: main addresses (eg : building entry), secondary addresses (eg: apartments) and uses/occupation within the units (eg: a home and a workshop).

The address database currently has approximately 8 million records associated with a single block and exact coordinates for 50% of the directory, which are in a process of continuous updating which is expected to finish by the end of 2022, as a fundamental input for the 2023 census survey.

Within this infrastructure, coordination with CHILE SDI has been fundamental, mainly in the generation of a base standard for street names[11]

Principle 2. Geocoded unit record data in a data management environment

This principle has been developed mainly through the dissemination of the census territorial structure, which has a series of layers of information that make up the cartographic base of the national territory, considering for this from the political-administrative division to the levels of urban blocks and entities rural[12].

Principle 3. Common geographies for the dissemination of statistics

In the process of looking for more citizen territorial units that allow communities to understand and use statistical information, the NSO has developed a platform with 2017 census information and urban equipment at the level of NEIGHBORHOOD UNITS, which are disseminated on the NEIGHBORHOOD DETAIL[13].

Principle 4. Statistical and geospatial interoperability

The progress made by the SDI in this principle is related to two relevant areas:

1) Internal development through the creation in 2017 of the Department of Geography, a unit in charge of governance, standards and dissemination of geospatial information inside and outside the institution. In addition, in 2019 the creation of regional infrastructure units is formalized, where the deconcentration of geographical functions in regions is developed, initiating the decentralization process with a view to greater autonomy in the long term; and,
2) Active participation in inter-institutional coordination through CHILE SDI, through the adoption of geographic information standards, participation in thematic worktables and participation in the emergency committee mainly.

Principle 5. Accessible and usable geospatially enabled statistics

Since the end of 2019, the SDI has made geospatial information available through an open data platform in order to facilitate use and interoperability. In the following link access to the open geodata platform[14].

Your National Response to COVID-19

How has the GSGF supported your national response to COVID-19?

Principle N ° 5: an application of disaggregated geospatial data queries has been carried out, whose focus is vulnerable populations and places with potential concentration of people, in addition to the integration with epidemiological data of the pandemic, whose source of information is CHILE SDI[15].

[11] https://ine-chile.maps.arcgis.com/apps /webappviewer/index.html?id=f0acf68eea8c411b9f1d270fcf53a62d
[12] https://ine-chile.maps.arcgis.com/apps/webappviewer/index.html?id=bc3cfbd4feec49699c11e813ae9a629f
[13] https://ine-chile.maps.arcgis.com/apps/opsdashboard/index.html#/ee7c8fc3d7aa421eb75380492809dceb
[14] https://www.ine.cl/herramdamientos/portal-de-mapas
[15] https://ine-chile.maps.arcgis.com/apps/dashboards/e8292e6a13814b6b8bcfd3415ef4eb02

How could the GSGF have supported your national response to COVID-19, if it had been implemented? What were/are the barriers in its implementation?

One of the SDI's barriers to providing more relevant support to the response to the pandemic has been the inability to make all the spatially disaggregated information available to the institution given the restrictions linked to the law of statistical secret policy.

Colombia

Institution: National Administrative Department of Statistics DANE

Submission From: NSO

The Overall Implementation of the GSGF

DANE - Colombia has the MGN National Geostatistical Framework in order to promote the integration and dissemination of statistical and geospatial information, based on the georeferencing of statistical information with the corresponding geographic locations, associating statistical data to the space of the area of land that originates it.

Additionally, the MGN supports the exchange of data to obtain a more efficient production of data, and is presented as the mandatory spatial reference framework for the entities that are members of the National Statistical System in Colombia.

The general characteristics of the National Geostatistical Framework are described below:

- Covers the entire surface of the country.
- Identify urban and rural areas.
- It facilitates different levels of geographic disaggregation.
- It is constituted by the codification of the political-administrative division of Colombia, Divipola.
- The levels of geographic disaggregation have a unique identification code, which allows association with census data.
- It should be clarified that the legal support for a National Data Infrastructure to support this process is under construction.

Figure 1 Colombia's National Geostatistical Framework

The link to consult and download information from the MGN is available at the following link: https://geoportal.dane.gov.co/geovisores/territorio/mgn-marco-geoestadistico-nacional

The Implementation of the Principles of the GSGF

Principle 1: Use of fundamental geospatial infrastructure and geocoding

The National Geostatistical Framework is made up of administrative geographic units (departments, municipalities, municipal capitals, populated centers, dispersed rural areas, among others), mainly delimited by natural and cultural accidents, and that are identifiable in the field, with their respective coding and statistics that facilitate the process of collecting and controlling statistical information (Figure 2).

This process includes the spatial reference to the different units that make up the MGN, as well as the capture of georeferenced information through their coordinates, using GPS devices.

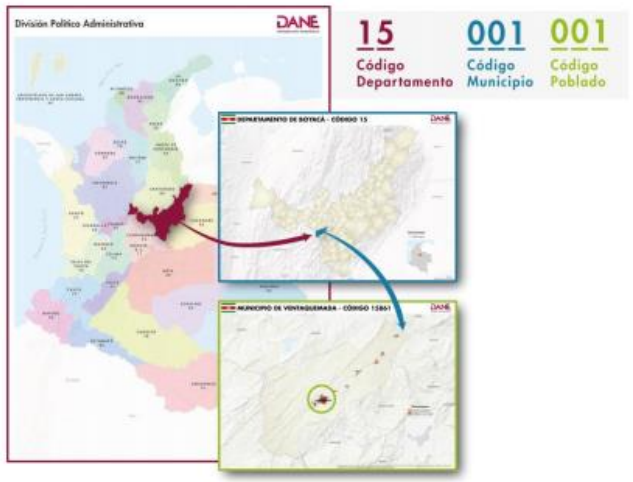


Figure 2 Structure of the geocoding environment in the MGN

Principle 2. Geocoded unit record data in a data management environment

The statistical microdata of the census operations, and some derived from the surveys, are geospatially enabled, that is, they have their georeferencing associated with the coordinates or area unit of less aggregation, for their flexible use in analysis, visualization and dissemination, supported by the implementation of processes that guarantee the statistical reserve.

Therefore, the anonymization process establishes the necessary measures to guarantee the security of the data, files and databases that contain sensitive information, to reduce the vulnerability to risks of particular identification of the source, as well as its possible destruction or alteration.

Principle 3. Common geographies for the dissemination of statistics

Implementation of this principle is ongoing. Currently, the common geographies with other sources include the main territorial levels, such as departments and municipalities, the latter as a minimum level of aggregation as common geography.

It should be noted that the exchange of information between organizations requires agreements between them to define the structures required in the exchange of data. In this sense, no methods have been established to convert data between geographies through standard conversion mechanisms (by correspondence).

Principle 4. Statistical and geospatial interoperability

DANE has a website[16] to access different geoservices and geo-viewers of information that DANE produces from its statistical operations, such as sample surveys, censuses and derived statistics. The site includes public information produced by DANE, using international standards such as Open Geospatial Consortium and Creative Commons License, to download and use georeferenced information.

DANE will continue to develop efforts to strengthen geospatial information in the production and dissemination of statistical information. Consequently, the entity will guarantee the availability of statistical information to the public and will recommend its implementation and adaptation to the National Government.

[16] https://geoportal.dane.gov.co

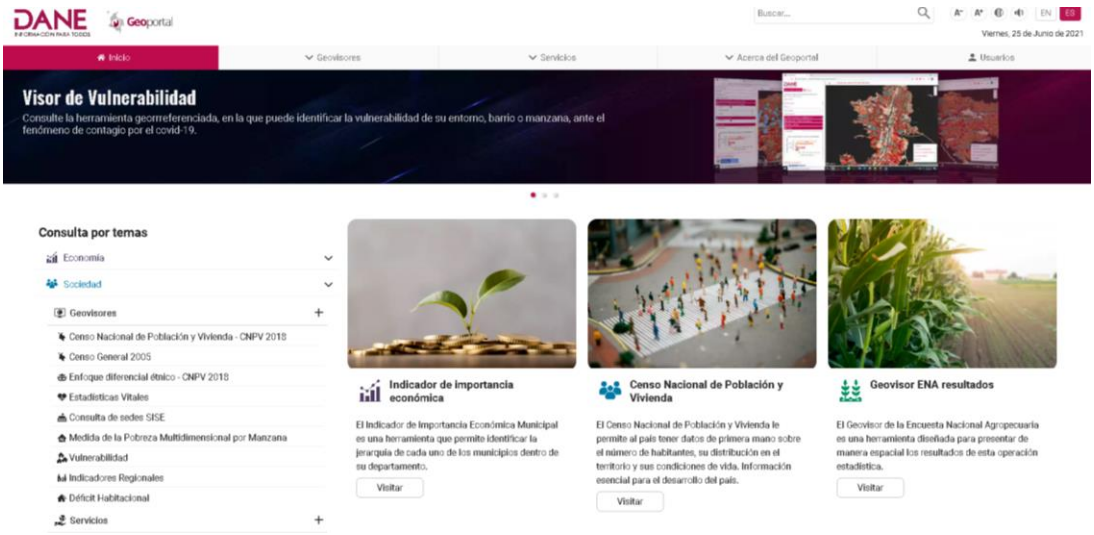


Figure 3 DANE's Geoportal

Principle 5. Accessible and usable geospatially enabled statistics

DANE has geoviewers and geographic services to facilitate the consultation, visualization and download of statistical and geospatial information, through sections classified by thematic categories. The geoviewers are easy to use and access, which allows the consultation, geo-visualization, analysis and download of robust information reaching levels of detailed disaggregation, guaranteeing access to different types of users, such as researchers, decision makers, territorial authorities and environmental , as well as the community in general.

Another outstanding product is the interactive thematic maps, generated in story map templates, for a dynamic geo-visualization, accompanied by graphics and other multimedia elements. Additionally, the DANE Geoportal has web map services, geographic metadata catalog, mobile applications for the collection and control of coverage, among others, being a support tool for the different phases of the statistical process, operating under safety and reliability standards.

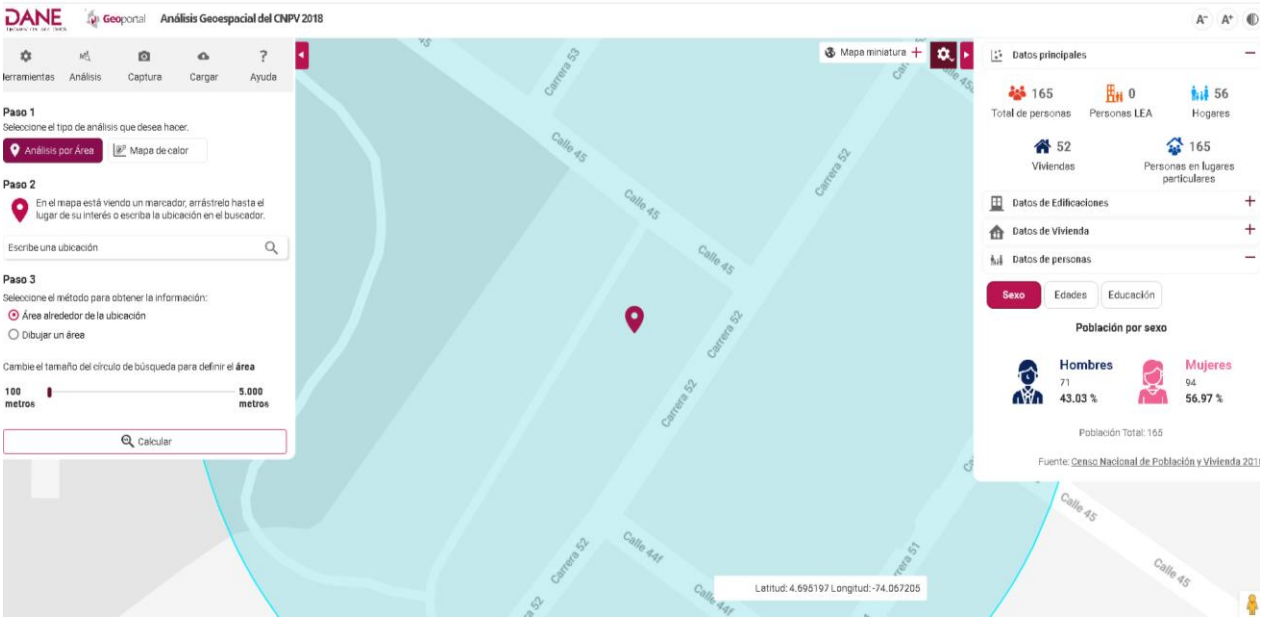


Figure 4 Geospatial analysis geovisor with information from the 2018 Population Census

Your National Response to COVID-19

How has the GSGF supported your national response to COVID-19?

The National Administrative Department of Statistics DANE and other government entities developed a geovisor of the vulnerability index to COVID-19[17], which allows knowing where the population is located, which due to its demographic and health characteristics could have more complications to contract the virus at a higher degree of disaggregation.

For the construction of the vulnerability index, which can be viewed at the block level of the municipal capitals, information from the National Population and Housing Census -CNPV- 2018 was used, with administrative records (the National Identification File -ANI- and the Civil Registry of Birth -RCN- of the National Registry of Civil Status; the Unique Database of Health Affiliation -BDUA-; and the individual records of health services provision -RIPS).

According to demographic variables, population comorbidities and population density, each block of the municipal capitals is located in one of the five levels of vulnerability: low, medium-low, medium, medium-high and high.

[17] https://visor01.dane.gov.co/visor-vulnerabilidad/

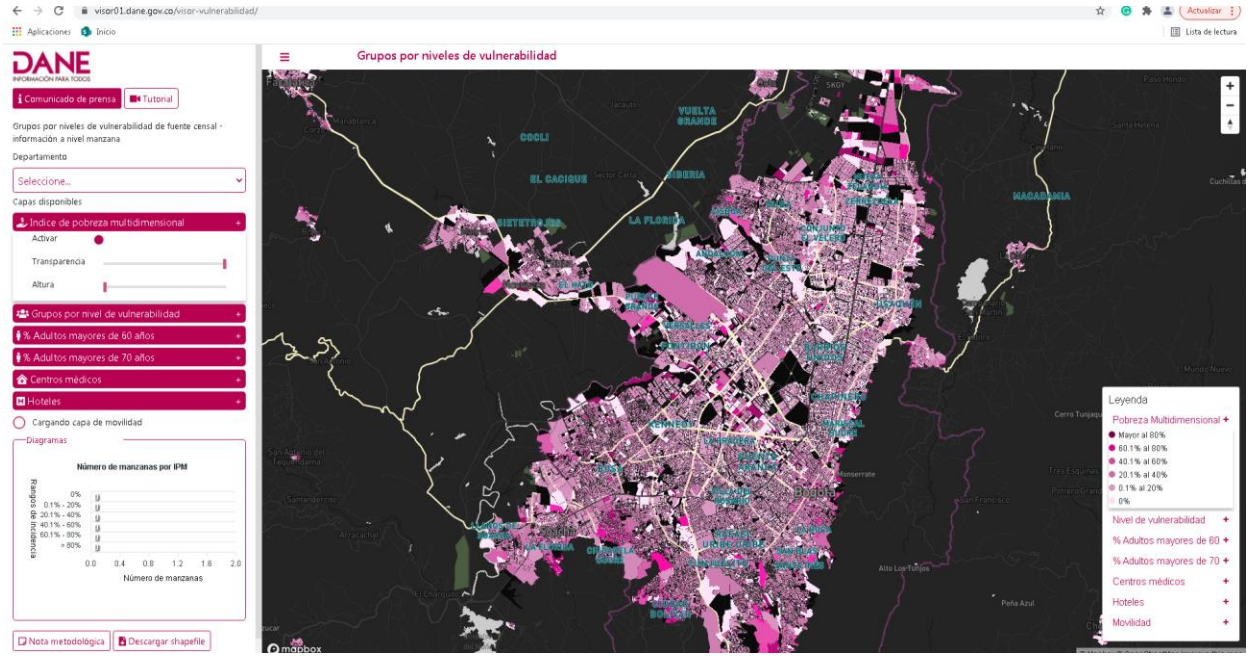


Figure 5 Geovisor of groups by vulnerability levels

How could the GSGF have supported your national response to COVID-19, if it had been implemented? What were/are the barriers in its implementation?

Yes, the GSGF has supported our national response to COVID-19 to provide harmonized and standardized geospatial information.

The barriers to implementation are associated with the complexities in the use of sensitive information corresponding to the pathologies of each patient, coming from individual records of the provision of health services.

Costa Rica

Institution: National Geographic Institute / National Institute of Statistics and Censuses

Submission From: Combined NGIA/NSO

The Overall Implementation of the GSGF

The GSGF is in a fairly incipient stage of development, since as NGO and NSO are independent institutions, their mission and vision are well differentiated in their objectives by law. Isolated joint work efforts have been made at other times, but these have also been promoted by external entities such as UN-GGIM. An example of this was the collaborative work that was carried out in 2018 within the framework of the MEGA Project (Statistical and Geospatial Framework for the Americas). Where the ANIG provided the official information of the political-administrative division at the country, province and canton level, and the NSO provided data on total dwellings, total population, population by men, population by women. All data were delivered according to the standards of the MEGA Project.

In addition to those mentioned, there is a legal framework between NGO and the NSO, which is an inter-institutional cooperation agreement, in which both institutions are empowered to exchange information to further the objectives of each institution.

The Implementation of the Principles of the GSGF

Principle 1: Use of fundamental geospatial infrastructure and geocoding

At the ANIG level, the Costa Rican Spatial Data Infrastructure (IDECORI) has been created, which is legally supported by a Decree of the Republic:

> *"IDECORI will be an inter-institutional coordination mechanism of ANIG that will integrate geographic information, considering the legal framework, policies and resources of the public, private and university higher education sectors, producers and users of geographic information from the national continental and marine territory"… "Its primary objective will be to promote the management of quality data and geographic information of national interest to strengthen decision-making in all fields of public and private policy; as well as articulate, harmonize, arrange, reuse the generation of products, geoservices and publication of fundamental, thematic and general data, duly standardized, georeferenced and compatible ".*

There are also technical regulations created for the classification of geographical objects, such as the Catalog of Geographical Objects of Costa Rica and an Official Profile of Geographical Metadata for Costa Rica. To date, Costa Rica does not have a standardized coding system to give addresses in the country. Directions from landmarks known to most people continue to be used.

Principle 2. Geocoded unit record data in a data management environment

At the NSO level, a coding for disaggregated units has been implemented, which contains the codes referring to province, canton, district and Minimum Geostatistical Unit (UGM), which is a unique code for each geographic unit.

Principle 3. Common geographies for the dissemination of statistics

It has been based on what is cited in Law 9694 of the National Statistical System, which establishes in all public institutions, the publication of data at least at the level of disaggregation of province, canton and district.

Principle 4. Statistical and geospatial interoperability

This point is in an incipient phase, of methodological adaptation for the integration of statistical and geospatial data. The census is awaited for the implementation of results through geostatistical information.

Principle 5. Accessible and usable geospatially enabled statistics

Currently, only statistical and geospatial information regarding socioeconomic variables of districts with extreme poverty is associated and they are disseminated through the Information Systems and Statistical Dissemination Area.

Your National Response to COVID-19

How has the GSGF supported your national response to COVID-19?

Within the framework of the Integration of Statistical and Geospatial Information in Central America project, an exercise was carried out, where, in the framework of the COVID-19 pandemic, the ngo and NSO institutions worked together with the union of the geospatial variables and statistics that were requested in the project. The institutions that sponsored this study were the Pan American Institute of Geography and History and the UN-GGIM Americas with the support of DANE of Colombia. The NGO provided the official information of the four administrative levels of Costa Rica (Country, Province, Canton, District) and the NSO provided the statistical data of the following variables: population over 60 years of age; obese population; population with heart and respiratory problems, diabetes; population without access to drinking water, without access to sewerage; population with overcrowded housing; population density in proportion and integer.

The idea of this exercise was to calculate the vulnerability indices for each administrative unit.With the support of the institutions involved, plus the technological contribution of ESRI, a HUB was created within the ArcGis Online environment where the products and results obtained were uploaded, which were represented with Story Maps and Dashboards which in a Very interactive they showed the results obtained.

This exercise demonstrated that NGO and NSO can work in a coordinated manner to obtain results, which can eventually be used for decision-making at different levels in the country.

How could the GSGF have supported your national response to COVID-19, if it had been implemented? What were/are the barriers in its implementation?

The main support of the GSGF would have been in the decision-making and identification of priority geospatial units, to direct the main efforts to contain COVID-19. The main barriers that could be identified were:

- Not having up-to-date data on socioeconomic and health variables available in the country;
- Health data is administered by the Ministry of Health, which is the official institution that manages the population's health variables, therefore, access to them is not so agile to be able to use them at any time; and,
- NGO and NSO are independent institutions with particular objectives within their legal system and therefore, they must fulfil them according to their mandate. It is through coordination and cooperation mechanisms that both institutions have occasionally worked when necessary. For this, there is a cooperation agreement between both institutions.

Cuba

Institution: National Office of Hydrography and Geodesy
Submission From: Combined NGIA/NSO
National Office of Statistics and Information (ONEI)
National Office of Hydrography and Geodesy (ONHG)

The Overall Implementation of the GSGF

In our country we consider that the implementation of a GSGF would be very effective and important for decision making, giving us the possibility to carry out new work modalities, thanks to the benefits it offers us, at the moment we are working on pilot projects, case studies with the aim of preparing and being able to implement an Integrated Geospatial Information Framework. In addition, we all know that geospatial information provides a unique perspective to analyse events and processes that take place on a territory, allowing each event to be located in its geographical position, which is essential to establish relationships between processes and support decision-making. The new technologies of spatial information provide precise, detailed and fast information of great utility for the evaluation of situations and the management of resources.

The Implementation of the Principles of the GSGF

Principle 1: Use of fundamental geospatial infrastructure and geocoding

In the country, the principles of the GSGF are being developed with the objective of facilitating the implementation and use of the reference of statistical units. For which several procedures are being used to obtain its geolocation:

- Census / statistical geographic areas;
- Cadastral plots;
- Geographies of the administrative political division; and,
- Georeferenced constructions / buildings.

Principle 2. Geocoded unit record data in a data management environment

As mentioned in the previous question, the country is in the process of designing and creating a National Geostatistical Framework, as well as the creation and implementation of the National Geostatistical Framework, it will allow the integration of data from a wide variety of information, such as statistics, socio-economic, environmental and demographic.

Incorporating these data, using geospatial processing, can generate new geospatially-enabled statistical variables and indicators for analysis.

Principle 3. Common geographies for the dissemination of statistics

Work continues on strengthening the updating of the various geographic areas (thematic layers) in the national cartographic agency and other institutes and organizations producing specialized cartography that will strengthen the process of integration, analysis, interpretation, visualization and dissemination of information.

Principle 4. Statistical and geospatial interoperability

This principle calls for the use of internationally adopted standards and good practices from both communities to enable greater interoperability of statistical and geospatial data, standards, processes, and organizations.

Still in our country it is necessary to improve the definition, access and use of geospatially enabled data. To achieve interoperability of data, it is necessary to eliminate obstacles and define policies and legislation that facilitate and promote cooperation between the different actors.

Principle 5. Accessible and usable geospatially enabled statistics

At the moment there is a national SDI and several institutional SDIs that provide information, but their development and use must be encouraged. The ONEI has designed an application where Census information is disseminated, requiring further development in other areas of information beyond demographic, with the aim of greater dissemination of statistical information from geospatial web services.

Your National Response to COVID-19

How has the GSGF supported your national response to COVID-19?

As explained above, the GSGF is being developed in our country, because its implementation would bring many benefits to our work, in any case, our country created a geoinformatics platform called Andariego Higia to face health disasters which is aimed at give a quick response of geo-referenced geographic information for the analysis of impacts of this type, which facilitates decision-making by the Government at different levels.

For the management and analysis of epidemiological information. The Andariego Higia Web GIS for the management of epidemiological files and other related information is personalized on the Andariego Fénix platform, which has the technology for creating dynamic models in real time. This allows the user to model concepts in the system, as well as easily adapt to future changes. In particular, it is configured for the management of information concerning the development of the Covid-19 disease in Cuba. The main interface of the system allows access to the different functionalities that facilitate, among others, the management of: people, epidemiological files, suspicions, confirmed cases, post-hospital surveillance, investigations, vaccine consent, EA Vaccine Survey, EAG notification to CECMED, Hospitals, Health Areas, Clinics, Specialized Centers and Isolation Centers.

How could the GSGF have supported your national response to COVID-19, if it had been implemented? What were/are the barriers in its implementation?

Having already created a Global Geostatistical Spatial Framework, faster and more effective decisions could be made, but nevertheless our country continues to prepare to implement a GSGF with the help of you and your experiences.

Dominican Republic

Provided responses from both the NGIA and NSO.

National Statistical Office

Institution: National Statistics Office (ONE)(NSO)

Submission From: NSO

The Overall Implementation of the GSGF

Our country has not implemented the GSGF, some efforts have been made for its implementation but it has not been possible.

Yes, the statistical data is linked to the geospatial, which allows us to make comparisons at all territorial levels, from region to neighbourhoods or places, exchange data through the interoperability of statistical and geospatial information between institutions, but a framework Generally, as such, we do not have.

The Implementation of the Principles of the GSGF

Principle 1: Use of fundamental geospatial infrastructure and geocoding

Spatial information is geocoded according to the official territorial distribution, allowing integration with statistical data at the national level.

Principle 2. Geocoded unit record data in a data management environment

The data are spatially linked, using territorial units as a basis, so that the specific coordinates of where the data occurred can be obtained

Principle 3. Common geographies for the dissemination of statistics

The common geography for statistical distribution and dissemination that we use are administrative areas.

Principle 4. Statistical and geospatial interoperability

Statistical data are perfectly linked to spatial information through the standardization of territorial units.

Principle 5. Accessible and usable geospatially enabled statistics

In accordance with good practice standards, statistical data integrated into spatial information is easily accessible through our data sharing means.

Your National Response to COVID-19

How has the GSGF supported your national response to COVID-19?

It has been possible to carry out analysis to identify areas of great impact of COVID-19, allowing the mitigation of those areas.

How could the GSGF have supported your national response to COVID-19, if it had been implemented? What were/are the barriers in its implementation?

Although we do not have a GSGF, as such, with the progress made we have been able to provide valuable information so that the government can respond to the population and attack COVID-19 from its different environments.

National Geospatial Information Agency

Institution: National Geographical Institute Jose Joaquin Hungria Morell

Submission From: NGIA

The Overall Implementation of the GSGF

Within the Statistical and Geospatial Framework of the Americas (MEGA), the José Joaquín Hungary Morell National Geographic Institute (IGN-JJHM) has provided the coverage of administrative political limits at the national, provincial and municipal levels and their link with the demographic data defined jointly for all countries that have assumed the MEGA.

The existing institutional relationship between the IGN-JJHM and the National Statistics Office (ONE)(NSO), as technical bodies attached to the Ministry of Economy, Planning and Development, currently facilitates and impels the efficient implementation of the GSGF, through joint work.

In the same order, the IGN-JJHM and within the facilities and opportunities offered by the Spatial Data Infrastructure, considers as a fundamental part of its implementation to incorporate and consider the standardization of statistical data, alliances between instances for the access and use of administrative records, reliability agreement for focused disclosure within SDI services.

The Implementation of the Principles of the GSGF

Principle 1: Use of fundamental geospatial infrastructure and geocoding

The José Joaquín Hungary Morell National Geographic Institute (IGN-JJHM) is currently executing with technical assistance from the World Bank and funds from the European Union, in which several initiatives converge. Among them: elaboration of a national geographic information policy, definition of fundamental data (administrative political limits, addresses and postal codes, cadastral information, among others), quality model, catalog of objects and representation, updating of the Dominican Profile of Metadata.

In order to maintain coherence with the ONE(NSO), for the coding of geographic objects and their representation, and their consequent organization within the quality model, we have adopted the codes already established and made them official, this has helped maintaining and optimizing the connection between both instances.

Principle 2. Geocoded unit record data in a data management environment

Result of the cataloguing of objects based on the ISO 19110 Geographic Information standard, the IGN-JJHM promotes and promotes the management of data in a secure and interoperable way. Likewise, the

political-administrative units of municipal districts, sections and places will be included to achieve, through a greater disaggregation of the data, to have more real, exact and reliable information.

Principle 3. Common geographies for the dissemination of statistics

Within the attributions of the IGN-JJHM, it appears the one to elaborate the official map of the country and the concern to the political and administrative limits. In this sense, work is being done on the revision of its geometry, jointly with the governmental instances whose responsibilities are framed in a geographic space of a sectorial scope. Likewise, a base cartography project has been submitted at a scale of 1: 25,000 and 5,000, in order to count and have disaggregated data for greater usability in the institutions.

Principle 4. Statistical and geospatial interoperability

One of the most significant initiatives that we are executing is the elaboration of the methodological guide for the creation of the geographic gazetteer, supported within the technological infrastructure of the integrated SDI as well as its services to citizens, in an environment of interoperability, access and visualization. This tool facilitates the incorporation of geocoded statistical data.

Principle 5. Accessible and usable geospatially enabled statistics

In the formulation of the national geographic information policy, the implementation of the standardization of geospatial data management processes is contemplated to achieve better levels of quality and interoperability, promoting governance mechanisms for inter-institutional articulation, in a political and legal framework. that governs the organization, procedures and agreements for the management of geospatial data.

Your National Response to COVID-19

How has the GSGF supported your national response to COVID-19?

Since April 2020, the IGN-JJHM, through the NGO Arcoiris, hired by the Ministry of Health and its General Directorate of Epidemiology for the geolocation of COVID-19 cases, has been working on the registry of cases contagion and in the process of incorporating the data to institutional portals[18].

How could the GSGF have supported your national response to COVID-19, if it had been implemented? What were/are the barriers in its implementation?

The existence of a link between the demographic data of the geocoded territorial localities would have meant greater efficiency in responses and interventions, facilitating the identification of the most exposed and vulnerable areas, allowing a better targeting of control measures, greater efficiency in assistance to those affected and better follow-up and monitoring of the development of the virus.

Traditionally, the weakness and / or absence of inter-institutional and inter-sector coordination for the access and availability of data and information is evident, which has signified one of the obstacles with the greatest impact on the effective execution of initiatives that require a joint response from the authorities.

[18] https://datos-publicos-coronavirusrd.hub.arcgis.com

Currently the IGN-JJHM leads a proposal for an agreement with the Ministry of Health through the General Directorate of Epidemiology to form an alliance, in order to share and access the administrative records of infectious-contagious diseases, so that data is available associated with territorial demarcations.

NB: The documents referenced are in the development phase. The scheduled date for their conclusion is in the month of September of this year, and they will be available on the SDI-RD page.

Ecuador

Institution: Military Geographical Institute (IGM), National Institute of Statistics and Censuses (INEC)

Submission From: Combined NGIA/NSO

The Overall Implementation of the GSGF

In Ecuador, we are in an early stage of implementation, with the first conversations about the GSGF among stakeholders. Such is the case that in 2018 the first technical assistance workshop was held to strengthen the use of geospatial and statistical information in decision-making and Public policies on the Framework with the collaboration and technical assistance of ECLAC and the participation of the main State entities that generate geoinformation and / or related to statistics. INEC has been working on a project to implement a National Geographic - Statistical Framework, in which various aspects of the GSGF have been considered; mainly considering the good practices acquired over the years.

The Implementation of the Principles of the GSGF

Principle 1: Use of fundamental geospatial infrastructure and geocoding

The production and dissemination of Geographical information of the territory is guided by the provisions of the Geographical Framework Data of Ecuador (detailed by Executive Decree): https://iedg.sni.gob.ec/geoportal-iedg/documentos/matriz_datos_geograficos_marco.pdf

The production of statistical data, including geospatially enabled statistical data geocoded at the block and census building level, this information is georeferenced and coded according to the territorial organization of the country (province, canton, parish) and the statistical divisions (zone, sector and block): https://www.entaciónrencifras.gob.ec/institucional/home Currently the country does not have an address standard, however the use of global address systems has been explored.

Principle 2. Geocoded unit record data in a data management environment

Ecuador's statistical information is geospatially integrated by linking to a unique code, according to the level of disaggregation of statistical operations. Territorial organization (province, canton and parish) and the statistical units (zone, sector, block and building), which are coded. The information is stored in databases and geographic databases (Figure 6).

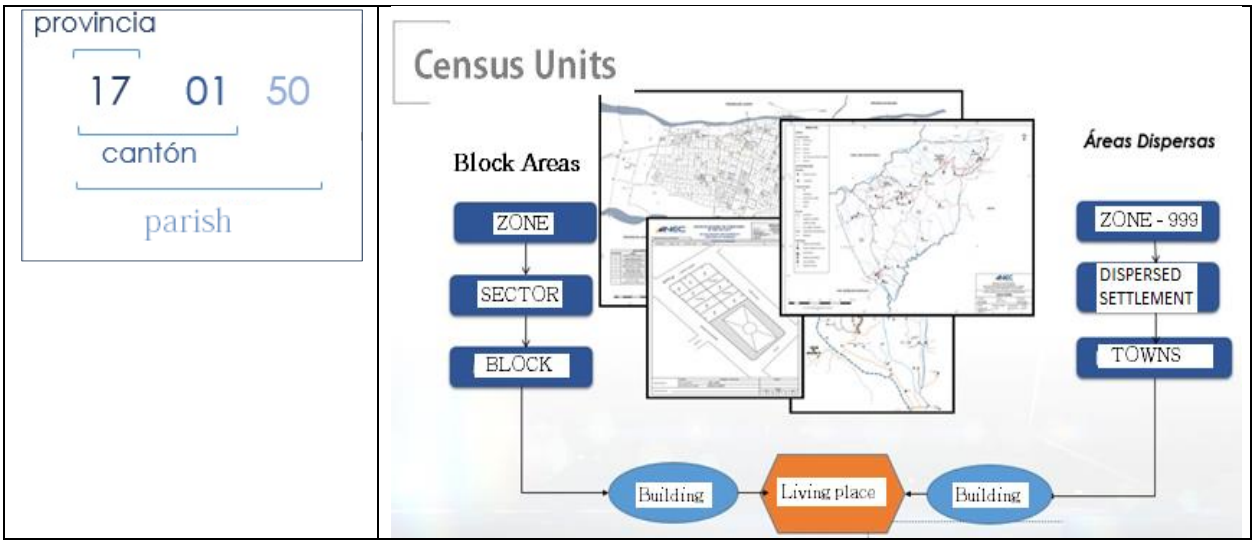


Figure 6 Geocoding statistical records

Principle 3. Common geographies for the dissemination of statistics

Administrative Geographies are used. The official information provided by the National Committee of Internal Limits (CONALI) is used, for the dissemination of statistics the territorial organization of the state (province, canton and parish) is used. Regarding methodologies, statistical operations enable the dissemination of methodologies through an official website. Figure 7 illustrates Ecaudor's Multipurpose Survey Source: https://www.entaciónrencifras.gob.ec/encuesta-nacional-multiproposito-de-hogares; and Poverty: https://www.entaciónrencifras.gob.ec/pobreza-dic Diciembre-2020.

Figure 7 Ecuador's Multipurpose Survey and Poverty Resources

With regard to metadata, they are currently generated according to the Ecuadorian Metadata Profile (PEM) in Geonetwork. Source: https://iedg.sni.gob.ec/geoportal-iedg/documentos/perfil_ecuatoriano_metadatos_pem.pdf. These are augmented by documented internal quality controls.

Principle 4. Statistical and geospatial interoperability

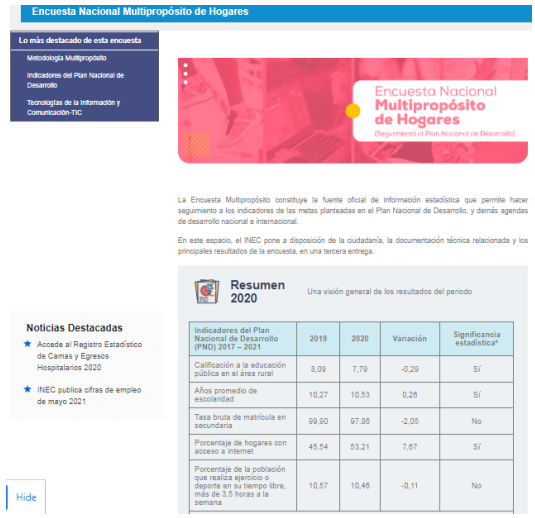
Regarding the geospatial field, work has been done since 2004 with the creation of the National Council of Geoinformatics (CONAGE), whose main objective is the creation, maintenance and updating of the Ecuadorian Geospatial Data Infrastructure (IEDG) (Source : *https://iedg.sni.gob.ec/geoportal-iedg/inicio.html*). The IGM is a member of the Coordinating Committee and Technical Secretary of CONAGE.

In the Geographic field, several technical, legal, and organizational aspects have been defined that help in interoperability, such as the establishment of the National Geospatial Information Policies (Source: *https://iedg.sni.gob.ec/geoportal-iedg /documentos/Estandares_de_informacion_geografica_cap1.pdf*) and various technical documents that can be reviewed here: *https://iedg.sni.gob.ec/geoportal-iedg/biblioteca.html*

In the statistical field, INEC is currently building its interoperability structure in accordance with the geospatial policies established by the IEDG. Since 2020, it began with a diagnosis to implement an institutional IDE, and this year we are working on the implementation of the Geoportal.

Principle 5. Accessible and usable geospatially enabled statistics

In the statistical field, INEC is currently building its interoperability structure in accordance with the geospatial policies established by the IEDG. Since 2020, it began with a diagnosis to implement an institutional SDI, and this year we are working on the implementation of the Geoportal. It is available through the official INEC website https://www.entaciónrencifras.gob.ec/estadisticas, published statistical information and geographic - statistical information (Source: https://www.entaciónrencifras.gob.ec/geografia-estadistica) in different formats, databases, methodologies, and other relevant information.



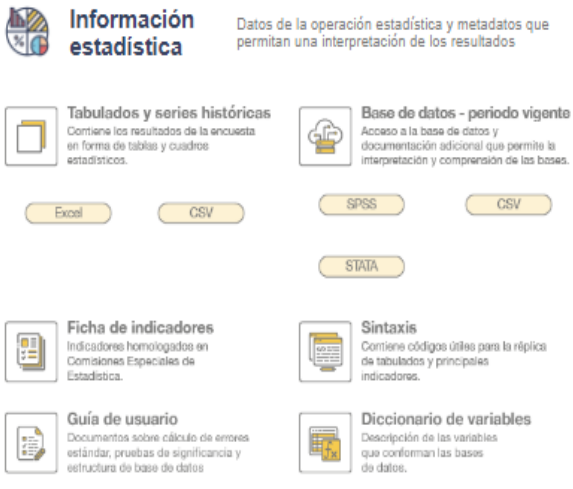


Figure 8 Ecuador's Dissemination of geospatially enabled economic statistical data.[19]

Your National Response to COVID-19

How has the GSGF supported your national response to COVID-19?

In Ecuador, the GSGF has not yet been implemented and we hope it can be done very soon; however, its importance in decision-making is understood.

It is worth mentioning that at the beginning of the pandemic, INEC collaborated with the Emergency Operations Committee (COE), in the generation of a vulnerability index. In addition, it was part of the situational room in conjunction with the IGM and other Institutions in which information regarding the health emergency that served for decision-making was analyzed.

The IGM, developed several applications with the philosophy of an SDI for monitoring the pandemic; but due to the sensitivity of the information, these are NOT for public use.

How could the GSGF have supported your national response to COVID-19, if it had been implemented? What were/are the barriers in its implementation?

If the GSGF were implemented at the national level, it would have been possible to collect and access information more easily, in order to be able to make decisions more efficiently. Having a more disaggregated implementation of the GSGF would help make better decisions.

[19] https://www.ecuadorencifras.gob.ec/encuesta-nacional-multiproposito-de-hogares/

Egypt

Name of Agency: Central Agency for Public Mobilization and Statistics (CAMPAS)

Submission From: NSO

The Overall Implementation of the GSGF

Egypt is working on establishing a National Spatial Data Infrastructure NSDI to unify the Basemap of Egypt in scale 1:2500 (using a recent Arial photos and satellite images for 125,000 Km^2 of built-up areas) linked with the statistical and detailed data of all the governmental Agencies in Egypt taking INSPIRE (European Union spatial data infrastructure) as an experiment.

In addition, all the geographical spatial data and statistical data in Egypt are identified with the smallest geographic boundary (Shyakha (Urban) - Village (Rural)). Currently Egypt is working now on putting a mechanism how to unify the administrative boundaries by formed a committee consisted of the agencies which are responsible for administrative decisions.

The Implementation of the Principles of the GSGF

Principle 1: Use of fundamental geospatial infrastructure and geocoding

CAPMAS has been finished of establishing a National Grid system with projection MTM-WGS84 (Modify Transfer Mercator) which will be used to generate a unique numbering and geocoding system for each unit in a dataset, such as a building, household or establishment.

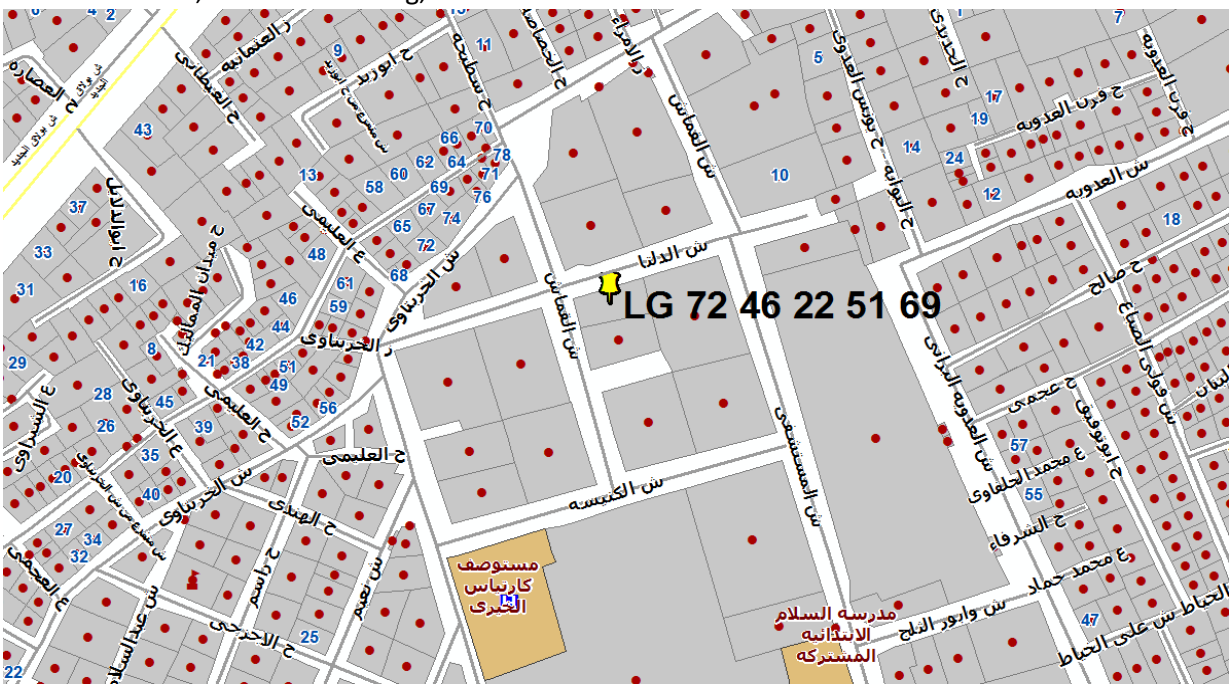


Figure Geocoding Unit Records

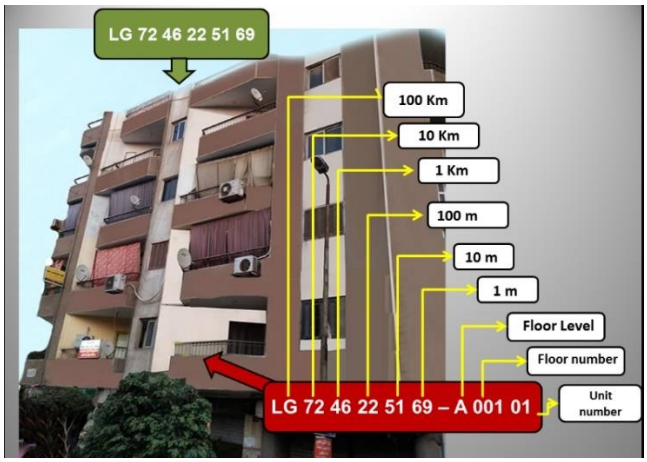


Figure 9 Creating Unique Identifiers for Buildings

Figure 10 Unique Identifier: "Unit Spatial Services Number"

Also, the Egyptian government under the leading of prime minister and CAPMAS as a main member are studding now how to create a unique identifier depending on the geographic location for all buildings over all Egypt to use it as national building ID.

Principle 2. Geocoded unit record data in a data management environment

All the geographical spatial data and statistical data are identified with the smallest geographic boundary (Shyakha (Urban) - Village (Rural)), and we had finished to make the integration and management of the geocode within dataset including spatial number identifier and the unique census number to join the detailed statistical building, household and business data of census 2017 .

Principle 3. Common geographies for the dissemination of statistics

One of the most important role of the NSDI is to unify the administrative geographic boundaries between all the Egyptian governraes, beside the mechanism of the map conflation for all spatial and attribute data existing in the governmental agencies to link with the base map of Egypt.

Principle 4. Statistical and geospatial interoperability

Egypt statistical and geospatial data operated metadata capabilities. Egypt applies standards for statistical and geospatial data, and agrees with Australia on the need to seek international agreement.

Principle 5. Accessible and usable geospatially enabled statistics

Egypt uses Open data policies and principles, and also after building and publishing the NSDI portal all the data will be accessed using Web services to enable dynamic accessing the to the geostatistical data.

Your National Response to COVID-19

How has the GSGF supported your national response to COVID-19?

A field research was conducted on the impact of COVID_19 on the business sector, the data was linked up to the layer of the administrative boundaries of the second level (Qism/Marzas).
It was found that many sectors were affected by this pandemic, the most important of which is the industry, trade and temporary employment sector, which was the first affected sectors.

Finland

Name of Agency: Statistics Finland

Submission From: Combined NGIA/NSO

The Overall Implementation of the GSGF

Statistics Finland and National Land Survey of Finland have been fostering one-to-one collaboration on improving interoperability of statistical and geospatial domains for many years. The ultimate purpose of the collaboration is to avoid overlapping work, save costs and improve quality of services for customers.

However, a more wide-spread and permanent impact on the integration and improved interoperability of geospatial and statistical domains requires calling upon all national key players to coact. Thus, a national network for integration of statistical and geospatial data was initiated in early 2021. All the primary goals identified for the network collaboration are aiming at improving interoperability of statistical and geospatial domains. Hence, the network will be focused at working with concrete issues and overcoming barriers that are central topics for implementing all the GSGF principles too.

Since the successful implementation of INSPIRE and national base registers Finland already has a stable and wide-spread information infrastructure for maintenance and dissemination of geospatial and statistical data. This infrastructure is being utilised for fostering the implementation the GSGF principles in practice. For the moment we have not yet analysed the implementation status of each GSGF principle separately, and therefore we cannot reply specifically to section C. However, this work will be carried out by the national network.

Your National Response to COVID-19

How has the GSGF supported your national response to COVID-19?

Voluntary, cross-organisational national collaboration was started by GI experts in Finland on March 2020. Statistics Finland and National Land Survey of Finland participated that work by offering their GI-expertise and collegiate network in the work. National data sources and services were discussed and new approaches were innovated.

How could the GSGF have supported your national response to COVID-19, if it had been implemented? What were/are the barriers in its implementation?

Geospatial view point was not specifically noted by the Statistics Finland's corona working group. Readiness to utilise mobile network operator data (MNO) was not established at the time, due to non-existing data flow (no valid agreements with operators). This was partly corrected during the covid-19.

Germany

Name of Submitting Agency: Federal Agency for Cartography and Geodesy

Submission From: Combined NGIA/NSO

The Overall Implementation of the GSGF

The German national infrastructure for the integration of statistical and geospatial information - National recommendations based on an analysis of the Global Statistical Geospatial Framework. We have a MoU between the Federal Statistical Office (NSO) and the Federal Agency for Cartography and Geodesy (NGIA) since 2016.

Together with the Federal Agency for Cartography and Geodesy (BKG), the Federal Statistical Office (Destatis) has analysed and assessed the requirements and recommendations of the European Implementation guide for the Global Statistical Geospatial Framework (GSGF) in order to evaluate the situation in Germany and derive recommendations for action.

The evaluation of the five GSGF principles has shown that many requirements and recommendations of the European Implementation guide have been implemented or are currently being implemented in Germany. This survey is only accomplished on the federal level and has not been filled out in conjunction with the Länder.

The answers to this survey are captured from a joint document made by BKG and Destatis describing the evaluation of the situation in Germany. Actually this document is being translated into English language. As soon as it is available it will be disseminated if desired.

The Implementation of the Principles of the GSGF

Principle 1: Use of fundamental geospatial infrastructure and geocoding

It can be stated that almost all recommendations concerning Principle 1 “Use of fundamental geospatial infrastructure and geocoding of statistical information” are being implemented or have been implemented.

Principle 2. Geocoded unit record data in a data management environment

There are still things to do regarding Principle 2 “Geocoded unit record data in a data management environment”

Principle 3. Common geographies for the dissemination of statistics

A major part of the requirements of Principle 3 “Common geographies for production and dissemination of statistics” is being implemented together by BKG and Destatis.

Principle 4. Statistical and geospatial interoperability

There are still things to do regarding Principle 4 “Statistical and geospatial interoperability - Data, standards and processes”.

Principle 5. Accessible and usable geospatially enabled statistics

More comprehensive action is required with respect to Principle 5 "Accessible and usable geospatially enabled statistics".

Ghana

Name of Agency: Ghana Statistical Service

Submission From: Desk Review from ECA

The Overall Implementation of the GSGF

Ghana is in the process to develop the National vision for the implementation of GSGF. Some components of GSGF, were implemented during the 2021and the DHS Ghana: 2019, 2017, 2016, 2014, 2011, 2008, 2007, 2006, 2003, 2002, 1998, 1993 and 1988.

The Implementation of the Principles of the GSGF

Principle 1: Use of fundamental geospatial infrastructure and geocoding

The Use of fundamental geospatial infrastructure and geocoding in the 2021 Ghana census has been noticed in the planning of urban land use patterns. Establishing boundaries of localities, constituencies, districts, and regions. Identifying localities and districts with boundary issues to seek the appropriate resolutions as well as the identification of new localities. The integration of population data with maps for geo-spatial analyses has been undertaken. Equally geocoding has enabled the identification of deserted or collapsed localities. It has facilitated population the identification density by locality, district, and region for urban planning as well as estimating the number of people displaced by natural disasters.

Principle 2. Geocoded unit record data in a data management environment

Geocoding of Housing unit location (Dwelling Frames, Housing Footprints), collective living quarter locations (Dwelling Frames, Housing Footprints) a set of digital enumeration area maps or derived dissemination units, which are designed to enable the production of all output products that will be disseminated to government departments and the general public.

Geocoding of Geographic boundary files in a digital format for all statistical reporting units for which census indicators will be tabulated. Listings of all statistical and administrative reporting units, including towns and villages, their variant names and geographic coordinates. Geocoding of Geographic equivalency files that indicate how current reporting units relate to those used in previous censuses, or how one set of reporting units relates to another set as well as the Geocoding of vector layers containing feature data, such as landmarks, roads, schools, hospitals and clinics, which can be used when analysing population data spatially. Geocoding was used to determine the Centroid files that provide a representative geographic point reference for each reporting unit. It also provided for gazetteers that provide geographic coordinates for all population settlements and other important geographic features in the country

Principle 3. Common geographies for the dissemination of statistics

A spatial geographic database, with polygonal and attribute information for the enumeration areas of the country (i.e., the units for which the territory is allocated to canvassers during the census). A

common digital base can assist with censuses of agriculture and population. Census data can be released at the EA level or aggregated into new small-area dissemination units, such as population clusters

Principle 4. Statistical and geospatial interoperability

A library of digital administrative boundaries, ranging from the provincial to the municipal levels (perhaps even at the level of the land parcel). Digital census atlases, dynamic atlases and spatial analysis techniques have been deployed

Principle 5. Accessible and usable geospatially enabled statistics

Know the ease of accessibility (geometry, perimeter, compactness) within districts as well as the dentification of gaps and overlaps of the already existing district and locality boundaries.

Your National Response to COVID-19

How has the GSGF supported your national response to COVID-19?

GSS has used geospatial information technology to develop the Ghana Government Covid-19 Tracking App. Principles 1, 2 and 3 were particularly useful to develop the Ghana national mobility patterns between densely populated settlements, which estimate the amount of travel between these locations using data on the size of population of the locations and the distances/travel time between them.

How could the GSGF have supported your national response to COVID-19, if it had been implemented? What were/are the barriers in its implementation?

To respond to such crisis situations in the future, GSS would like to have current and detailed national cadastre data in order to link Geospatial information with ownership information.

Honduras

Name of Submitting Agency:	Property
Submission From:	Combined NGIA/NSO

The Overall Implementation of the GSGF

The implementation of the GSGF has materialized from the integration of demographic and Cartographic information at the National at the Departmental and Municipal geographic levels, and regionally through the MEGA project. Nationally, the GSGF supports the National Geostatistical Framework National Statistics Census.

The Implementation of the Principles of the GSGF

Principle 1: Use of fundamental geospatial infrastructure and geocoding

Interoperability has been achieved between statistical and geospatial data for the national, departmental and municipal levels.

Principle 2. Geocoded unit record data in a data management environment

At the country level, geocodes have been established that allow us to link geospatial information with statistical information, achieving the use of information at the departmental and municipal levels, which facilitates the linking of data on housing and People classified by gender.

Principle 3. Common geographies for the dissemination of statistics

For the administrative level, it is used at the departmental and municipal level.

Principle 4. Statistical and geospatial interoperability

The responsibilities of all institutions that handle statistics with data and information are defined by the National Institute of Statistics and there is a web page https://www.ine.gob.hn/V3/baseine/ that consolidates the data at the national level , departmental and municipal; In addition to this, there is also the Microdata Laboratory.

Principle 5. Accessible and usable geospatially enabled statistics

Within the framework of the MEGA project and the creation of the COVID-19 vulnerability index, the geodatabase integration has been carried out and information has been prepared for publication, which will allow access and use of country data.

Your National Response to COVID-19

How has the GSGF supported your national response to COVID-19?

The support has been at the municipality level, the covid 19 vulnerability index has been calculated, with the use of the ARCGIS SERVER technological tool, which supports the publication of data for dissemination of results.

How could the GSGF have supported your national response to COVID-19, if it had been implemented? What were/are the barriers in its implementation?

The integration of statistical, health and geospatial information has been achieved until reaching the municipality level and we have as a challenge to reach a block level when there is availability of geospatial and health data available, which can be integrate with existing data at the statistical level.

India

Name of Agency: Ministry of Statistics and Programme Implementation

Submission From: NSO

The Overall Implementation of the GSGF

GSGF, as a framework, has not been implemented in India. However, it is observed that some of the principles of GSGF have been followed while geo-coding statistical information. Further detail on India's approaches to the integration of statistical and geospatial information are detailed within the relevant Annex on Page 80.

The Implementation of the Principles of the GSGF

Principle 1: Use of fundamental geospatial infrastructure and geocoding

NSDI in consultation with Geospatial Information Sectional Committee of Bureau of Indian Standards (BIS) (designated as LITD -22) has been involved in framing of relevant national geospatial data and process standards. LITD-22 has been the National Mirror Committee of ISO for developing and publishing the standards. Some of the Geospatial BIS Standards framed/ cobranded are IS 16439:2016 – Metadata standard for Geospatial Information, IS 16626:2017 –Geography Markup Language (GML), IS16699: 2018 -Web Map Server Interface (WMS), IS 16967:2018 –GI -Location-based Services –Tracking and Navigation, IS 16968:2018 –GI –Location-based Services –Multi-modal Routing and Navigation and IS 16970:2018 –GI –Rules for Application Schema. As of now, all agencies are recording the geo-codes of the surveyed location for spatializing the information.

Principle 2. Geocoded unit record data in a data management environment

Different agencies in India are working in a complementary manner towards collection of geo-coded information in their surveys, that allows for information to be integrated with other data.

Principle 3. Common geographies for the dissemination of statistics

Most of the agencies are using administrative boundaries for the dissemination of statistics. The maps on the administrative boundaries as released by Survey of India, the national mapping agency, are adopted for dissemination.

Principle 4. Statistical and geospatial interoperability

No specific examples of implementation

Principle 5. Accessible and usable geospatially enabled statistics

All datasets are released in the public domain by the Source Agencies. In addition, many Ministries/Departments of Government of India have developed various Geo-portals for data sharing, services and strengthen the E-learning process.

Your National Response to COVID-19

How has the GSGF supported your national response to COVID-19?

In the context of COVID-19, agencies are integrating data from multiple sources for operational intelligence.

- Aarogya Setu, mobile application has been developed by the Government of India for real time tracking of COVID-19 infected patients. The App is being used in contact tracing of the suspected COVID-19 cases, reducing time and error in manual identification, helping the Government to take necessary timely steps for assessing risk of spread of COVID-19 infection, and ensuring isolation where required.
- NDMA (National Disaster Management Authority) has developed a dashboard that helps in keeping the track of the number of cases of COVID-19 reported in the country. The dashboard showcases the total number of cases reported in India as well as the world. It also brings the number of cases reported and the ones that resulted in the death of the patient.

- The National Mapping Agency SOI, under the Department of Science and Technology has updated its portal (www.indiamaps.gov.in/soiapp/) as the core of the integrated geospatial platform to address COVID-19 outbreak and its socioeconomic impact. For required data collection pertinent to COVID emergency management, the SAHYOG mobile app, developed and managed by SOI has been customized to collect COVID-19 specific datasets through community engagement to augment the COVID-19 response activities by Government of India.

Indonesia

Name of Agency: Badan Pusat Statistik (BPS), Statistics Indonesia
Submission From: NSO

The Overall Implementation of the GSGF

Mapping process usually takes place every 10 years right before the next census. In 2009, the delineating of the Enumeration Area (EA) was conducted using "traditional method" in which it is manually sketched in A3 paper by an appointed officer. This mapping process will only be updated as needed from time to time.

Before 2019, BPS had been producing a digital map at a village level only. This map had been used for dissemination purposes. In 2018, BPS recognized the GSGF as a framework for integration between geospatial and statistics. In the same year, we conducted a thorough planning for the Field mapping process in 2019. Different from the previous mapping process, in 2019 Geospatial technologies were implemented in the whole process.

The Implementation of the Principles of the GSGF

Principle 1: Use of fundamental geospatial infrastructure and geocoding

There are two types of statistical units enabling geospatial infrastructure for census and survey activities; Census Blocks as EA's and households. These units are presented as polygon boundaries and point coordinates respectively.

A census blocks boundaries derived from one or multiple local neighborhood areas in order to obtain a homogeneous number of buildings. The delineation process of census blocks is initiated by identification process on the field using GPS and Android application namely "WILKERSTAT BPS", before then processed in a desktop software and satellite imagery to obtain the digital map of census blocks.

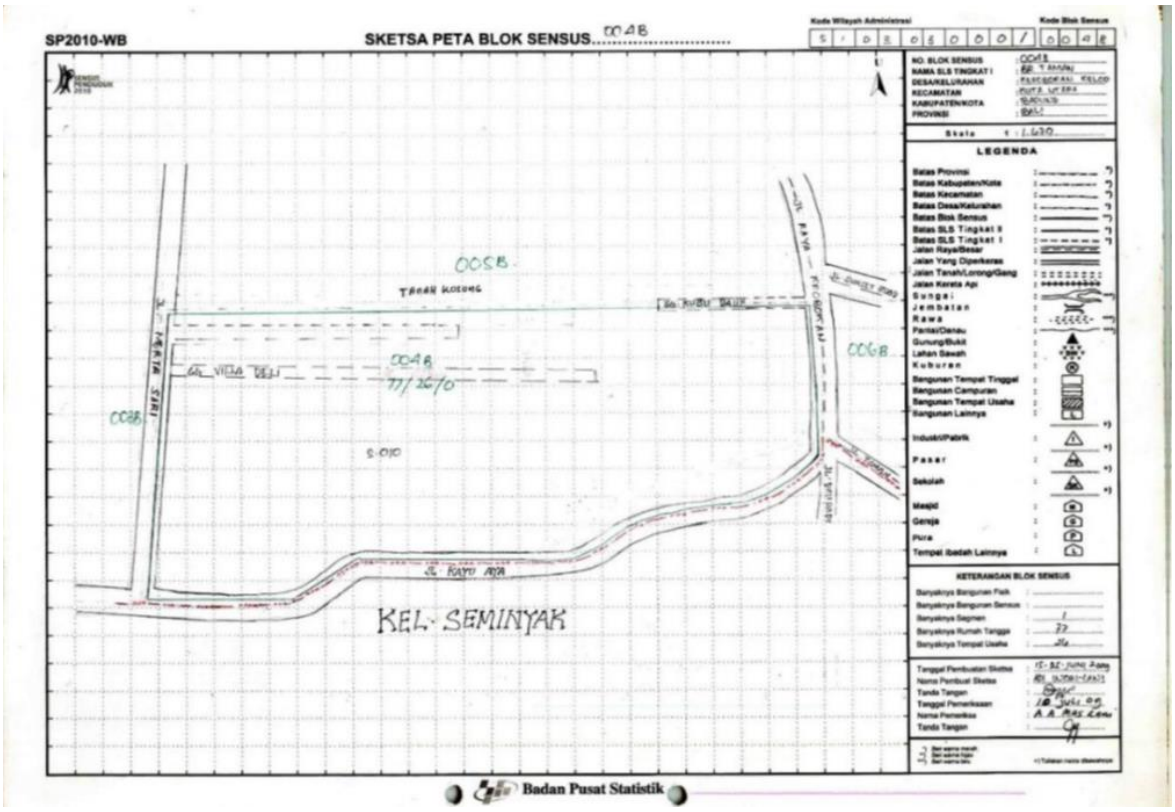


Figure 11 Enumeration by the "Traditional Method" A Sketch Map

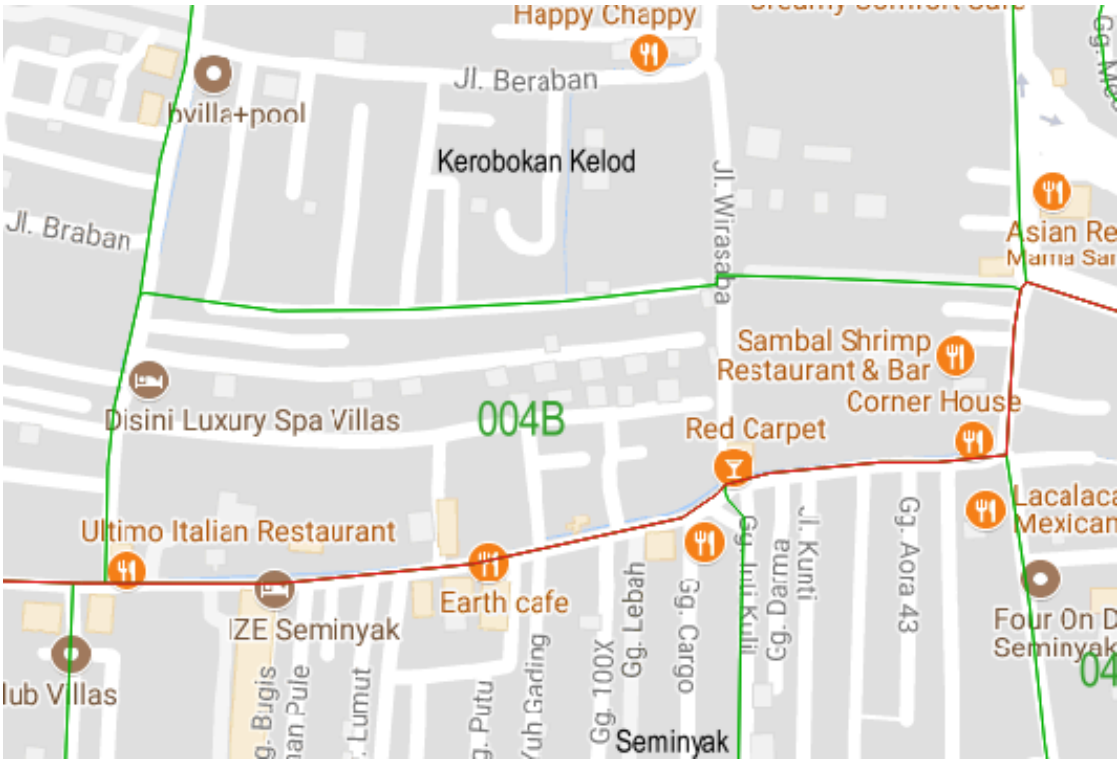


Figure 12 Digital Enumeration

Population census 2020 was initially planned to be conducted using Computer-Assisted Personal Interviewing (CAPI) method but eventually resorted to Paper-and-Pencil (PAPI) as the result of budget cut off for pandemic handling measures. Hence, instead of obtaining the coordinate location of each building, the area was imposed to be drawn on a paper map. As a result, in 2021, all building locations on the paper map have to be digitized using desktop software. However, point coordinates of statistical units for economic statistical data such as hotels and tourist attractions have been collected since 2019.

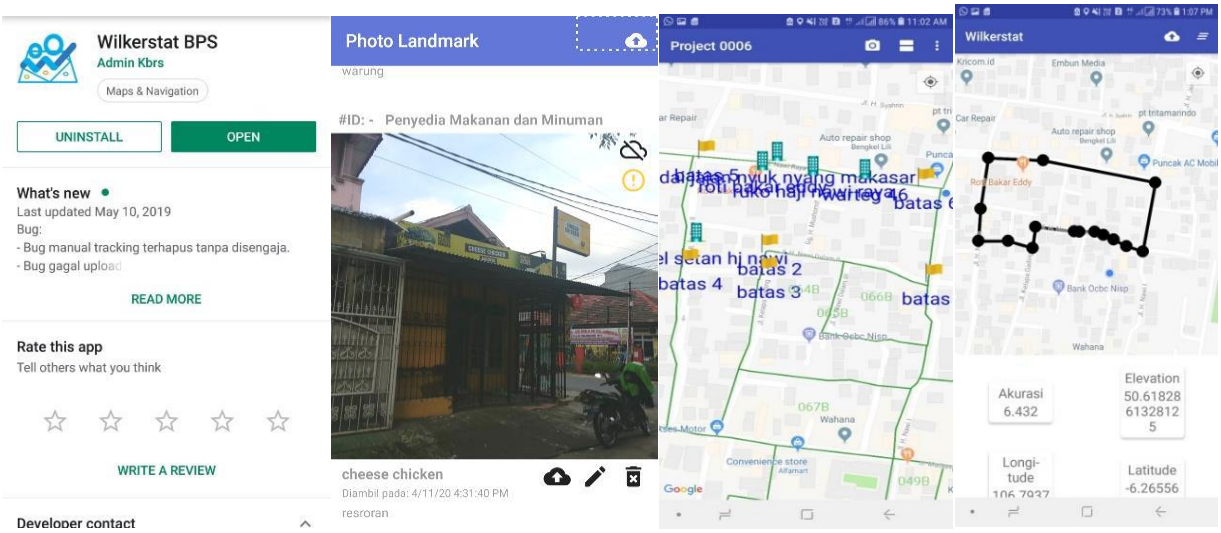


Figure 13 Android application for field mapping process

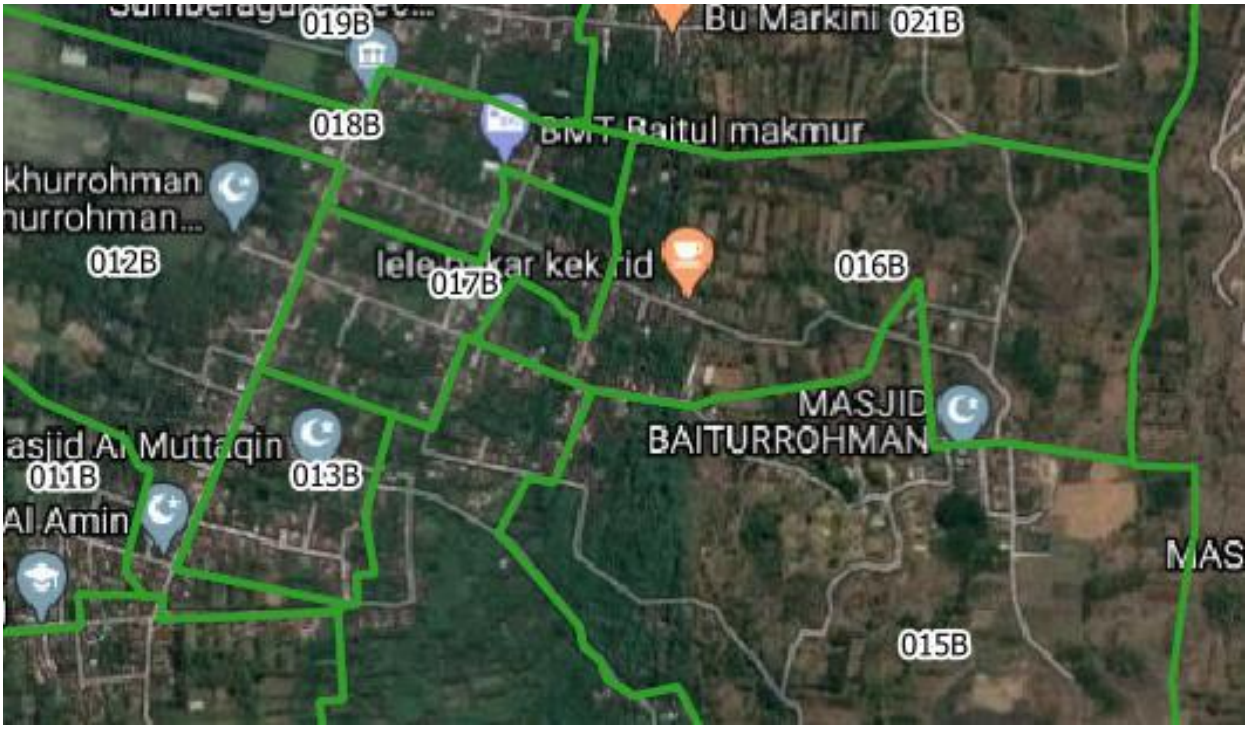


Figure 14 Subset of Census Block Map

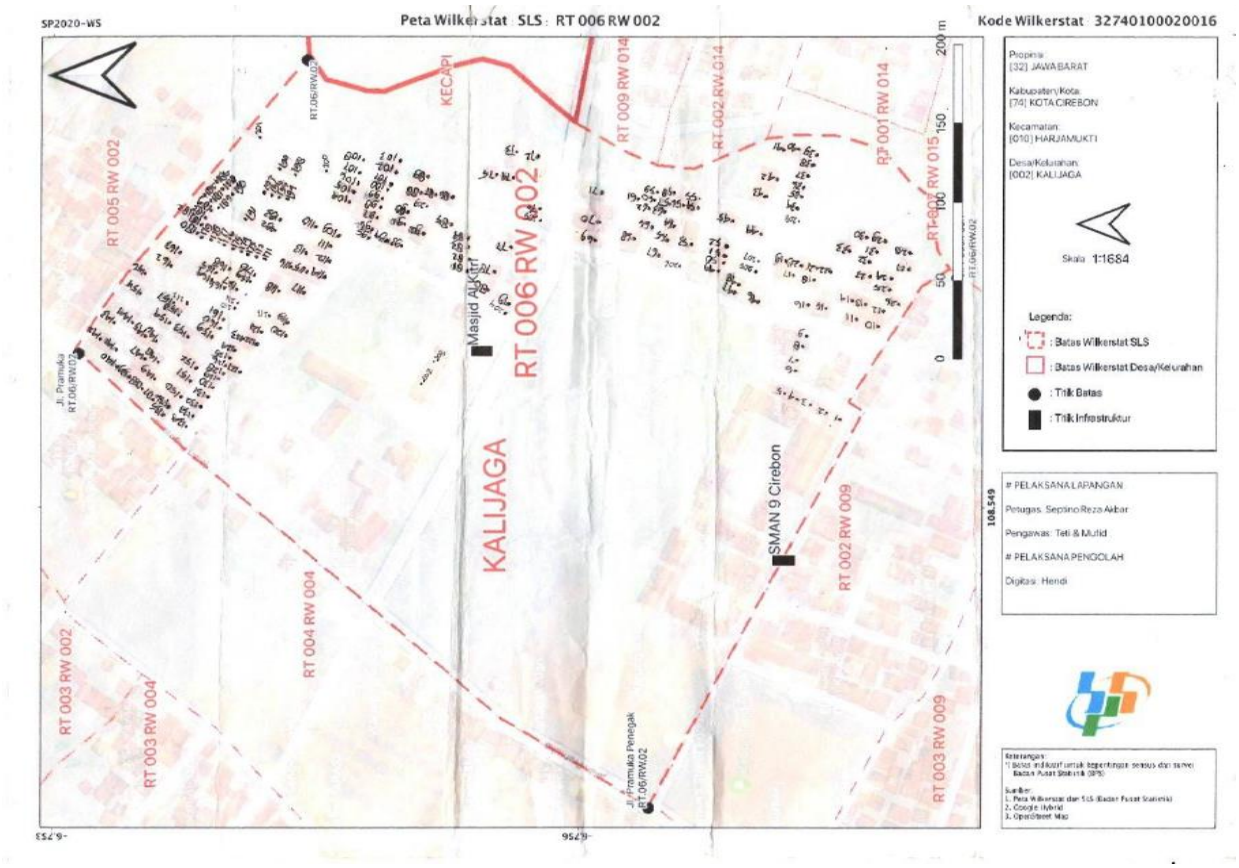


Figure 15 Building points on a paper map

Figure 16 Building points after digitalization

Figure 17 Other statistical units for economic statistical data

Principle 2. Geocoded unit record data in a data management environment

All geocoded units have a standardization in both geometry and the attributes which can't be overlapped. The quality control process of these standards is conducted using a Geospatial System. This system is used internally for delivering geospatial data from the branch offices and for quality control of the data. The quality control is processed automatically by the system using a background processing.

The geometry error such as gaps and overlaps will be marked by the system, as well as for non-standard attributes such as unmatched IDs to the master.

A tiered approval mechanism is implemented in this system, once the data is approved by Headquarter it automatically stored in the final database and produces a geospatial service for other platform consumption. In addition to that, standardized area code in every level of administration enables data to be linked with one another. These area codes are managed in such a way that changing area boundary due to new administration, splitting administration, or a merge of administration will be systematically recorded and new area code will be generated using the same standard. These records will facilitate history tracking of these changes.

For instance, sub-districts in Y city are numbered as such: 010, 020, 030, 040, 050, and 060. If in the future area X with code 030 is to split into two new areas, the new area may have the number 031. This is possible due to the systemic numbering system used by BPS-Statistics Indonesia.

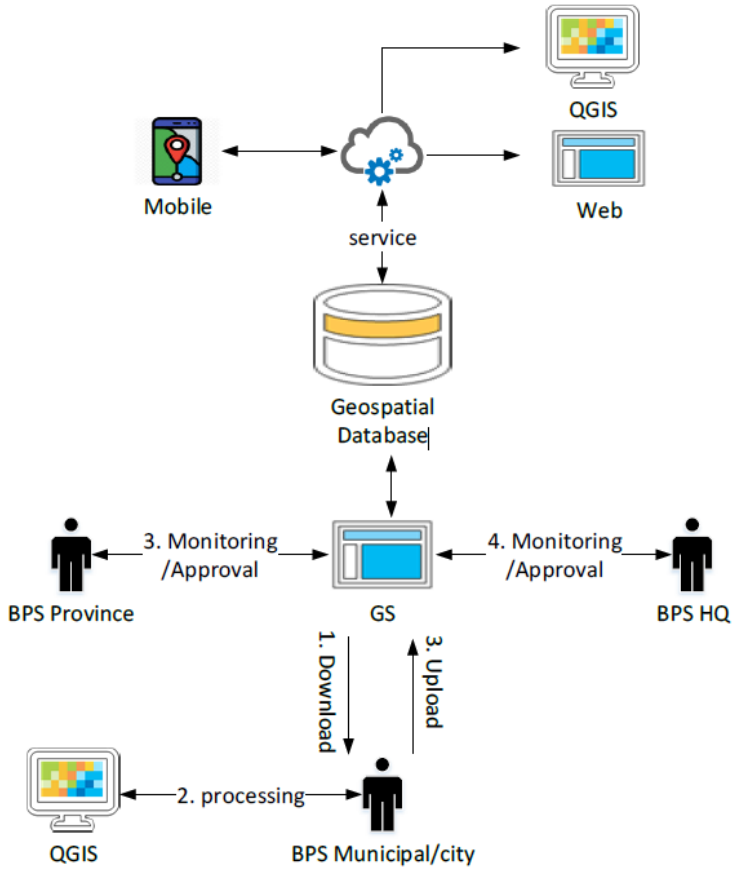


Figure 18 The infrastructure of Geospatial System (GS)

Figure 19 Geospatial System Used within NSO

Principle 3. Common geographies for the dissemination of statistics

As mentioned in the previous Principle 2, all statistical units have a standardization in its attributes including the code ID. Each spatial feature's attribute must have a standard Code ID. The ID referred to Province ID, District ID, Sub District ID, and Village ID. For example, a census block with ID: 5171030002001B means:

- 51 is Province ID, "Bali"
- 71 is District ID, "Denpasar"
- 030 is Sub District ID, "Denpasar Barat"
- 002 is Village ID, "Pemecutan Klod"
- 001B is Census "Block Number"

The rules will facilitate the process of data aggregation/disaggregation and integrating data. Since other statistical data has the same rule of the Code ID.

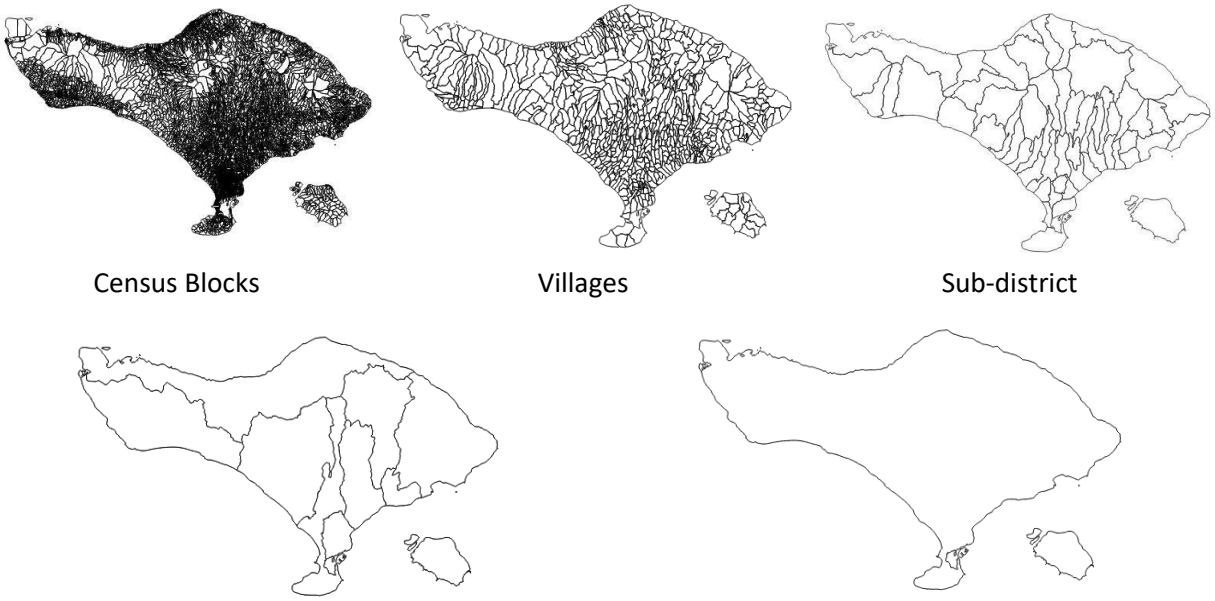


Figure 20 Aggregation Process, Province of Bali

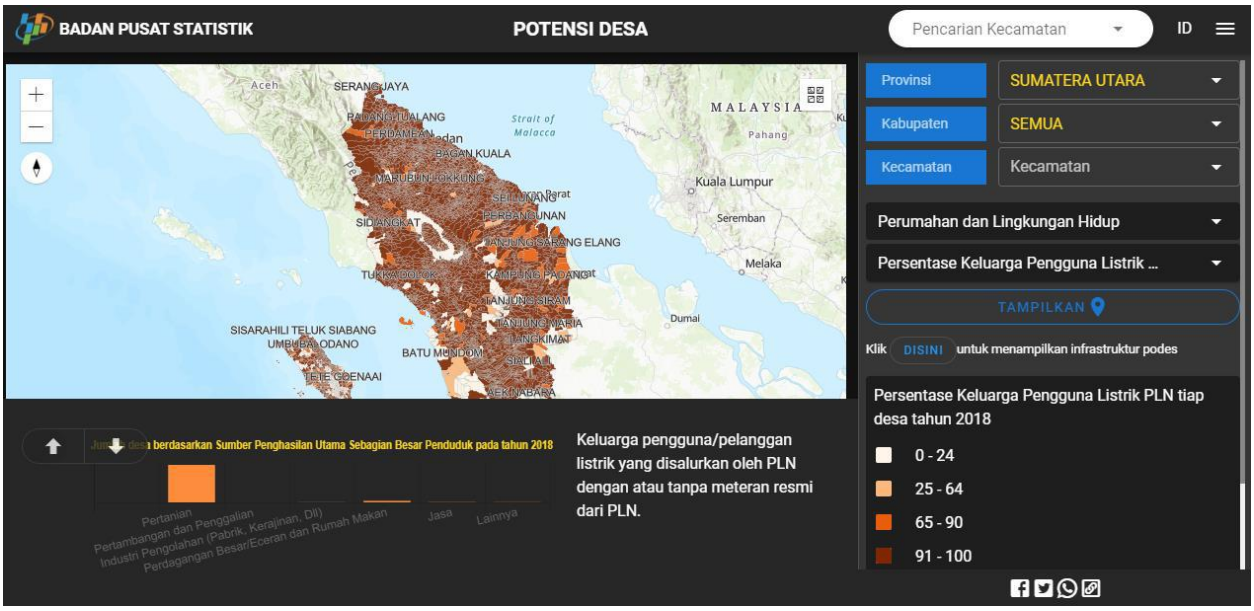


Figure 21 Sample of Dissemination Geospatial and Statistics data

Principle 4. Statistical and geospatial interoperability

This principle is related to the infrastructure of the Geospatial System (GS) that was explained in principle 2. GS provides the final data in Web Map Service and Web Feature Service Format, which are consumed by other platforms through API mechanisms. As shown in figure 8, Village Potential Statistics are presented in a digital map using Web Map Service. In addition, to support interoperability, metadata for both statistical and geospatial data are also provided, although managed in different systems.

However, for public domain, only certain data can be accessed by the API due to the confidentiality issue. Meanwhile, certain users such as the government will have different authorities to access more detailed data for statistics and decision-making purposes.

Principle 5. Accessible and usable geospatially enabled statistics

The authority for delineating administrative area boundaries belongs to the National Mapping Agency (NMA). However, for enumeration purposes, BPS-Statistics Indonesia has also delineated area boundaries as statistical work areas. In this case, BPS-Statistics Indonesia's map of statistical work areas has some limitations for public utilization and is prohibited for the calculation of the administrative area and other geographic measurement. All BPS digital maps users are required to sign the Letter of Agreement of Data and/or information Usage (LADU) prior to accessing digital maps.

In geospatial information presentation, BPS-Statistics Indonesia uses their own digital map instead of NMA's digital map to facilitate the integration of statistical and geospatial data. NMA's digital map uses different coding systems and standards, thus it cannot be directly integrated with BPS-Statistics Indonesia's statistical data. BPS-Statistics Indonesia always ensures that the digital map has been updated to the latest version during census and survey.

BPS-Statistics Indonesia has been using maps in disseminating statistics to provide an even more clear depiction of data. For example, in disseminating population census 2020 results, a Web Map Service is

used to retrieve a map. Statistics information will be layered on top of the map generating new thematic maps for users to use.

Your National Response to COVID-19

How has the GSGF supported your national response to COVID-19?

The responsibility of National Response to COVID-19 belong to Indonesian National Board for Disaster Management (BNPB). Thus, BPS act as data provider only. In 2020, we sent all geospatial data to BNPB in order to support the risk map analysis of Covid-19.

Figure 22 Covid-19 Data Dissemination using Map (https://bnpb.go.id/covid-19/)

How could the GSGF have supported your national response to COVID-19, if it had been implemented? What were/are the barriers in its implementation?

BPS has contributed to the provision of BPS digital maps for analysis of the handling of COVID 19. In producing these digital maps, BPS has implemented GSGF. GSGF is useful for producing quality BPS digital map. While the analysis of national response to COVID19 is conducted by other government agencies (BNPB).

Kenya

Name of Agency: Kenya National Bureau of Statistics

Submission From: Desk Review from ECA

The Overall Implementation of the GSGF

The Overall Implementation of the GSGF

Kenya is in the process of developing the National vision for the implementation of GSGF. Components of GSGF, were implemented during the 24-Aug-19 census and the DHS Kenya: 2015, 2014, 2010, 2008-09, 2004, 2003, 1999, 1993, 1998 and 1989.

Principle 1: Use of fundamental geospatial infrastructure and geocoding

The implementation of preparatory activities for the 2019 KPHC started in early 2016 with cartographic mapping exercise. The process involved delineation of the country into small geographical units known as Enumeration Areas (EAs). The EAs were used in determining the number of census personnel required as well as in ensuring total coverage during enumeration. The use of modern technologies in the entire census cartographic mapping was embraced, as per the UN recommendations for countries undertaking the 2020 round of population and housing censuses. Smart phones and tablets embedded with Geographical Positioning System (GPS) were used to pick coordinates for homesteads, households and other points of interest. Satellite imageries and aerial photographs were used to prepare maps for rural and urban areas, respectively. Open Data Kit (ODK), Esri Survey 123 applications were used during field mapping while ArcGIS was used during digitization and map production. Sub-location and EA maps generated based on administrative boundaries, were then uploaded onto mobile devices for use during the enumeration exercise.

The Use of fundamental geospatial infrastructure and geocoding in the 2019 Kenyan census has been noticed in the planning of urban land use patterns. Establishing boundaries of localities, constituencies, districts, and regions. Identifying localities and districts with boundary issues to seek the appropriate resolutions as well as the identification of new localities. The integration of population data with maps for geo-spatial analyses has been undertaken. Equally geocoding has enabled the identification of deserted or collapsed localities. It has facilitated population the identification density by locality, district, and region for urban planning as well as estimating the number of people displaced by natural disasters.

Principle 2. Geocoded unit record data in a data management environment

Geocoding of Housing unit location (Dwelling Frames, Housing Footprints), collective living quarter locations (Dwelling Frames, Housing Footprints) a set of digital enumeration area maps or derived dissemination units, which are designed to enable the production of all output products that will be disseminated to government departments and the general public.

Geocoding of Geographic boundary files in a digital format for all statistical reporting units for which census indicators will be tabulated. Listings of all statistical and administrative reporting units, including towns and villages, their variant names and geographic coordinates. Geocoding of Geographic equivalency files that indicate how current reporting units relate to those used in previous censuses, or how one set of reporting units relates to another set as well as the Geocoding of vector layers containing feature data, such as landmarks, roads, schools, hospitals and clinics, which can be used

when analysing population data spatially. Geocoding was used to determine the Centroid files that provide a representative geographic point reference for each reporting unit. It also provided for gazetteers that provide geographic coordinates for all population settlements and other important geographic features in the country.

Principle 3. Common geographies for the dissemination of statistics

A spatial geographic database, with polygonal and attribute information for the enumeration areas of the country (i.e., the units for which the territory is allocated to canvassers during the census). A common digital base can assist with censuses of agriculture and population. Census data can be released at the EA level or aggregated into new small-area dissemination units, such as population clusters.

Principle 4. Statistical and geospatial interoperability

A library of digital administrative boundaries, ranging from the provincial to the municipal levels (perhaps even at the level of the land parcel). Digital census atlases, dynamic atlases and spatial analysis techniques have been deployed

Principle 5. Accessible and usable geospatially enabled statistics

Know the ease of accessibility (geometry, perimeter, compactness) within districts as well as the dentification of gaps and overlaps of the already existing district and locality boundaries.

Kuwait

Name of Agency: Central Statistical Bureau

Submission From: NSO

The Implementation of the Principles of the GSGF

The State of Kuwait has not officially adopted or implemented the GSGF however; our framework consists of similarities to the GSGF.

The Implementation of the Principles of the GSGF

Principle 1: Use of fundamental geospatial infrastructure and geocoding

Geocoding areas from governorates, districts, areas, blocks, squares and plot addresses are entirely geocoded to be able to get the x and y coordinates.

Principle 2. Geocoded unit record data in a data management environment

Linking all the statistical information from census to more periodical surveys to local addresses when applicable and all the range of geocoded areas when needed.

Principle 3. Common geographies for the dissemination of statistics

The State of Kuwait uses administrative boundaries and in the future will use grid based mapping. We allocate our data to smaller administrative segments and to statistical units.

Principle 4. Statistical and geospatial interoperability

Different government bodies from the municipality boundaries, public authority of civil information, and the statistical bodies work together to share information to benefit the common goal and increase are data's accuracy, quality for a more efficient, and precise data corroboration.

Principle 5. Accessible and usable geospatially enabled statistics

It is vital to share and release our data to the public so long as the level of data selected will not infringe national issues to protect the privacy and security of both the people and country.

Your National Response to COVID-19

How has the GSGF supported your national response to COVID-19?

Government bodies working together to assess the cases by density populations and administrative boundaries to track and understand the spreading of the COVID-19 afflicted cases. Use this data to determine and asses how to contain the spread.

How could the GSGF have supported your national response to COVID-19, if it had been implemented? What were/are the barriers in its implementation?

With the implementation of the GSGF COVID-19 would have been significantly helpful in a spectral of methods. It would of help sort out the data collected by other government bodies more accurately and efficiently, which would have resulted a further contained increasingly rapid view of information. The GSGF could have made clearer where the virus was emerging from and spreading to reduce the rate of infection. Administrative boundaries of virus development could have been pinpointed and contained sooner. If the Ministry of health shared, its information with other government bodies with a shorter periodical time, the response time would have been more efficient and better maps would have increasingly helped the response teams.

Malawi

Name of Agency: National Bureau of Statistics
Submission From: Desk Review from ECA

The Overall Implementation of the GSGF

The Overall Implementation of the GSGF

Malawi is still to develop the National vision for the implementation of GSGF. Some components of GSGF, were implemented during the 21 Mar--30 Mar- 2008 census and the DHS Malawi: 2017, 2015-16, 2014, 2013-14, 2012, 2010, 2004, 2000, 1996 and 1992.

The Implementation of the Principles of the GSGF

Principle 1: Use of fundamental geospatial infrastructure and geocoding

The Use of fundamental geospatial infrastructure and geocoding is well noticed in the Malawian 2018 census cartographic exercise with the overall, the aim of updating the geographic frame which the NSO uses for all its data collection activities. However, the main and crucial task was to demarcate EAs so

that we have up-to-date and accurate EA maps in time for census enumeration in June 2018. Specifically, the mapping exercise accomplished the following objectives: i) coming up with credible Census Mapping strategy (CeMaS) document which will form as basis future mapping endeavours but also as reference for various methodologies, terminology and standards pertaining to 2018 Census mapping; ii) acquiring satellite imagery which will provide necessary input in updating EA; iii) generate a dwelling frame (DF) which will be used in census and other surveys to easily identify households; iv) update EA boundaries in time for the 2018 Census enumeration v) produce a range of map products such as EA maps which will be used during 2018 Census enumeration and subsequent surveys by the NSO and set up GIS, IT, and human resource infrastructure to be able to support 2018 Census enumeration activities through provision of various geography related services.

Principle 2. Geocoded unit record data in a data management environment

Geocoding of Housing unit location (Dwelling Frames, Housing Footprints), collective living quarter locations (Dwelling Frames, Housing Footprints) a set of digital enumeration area maps or derived dissemination units, which are designed to enable the production of all output products that will be disseminated to government departments and the general public.

Geocoding of Geographic boundary files in a digital format for all statistical reporting units for which census indicators will be tabulated. Listings of all statistical and administrative reporting units, including towns and villages, their variant names and geographic coordinates. Geocoding of Geographic equivalency files that indicate how current reporting units relate to those used in previous censuses, or how one set of reporting units relates to another set as well as the Geocoding of vector layers containing feature data, such as landmarks, roads, schools, hospitals and clinics, which can be used when analysing population data spatially. Geocoding was used to determine the Centroid files that provide a representative geographic point reference for each reporting unit. It also provided for gazetteers that provide geographic coordinates for all population settlements and other important geographic features in the country

Principle 3. Common geographies for the dissemination of statistics

A spatial geographic database, with polygonal and attribute information for the enumeration areas of the country (i.e., the units for which the territory is allocated to canvassers during the census). A common digital base can assist with censuses of agriculture and population. Census data can be released at the EA level or aggregated into new small-area dissemination units, such as population clusters

Principle 4. Statistical and geospatial interoperability

A library of digital administrative boundaries, ranging from the provincial to the municipal levels (perhaps even at the level of the land parcel). Digital census atlases, dynamic atlases and spatial analysis techniques have been deployed

Principle 5. Accessible and usable geospatially enabled statistics

The geocoded data has been visualized in geoportals and dashboards etc.

Mexico

Name of Agency: INEGI

Submission From: Combined NGIA/NSO

The Overall Implementation of the GSGF

The Geostatistical Framework began to be developed in 1978 by the General Coordination of the National Statistics, Geography and Informatics Services (CGSNEGI), in the absence of a cartography that would represent the clear Territorial Division of the country's Federative Entities and Municipalities. It was specifically designed to be the basis for planning, field work, coverage control and organization of results from national censuses and surveys that are the responsibility of the National Institute of Statistics and Geography.

Due to its qualities, this product has been adopted by various State Units and users for their own purposes, which has fostered communication channels, declaration of needs and cooperation alliances.

In addition to its structure in levels of disaggregation (which allow referring data from state levels to the detail of block faces), the Geostatistical Framework is in the process of incorporating new elements to fulfil its purpose, such as the characterizations of the basic geostatistical areas (AGEB) and new resources for updating.

This product aligns with the five principles of the Global Geospatial Statistical Framework developed by the United Nations Group of Experts on the Integration of Statistical and Geospatial Information (EG-ISGI). These principles cover the following aspects: use of fundamental geospatial infrastructure and geocoding; geocoded unit record data in a data management environment; common geographies for the dissemination of statistics; statistical and geospatial interoperability; and geospatially enabled statistics that are accessible and usable.

The Implementation of the Principles of the GSGF

Principle 1: Use of fundamental geospatial infrastructure and geocoding

The Geostatistical Framework considers for its permanent updating a process of updating the urban and rural cartography, which is based on a pre-digitization of areas of growth from the use of high-resolution satellite images that are verified in the field and captured on mobile devices through the digitization of blocks and rural towns. This process also uses cartographic administrative records for the identification of updates and for the representation of the geostatistical delimitations of the State Geostatistical Area, Municipal Geostatistical Area and locality. It considers the legal supports available from the political-administrative limits of the federal entities, municipalities and territorial demarcations of Mexico City whose description is clear and precise that allows its cartographic transcription.

Principle 2. Geocoded unit record data in a data management environment

Since its creation, the Geostatistical Framework has been an essential part of the censuses and surveys carried out by the Institute. Its foundation is precisely to enable an environment in which statistics are linked to the geographic space that gives rise to it.

- It is represented in cartographic and tabular products, in print and digital formats. The geostatistical components are identified through their keys, with which a one-to-one relationship is achieved with the captured statistical data;
- Its cartographic parameters, based on a global coordinate system, allow the association -within tolerance margins- with georeferenced data from other sources;
- The geographical relationship of the statistics contributes to the analysis of each geostatistical area;
- Its updating and validation processes support the fundamental purpose and the location and unique identification of its components, in accordance with the applicable technical regulations;
- Its components are regulated in accordance with the Geostatistical Framework Data Dictionary and ratified in the Metadata;
- Updated according to technical criteria for its delimitation, coding, updating and integration, as well as for its availability to users; and,
- The coding of the components of the Geostatistical Framework is used for the spatial reference of the statistical data, therefore, in the publication of statistical results, the version of the Geostatistical Framework used in the corresponding census event is considered.

Principle 3. Common geographies for the dissemination of statistics

Since 1978 the Geostatistical Framework has maintained its organizational base. It is updated and new levels of disaggregation have been introduced to meet the needs of institutional censuses and surveys. A basic rule in its conformation, delimitation and updating is to keep the spaces recognizable in time and space, as well as to elaborate equivalence tables, which constitute records of the evolution of the data; they are also a common spreading factor.

- Created as the only framework to georeferenced national statistical information from institutional censuses and surveys;
- It enables the association, with the geographic space of origin, of the different statistical data;
- Defines and structures its components with the premise of referring the statistical information to the geographic space, through territorial elements called geostatistical areas;
- It is applied in the National Information Subsystems of the SNIEG (sociodemographic, economic and government); and,
- It is used in the dissemination of institutional statistical information, as a context of the country and its territorial division.

Principle 4. Statistical and geospatial interoperability

Based on its criteria, the Geostatistical Framework codes each geospatial unit. The information is integrated, organized in catalogues and ready for use in censuses and surveys. It is also a substantive geospatial input for other State Units. Its organizational foundation is based on a codification of the territorial space at different levels of disaggregation.

- Components continuously updated with INEGI's own activities, application of provisions of the territorial division and information captured in administrative records;
- Geostatistical reference associated with the statistical data of origin;
- Catalogues of the keys of the Geostatistical Framework components, linked to the geographic space they represent;

- The information of the Geostatistical Framework is available on the INEGI page in data formats that facilitate interoperability and with its documented metadata in accordance with the Technical Standard for the elaboration of Geographic Metadata; and,
- Currently, INEGI makes efforts to facilitate the online use and exploitation of the Geostatistical Framework information, such is the case of the Web Service of the Unique Catalogue of Geostatistical Keys, which facilitates access to the updated catalogues with the information and systems of the dependencies that make use of this service.

Principle 5. Accessible and usable geospatially enabled statistics

On the official site of INEGI you can find various options that allow you to disseminate, visualize and analyse the data, such as the Digital Map of Mexico that integrates a wide variety of both statistical and geographic information, in addition to the Geostatistical Framework.
Publication and free download of cartographic products:
- Published at least once a year on the institutional website and in the publication of census results, with the updates captured in each version.
https://www.inegi.org.mx/temas/mg/#Descargas

The availability of information from the Geostatistical Framework since its creation, in relation to censuses and institutional surveys, dates from the 1980 census round

- It is represented in cartographic and tabular products; in printed and digital formats, made available to users in different electronic media and through the Public Information Service; and,
- Components regulated in accordance with the Geostatistical Framework Data Dictionary and ratified in the metadata; both made available to users.

The results of the Population and Housing Census 2020 with information on the spatial distribution of the population and housing, are available for consultation and download associated with an element of the Geostatistical Framework, so it is possible to obtain statistical information at the national level, federal entity, municipality or territorial demarcation of Mexico City, locality, AGEB and urban block.

Your National Response to COVID-19

How has the GSGF supported your national response to COVID-19?

The Geostatistical Framework has provided geostatistical information (that is, geographically referenced statistical data) that allows knowing the detailed distribution of population groups by sex and age, mainly at the municipal and local level, to design strategies to contain the most vulnerable groups, health and vaccination. The geographical reference allows establishing spatial relationships with other physical and economic factors that must be considered.

To facilitate departures, operational coordination strategies have been set up in the country, which, through the Geostatistical Framework, have facilitated dissemination and decision-making, in accordance with the very precepts that the GSGF dictates.

Namibia

Name of Agency: Namibia Statistics Agency

Submission From: NSO

The Overall Implementation of the GSGF

The GSGF overall has been incorporated into the Namibia Statistics Agency's second strategy and action plan as a strategic objective. The strategic objective is "Objective 3.2: Improve statistical integration with spatial data." All integration activities are lined up under this strategic objective. The strategic plan is accessible on https://nsa.org.na/page/strategic-plan and the strategic objective is from page 40 of the document. The two actions under this objective are to advocate for common geographies for the dissemination of statistics and to develop a geocoded register of dwellings and other structures in the country.

The Implementation of the Principles of the GSGF

Principle 1: Use of fundamental geospatial infrastructure and geocoding

This principle is fully implemented in Namibia as part of the Namibia Spatial Data Infrastructure which is coordinated by the Namibia Statistics Agency. Namibia has formally gazetted 25 fundamental data themes of which one is addresses which is key to the implementation of the GSGF (see below). Each theme or data basket contains quality assured and nationally certified geospatial datasets with official attributes determined by the producer and NSDI stakeholders.

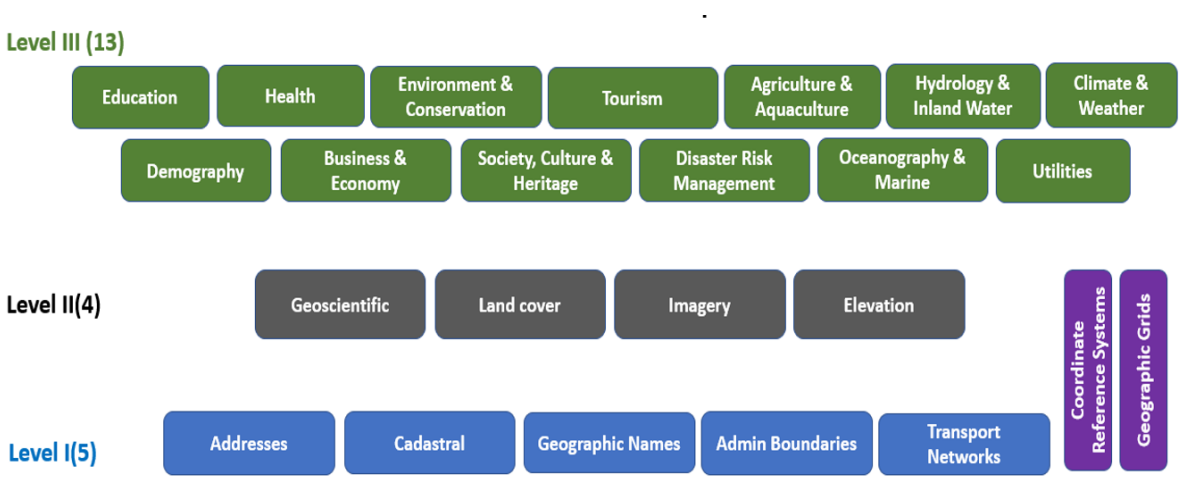


Figure 23 Gazetted Namibia Fundamental Geospatial Data Themes

However, there is a lack of a standardized national addressing system. For instance, some urban areas use street addresses while others use house numbers. In rural areas there are no addresses apart from the general locality list.

Principle 2. Geocoded unit record data in a data management environment

Namibia as part of pre-enumeration activities in preparation for the 2021 population and housing census has developed a geographic register of buildings and households. All this data is managed in a

data management environment and managed in a GIS software. Census mapping concluded in April 2021 and the register/dataset is being cleaned and will only be available to key institutions of government.

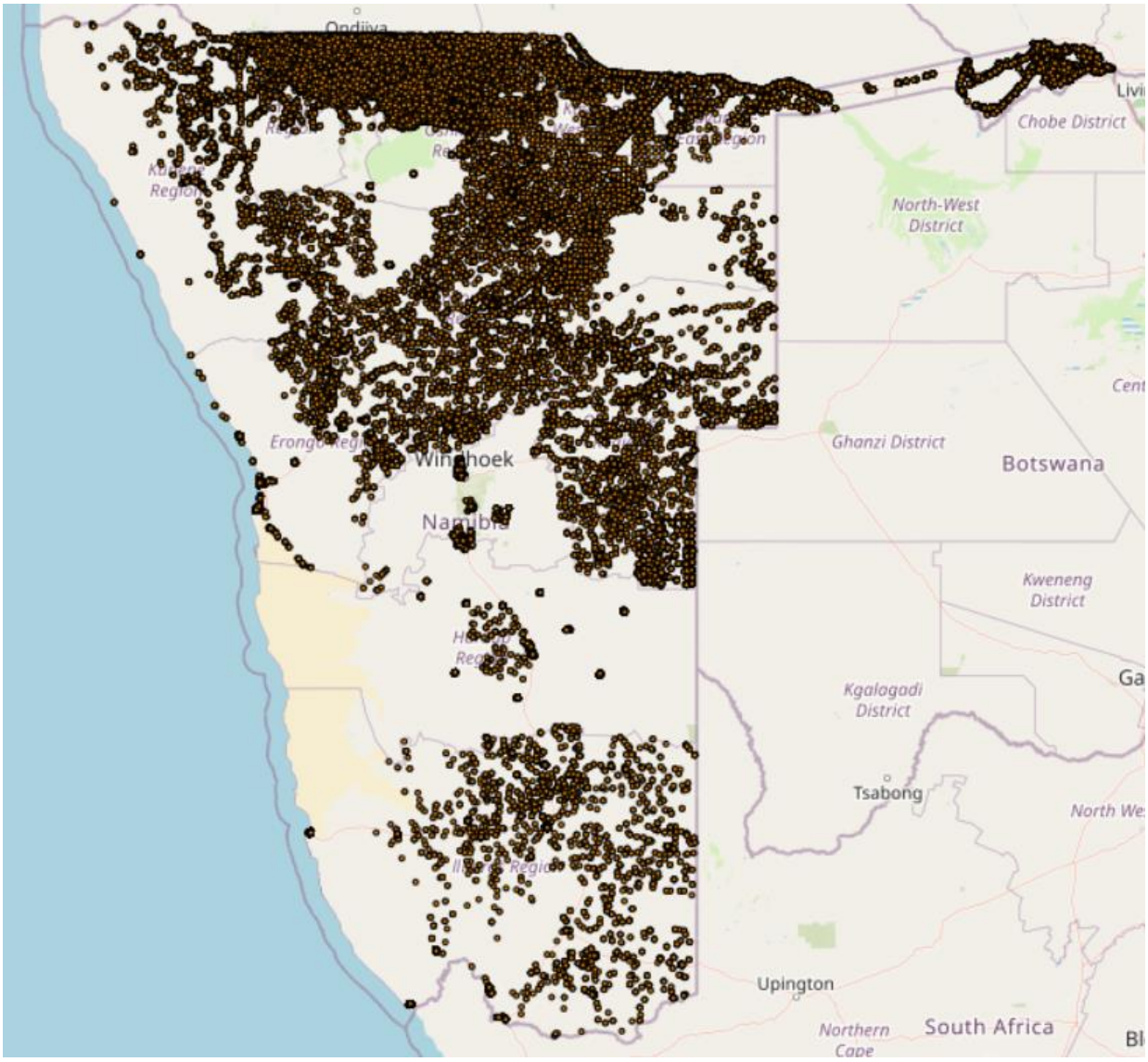


Figure 24 Geocoded Register of Buildings and Households

Principle 3. Common geographies for the dissemination of statistics

Namibia collects statistics based on enumeration areas for censuses and national sampling frame for surveys. Statistics are aggregated and disseminated at constituency, region and national levels. Calls have been made to highly disaggregate statistics to lower level boundaries. The country is challenged with the existence other sector-specific administrative boundaries that cut across enumeration areas and administrative boundaries e.g. police zones, magisterial districts, farm registration divisions, health districts, education circuits, etc. These boundaries are not harmonized with enumeration areas and when statistics are required for these functional units, projections have to be made e.g. know how many children under 5 year for the immunizations that occur in health districts.

Figure 25 illustrates how enumeration areas are harmonized within constituency boundaries.

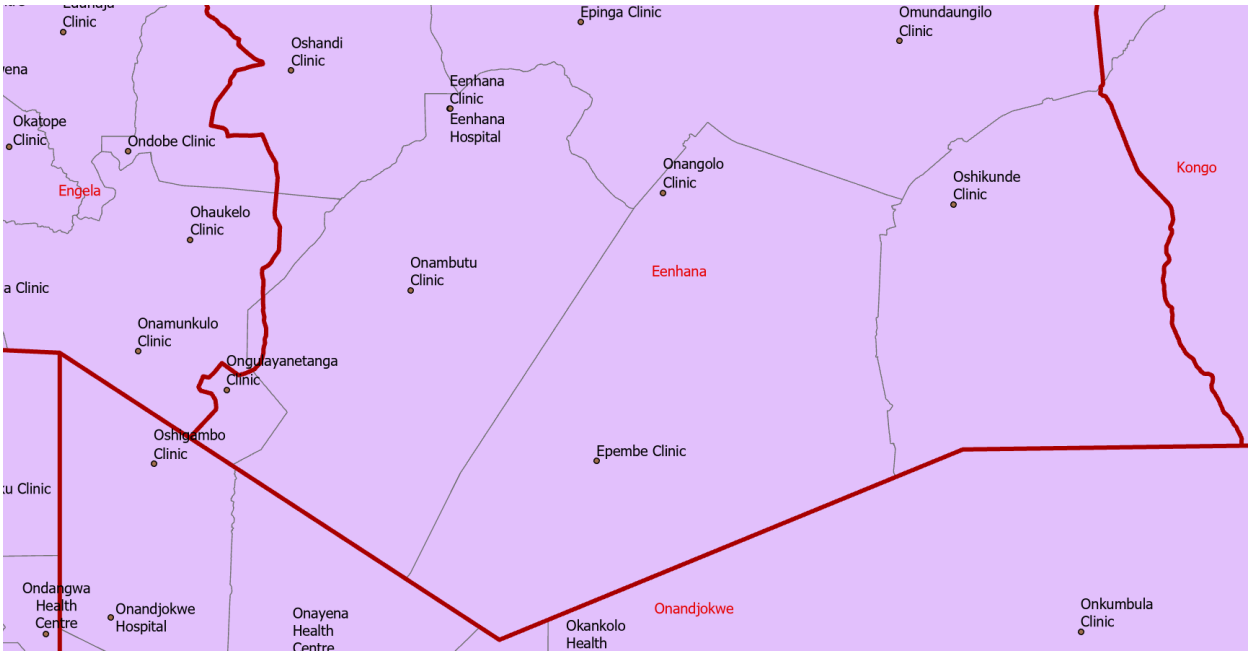


Figure 25 Overlapping boundaries of health districts (red) and constituencies (black).

As part of pre-enumeration for the envisaged 2021 population and housing census, the Namibia Statistics Agency is developing a methodology to move towards a geographic register of households linked to dwellings for statistical collection. This will ensure that statistics can be geographically disaggregated or aggregated for any functional unit without the challenges of projections. However, this will have to be done considering all the arising issues pertaining to privacy and confidentiality. The country is eagerly awaiting the guidance materials that can be provided by the EG-ISGI on handling privacy and confidentiality.

Principle 4. Statistical and geospatial interoperability

This aspect has not been attended to so far due to lack of technical capacity. A lot of assistance is required to assist the country in business process mapping based on the GSBPM. Interoperability principles are highly technical and requires building capacity.

Principle 5. Accessible and usable geospatially enabled statistics

The Namibia Statistics Agency links its major statistics to geography to aid in the dissemination/communication process. Maps are used to communicate statistics in a simpler and more user-friendly manner. These maps supplement traditional tables and graphs commonly used to disseminate statistics. Furthermore geospatially-enabled statistics are disseminated through the National Geographic Portal[20] and also through Atlases.

[20] https://digitalnamibia.nsa.org.na

Your National Response to COVID-19

How has the GSGF supported your national response to COVID-19?

In Namibia the Ministry of Health and Social Services have been geocoding positive cases of COVID-19 and their contacts. The spatial pattern/distribution of cases has assisted the Ministry to strengthen their surveillance. The Namibia Statistics Agency has built capacity in this geocoding exercise and maps of patterns are used to re-enforce lockdowns/surveillance.

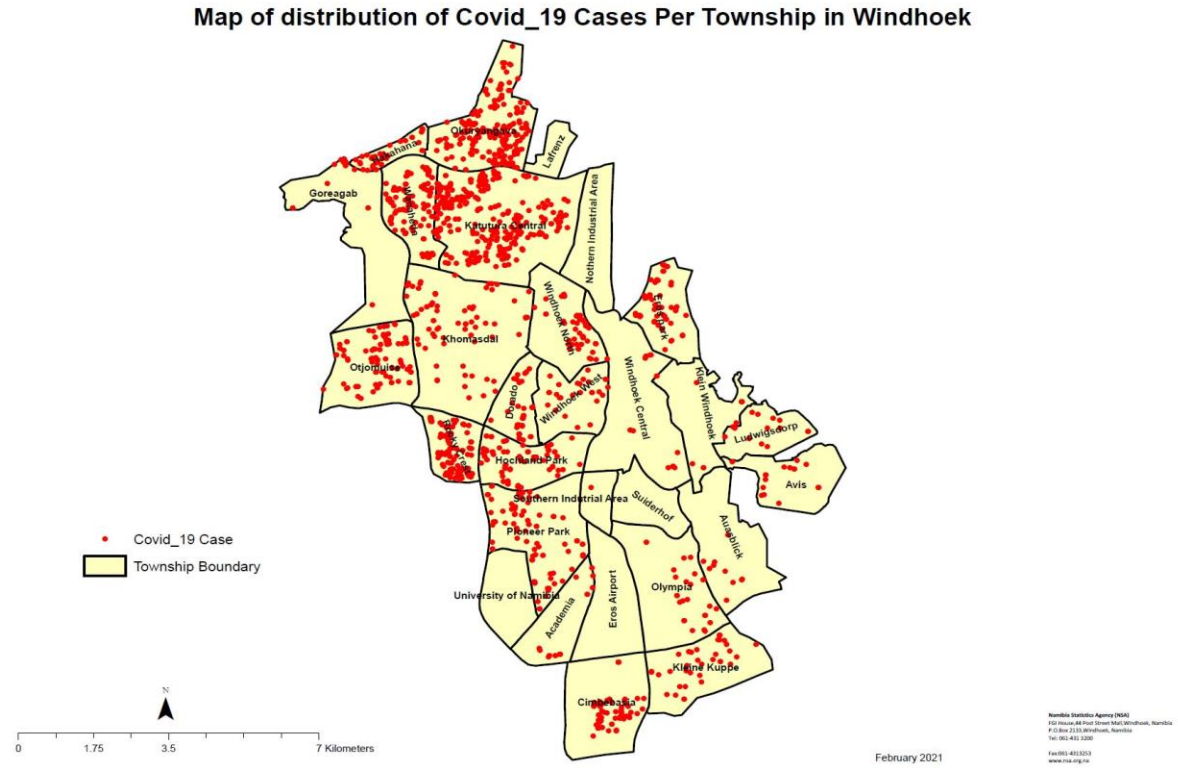


Figure 26 Distribution of COVID-19 Cases by Township - Windhoek, Namibia

How could the GSGF have supported your national response to COVID-19, if it had been implemented? What were/are the barriers in its implementation?

The lack of a fully geocoded address register in the country has impaired the geocoding exercise of COVID-19 cases. The country lacks a standardised national address standard to build a proper and seamless address register. The existence of a standardised national address dataset would have made it easier to timely geocode COVID-19 cases and assist in contact tracing. This would have scaled-down the spread of cases especially in the severely affected coastal towns. No geocoding was attempted for rural areas due to lack of a proper village database or lowest locality list.

New Zealand

Name of Agency: Stats NZ

Submission From: NSO

The Overall Implementation of the GSGF

New Zealand has implemented all components of the GSGF. This process was not carried out as a single programme but was built over several years using existing technology and infrastructure – some of which pre-dates the development of the GSGF.

Key Resources include:

- Published information on about geographic classifications: https://www.stats.govt.nz/geographic-data-and-maps/
- Online map products: https://maps-by-statsnz.hub.arcgis.com/
- Downloadable geospatial data: https://datafinder.stats.govt.nz/

Having the components in place allows us to focus on making improvements to the infrastructure and looking into future technologies that will be incorporated into future versions of the GSGF. These include:

- Integrated property data that links address, property, and dwellings.
- Gridded geographies.
- Environmental geographies.
- Earth Observation for statistical production.
- Alternative location models such as building features.
- Alternative location systems such as Discrete Global Grid Systems.

The Implementation of the Principles of the GSGF

Principle 1: Use of fundamental geospatial infrastructure and geocoding

New Zealand's official street addressing system[21] was geocoded by LINZ and made publicly available. Stats NZ added in-use addresses from 3rd parties and uses field staff to verify the addresses and their location. This forms the basis for the Statistical Location Register (SLR). Street addresses were used for the first time to mail out census forms for the 2018 census.

Principle 2. Geocoded unit record data in a data management environment

Stats NZ developed an internal geocoding and street address verification system which is used to maintain the Statistical Location Register (SLR). The SLR resides in a protected environment with restricted access to personnel.

The SLR is one component of the three registers system that also includes businesses and people. Stats NZ hosts the Integrated Data Infrastructure (IDI) that contains data about citizens from core government agencies. Addresses and their locations are key linking variables and were used to augment

[21] https://www.linz.govt.nz/system/files_force/media/publications-attachments/useful_info_for_working_with_addresses.pdf?download=1

data in areas that had low responses in the 2018 Census. The IDI is also part of a restricted environment which is available to researchers on application.

Principle 3. Common geographies for the dissemination of statistics

The statistical geographies were digitised in the early 1990's and updated in 2018 with the publication of the Statistical Standard for Geographic Areas[22]. Statistical geographies begin with the Meshblock which contain between 30 and 60 dwellings. These were used originally for census enumerators. Statistical Areas developed for output, SA1 and SA2, are part of the nested hierarchy with populations of around 100 for SA1, and 1,000 for SA2. They allow for the release of data at the safest resolution to maintain confidentiality. Statistical Areas combine to create local government administration areas and electoral districts. Statistical and administrative geographies are updated annually and made available to the public as spatial data from Datafinder, our geographic data service[23]. Confidentialised population data for Statistical Areas is disaggregated to address points to calculate populations for additional geographies.

Principle 4. Statistical and geospatial interoperability

Online maps were created for the first time following the 2013 census. This was made possible by investing in an ESRI-based geospatial platform. Geospatial data products were released on the geographic data service[24]. These products were developed for geospatial users and combine the statistical table with the geography as a geospatial layer. Previously the two components were delivered separately to be joined before use by each user.

Maps and visualisations[25] are a common element of statistical releases. ESRI provide the primary platform for online mapping, along with some R/Shiny applications. The underlying data is made available as OGC and ESRI REST web services

Principle 5. Accessible and usable geospatially enabled statistics

The primary purpose of statistical geography design is to preserve confidentiality and reduce the amount of data suppression where there are low counts of a particular variable. Stats NZ established a geographic data service to disseminate geospatially enabled data for download or consumed as web services.

All publicly available data is licenced for permissive use using NZ's Creative Commons attribution data licences. This is mandated by the New Zealand Government Open Access and Licencing framework[26] (NZGOAL).

[22] https://www.stats.govt.nz/methods/statistical-standard-for-geographic-areas-2018
[23] ibid
[24] ibid
[25] https://maps-by-statsnz.hub.arcgis.com/app/3a61db9ab16d435b91b3997ed3a4b634
[26] https://www.data.govt.nz/toolkit/policies/nzgoal/

Your National Response to COVID-19

How has the GSGF supported your national response to COVID-19?

COVID-19 demanded geospatial products that were outside the normal statistical release programme. By using address points as an intermediate step Stats NZ was able to publish 3D gridded visualisations of vulnerable population age groups[27] and indigenous populations living in deprived areas[28]. LINZ and Stats NZ contributed data to the Manaaki Promise[29] web site designed to support Maori and Pacific people who are among our most vulnerable populations. Census 2018 data was published as web services on an ArcGIS Online platform[30] – some of which were consumed directly by Manaaki Promise's web maps.

New visualisations of statistics were also produced to aid impact to and understanding of statistical data. These include multi-variate dot-density maps of ethnicity[31] and commuting[32], ethnicity cartograms[33], and an animation of population movements[34] using cellphone data as the country moved into lockdown.

Panama

National Statistical Office

Institution: Comptroller General of the Republic / INEC

Submission From: NSO

The Overall Implementation of the GSGF

From the perspective of the NSO of Panama, we have not implemented a GSGF as such or with the fundamental purpose of providing or disseminating data to third parties. The circumstances of obtaining timely data and the lack of geostatistical information at the institutional level (either because they do not produce it or lack technical capacities); We have had to respond by offering geospatial and statistical inputs and products to educational institutions, government bodies, private companies, NGOs and the general public.

Bearing in mind that we have built a GIS since 2003, with base information for conducting National Censuses, we have contributed to generating geocoded information through the National Geostatistical Framework that somehow supplies the aforementioned needs. Currently we have had approaches with several Institutions in order to share information that strengthens the current systems.

The Implementation of the Principles of the GSGF

Principle 1: Use of fundamental geospatial infrastructure and geocoding

The fundamental data that we have determined are the administrative levels (country, province, district and township), the road network, hydrography, track gauge, populated places, neighborhoods and

[27] https://www.stats.govt.nz/news/where-do-over-65s-live
[28] https://www.manaakipromise.co.nz/app/a038483c635d4896ac0756a2708a12e9
[29] https://www.manaakipromise.co.nz/app/a038483c635d4896ac0756a2708a12e9
[30] https://maps-by-statsnz.hub.arcgis.com/app/3a61db9ab16d435b91b3997ed3a4b634
[31] https://storymaps.arcgis.com/stories/28ff84c3ff6640ee9f216580faa96dcc
[32] https://storymaps.arcgis.com/stories/6f8b5f981ad34f11bedaf1725e9cb698
[33] https://storymaps.arcgis.com/stories/8c8c82cfc2a6406f979519a382d0b81b
[34] https://www.rnz.co.nz/news/national/415008/new-videos-show-how-covid-19-slowed-new-zealand-s-pulse

georeferenced structures. All of them have all their geocoded elements, in accordance with the codes of the administrative political division of the Republic of Panama, and the codes of populated place and neighborhood generated by the NSO. Similarly, each structure has a unique geocode.

Principle 2. Geocoded unit record data in a data management environment

We have the platform, structure and experience to link statistical data up to levels of populated places, however beyond those provided by the Censuses, such as external data or generated by Surveys, we have not taken the action to exploit this information. Another aspect to mention, would be that we lack a metadata as such.

Principle 3. Common geographies for the dissemination of statistics

In our case, we do not represent the geography in the form of grid units, but rather we use the administrative areas for the aggregation and disaggregation of the data. Regarding dissemination, it is a challenge to provide the user with information through virtual platforms or geovisor, we currently have a module to hang thematic maps prepared in image format.

Principle 4. Statistical and geospatial interoperability

This year our objective is the campaign (which we started) to establish interoperability with strategic institutions according to their functions for the exchange of statistical and geospatial information. We know we have a long way to go, but we find ourselves in the middle of it; this through inter-institutional agreements or conventions that are under development.

Principle 5. Accessible and usable geospatially enabled statistics

We have not implemented offering users geospatial data in a virtual way, since we do not have the tools to share information that allows you to access, view, and analyze the information easily.

Your National Response to COVID-19

How has the GSGF supported your national response to COVID-19?

We have provided support by offering analog and digital cartographic material to entities such as: Ministry of Health, Ministry of Social Development.

How could the GSGF have supported your national response to COVID-19, if it had been implemented? What were/are the barriers in its implementation?

When was timely appropriate, we could have contributed experience, supplies, technical personnel and technology in order to accurately locate the contagion points by residence, establish sanitary control sites, and support monitoring and spatial follow-up tasks. The main barrier was not having been invited to participate together with other government entities that could have provided valuable contributions.

National Geospatial Information Agency

Institution: Tommy Guardia National Geographic Institute

Submission From: NGIA

The Overall Implementation of the GSGF

To implement the GSGF, an action plan was established within the country's spatial data infrastructure. In the context that the Integrated Geospatial Information framework is also being implemented, we have established common ground, and for this we have started with the establishment of fundamental data. So, we can say that the implementation refers to the Spatial Data Infrastructure.

The Implementation of the Principles of the GSGF

Principle 1: Use of fundamental geospatial infrastructure and geocoding

We are still agreeing on the implementation process. Because the subject of Geocoding is new for cartographic and statistical agencies in a common way.

Principle 2. Geocoded unit record data in a data management environment

There is geocoded data since the census definition. But there is no geospatial integration with information from a common infrastructure. Because of the previous point, a plan is formulated for their coherent and interoperable integration.

Principle 3. Common geographies for the dissemination of statistics

The common areas are among the fundamental data to be homologated, in this context, it has been possible to reach an agreement both from the NGO and the NSO. One of the fundamental geospatial basis on which statistical information must lay on.

Principle 4. Statistical and geospatial interoperability

Through the spatial data infrastructure, work has been done to ensure that all information is interoperable. However, work has yet to be done on the issue.

Principle 5. Accessible and usable geospatially enabled statistics

To date, we have access to geospatially enabled statistical data

Your National Response to COVID-19

How has the GSGF supported your national response to COVID-19?

Provide cartographic information for logistics and transportation of vaccines, medical personnel, food.

How could the GSGF have supported your national response to COVID-19, if it had been implemented? What were/are the barriers in its implementation?

There are multiple barriers to implementation, there is a lack of budget for data generation, there is an excessive lack of valuation of information in general for decision-making, especially to keep the data updated. If the framework were in operation, there would be no duplication of functions and works, this benefits the country in directing resources in a focused manner. On the other hand, there would be no uncertainty in the use of data, since they were homologated under the same source, there were not several versions of the same data in different institutions.

Peru

Name of Agency: National Institute of Statistics and Information Technology - INEI
Submission From: NSO

The Overall Implementation of the GSGF

The Global Statistical and Geospatial Framework is in the process of being implemented, but initiatives such as GeoSur, IDE and MEGA have undoubtedly contributed to its implementation. Cooperative inter-institutional work at the national or international level is very helpful for exchanging experiences and strengthening capacities.

Recently, an exchange of experiences was held between DANE (Colombia) and INEI (Peru) where it was identified that each specialist may have different interpretations of the same principles, and that the 5 principles do not necessarily work in that order, for which was an enriching experience, and that helps us to continue understanding it for the improvement and strengthening of our cartographic and geospatial work on the data that is produced.

In 2019, I participated in the MEGA project (Colombia), where the administrative limits of 3 geographical levels were unified in coordination between the INEI and the IGN (National Geographic Institute). Likewise, INEI (NSO) is participating in the training provided by SDI-Peru, in the Metadata courses.

The Implementation of the Principles of the GSGF

Principle 1: Use of fundamental geospatial infrastructure and geocoding

Although the process of a single standardization for national organizations is in process, practically all the organizations of the state structure find the georeferencing of their data almost indispensable. Some are in this process, and even the same national census of 2017 carried out this process at the household level. Much of the most important cartographic layers and elements are also georeferenced, mainly in metropolitan Lima and the large cities, although all these cartographic data are not articulated between the different institutions.

Principle 2. Geocoded unit record data in a data management environment

Many of the national organizations use the national code identifier “UBIGEO” as a reference for the geocoding of their records and in the microdata, so that they can be viewed in any of the GIS tools. The use of metadata is being taken into account as well. The use of big data tools are also being applied in some specialized institutions. The roles of the functions for the custody of data and its maintenance are identified within each institution, however, there are logistical and planning problems for updating them.

This process requires the establishment and implementation of data and metadata standards so that data production is usable and consistent, both in geographic references and in small areas.

Principle 3. Common geographies for the dissemination of statistics

Normally, the information of the georeferenced and/or enabled data can be disaggregated and visualized and interpreted to a large extent up to the political-administrative level N°3, which are the districts. Regarding the aggregation and disaggregation methods, the use of grids is not yet widely used.

Regarding the use of the grids, an attempt is made to work with a geospatial framework for the next national agricultural census, which are already being piloted in two areas of the country.

Principle 4. Statistical and geospatial interoperability

SDI Peru promotes the use of standards for the geospatial information produced, and some institutions have already adopted this principle, however, the INEI(NSO) is still in the process.
The lack of standards means that information on the web cannot be interoperated and that monolithic and isolated systems are created. There is little exchange of information in public entities.

Principle 5. Accessible and usable geospatially enabled statistics

Currently, the user can view and even download much of the fundamental data such as national charts in shp format: contour lines, hydrography, toponymy. However, when it comes to more specialized layers or data, there may be more difficulties in accessing them.

Another detail that can be presented in the information is the use of a multiplicity of formats, and platforms. INEI as the NSO regularly publishes information open to the general public, through query systems that integrate the database with statistical and geospatial information, such as:

- DATACRIM (Integrated Crime Statistics System)
- SIRTOD (Regional Information System for Decision Making)
- Consultation System for Populated Centers
- Statistical Information System to support prevention for the effects of the El Niño Phenomenon and other Natural Phenomena
- Poverty Map at the Provincial and District levels.

Your National Response to COVID-19

How has the GSGF supported your national response to COVID-19?

During COVID 19, the INEI(NSO) has collaborated with statistical, economic and social information, in addition to providing georeferenced information on blocks, homes, essential institutions such as banks, markets, among others; to the ministries and government authorities in charge of the elaboration of health and economic strategies. However, this geospatial framework had to undergo a rapid update process based on satellite images to cover the peripheral areas that had undergone changes since 2017.

How could the GSGF have supported your national response to COVID-19, if it had been implemented? What were/are the barriers in its implementation?

It would have allowed faster action in decision-making and in the implementation of strategies with a territorial approach. For example, the fact that some institutions do not have certain data georeferenced, means that it has to be done in a hurry and it takes time to have that information, as well as with information that is not updated or disseminated in different institutions.

Senegal

Name of Agency: Agence nationale de l'Aménagement du Territoire

Submission From: NGIA

The Overall Implementation of the GSGF

Statistics and geospatial information are managed by two separate organizations (NSO and NGIA). These two governmental entities have signed a collaborative agreement in the form of a Memorandum of Understanding (MoU).

Besides, a working group under the responsibility of the Ministry of Finance and Planning brings together members of different governmental organizations (including both the NSO and NGIA) that produce and manage statistics/sectoral data or geospatial information to contribute to the monitoring of the SDGs with Earth Observation (Groupe technique de la plateforme des parties prenantes pour le suivi des ODD du secteur de l'environnement - GTPODDE).

The Implementation of the Principles of the GSGF

Principle 1: Use of fundamental geospatial infrastructure and geocoding

Fundamental geospatial infrastructure is being built and a lot has been achieved already (more than 90% in terms of fundamental datasets created already).

Principle 2. Geocoded unit record data in a data management environment

Our statistical data on the population is geocoded only down to the level of the locality (village or a small settlement just beneath the village), not yet to the household level (which is a desirable geocoded unit).

Principle 3. Common geographies for the dissemination of statistics

Implemented down to the fourth level administrative boundaries (communes = municipalities) although not all "communes" have their boundaries currently precisely identified and appropriately materialized.

Principle 4. Statistical and geospatial interoperability

Integrated up to the fourth level administrative boundaries for part of certain statistical data and not for all available statistics.

Principle 5. Accessible and usable geospatially enabled statistics

Already in 2013, the NSO leveraged geospatial information to conduct the national general census. It literally used the fourth level administrative boundaries that were generated by the NGIA to produce statistics on people, settlements, agriculture, etc. The operation was conducted using PDA/tablets. Though not all available statistics at the NSO are georeferenced.

Your National Response to COVID-19

How has the GSGF supported your national response to COVID-19?

Through a web application to monitor the epidemic at the second level administrative boundaries to support the decision-making on the movements of people and where to bring more resources...

How could the GSGF have supported your national response to COVID-19, if it had been implemented? What were/are the barriers in its implementation?

We could have supported decision-making better by focusing more on the areas that matter if the data was more disaggregated.

Addendum

As the national spatial planning agency, without the integration of various sectoral or statistical data with the fundamental geospatial data that we generate and manage, we could not have produced the national spatial plan that is being currently promoted by the government and mandated for implementation by all actors throughout the country. There is still significant progress to be made, especially to establish a formal cooperation framework with the NSO.

Sierra Leone

Name of Agency: Statistics Sierra Leone

Submission From: Desk Review from ECA

The Overall Implementation of the GSGF

The Overall Implementation of the GSGF

Sierra Leone is developing the National vision for the implementation of GSGF. Some components of GSGF, were implemented during the 5-18 December 2015 census and the DHS Sierra Leone: 2019, 2016, 2013 and 2008.

Principle 1: Use of fundamental geospatial infrastructure and geocoding

Cartography and Geographic Information Systems (CGIS) was introduced into mainstream Statistics Sierra Leone during the 2004 Population and Housing Census. Updating of the EA frame: The national frame used in the sampling process for all surveys/research in the office is housed in the CGIS division as a classified document. However, this frame is created as a result of each census conducted and since censuses are conducted once every ten years (decennial). The frame is updated from time to time so as to avoid getting outdated. The updating of this EA frame forms part of the routine activities of the division.

The main exercise is to re-define the boundaries of the EA; in the urban areas it involves quick household counts and updating social facilities (Markets, Schools, Health facilities etc.) which also serve as reference points around the EA boundary. For rural EAs the update is usually about localities. The challenge is mainly in the urban areas with rapid population and peripheral growth.

Census cartographic mapping: Census mapping supports enumerators and supervisors to carry out their specific assignments that include identification of enumeration areas, location of households, agricultural

holdings, establishments and demarcation of supervisory areas on the basis of size, population and manageable distances.

Census mapping assists in eliminating omission and duplication of information; ensuring that data are allocated to the proper administrative units; determining the number and distribution of census personnel; and comparing data from other censuses or surveys. Maps are needed during all stages of a census or survey. They are required in the planning stages, data collection and analysis and presentation of the results.

This process involves conducting quick counts of households in localities and demarcating localities, parts of localities or a combination of localities as EAs depending on the number of households as prescribed by the census/survey methodology.

Listing and segmentation: The Cartographic section in the CGIS division plays a crucial role in the implementation of every survey conducted by the office irrespective of whichever division is coordinating that survey. Most surveys/research require listing of households before the commencement of main data collection. Segmentation of Enumeration Areas (EAs) exceeding the normal 80-120 households is required if enumerators should be given equal work loads.

Principle 2. Geocoded unit record data in a data management environment

Geocoding of Housing unit location (Dwelling Frames, Housing Footprints), collective living quarter locations (Dwelling Frames, Housing Footprints) a set of digital enumeration area maps or derived dissemination units, which are designed to enable the production of all output products that will be disseminated to government departments and the general public.

Geocoding of Geographic boundary files in a digital format for all statistical reporting units for which census indicators will be tabulated. Listings of all statistical and administrative reporting units, including towns and villages, their variant names and geographic coordinates. Geocoding of Geographic equivalency files that indicate how current reporting units relate to those used in previous censuses, or how one set of reporting units relates to another set as well as the Geocoding of vector layers containing feature data, such as landmarks, roads, schools, hospitals and clinics, which can be used when analysing population data spatially. Geocoding was used to determine the Centroid files that provide a representative geographic point reference for each reporting unit. It also provided for gazetteers that provide geographic coordinates for all population settlements and other important geographic features in the country

Principle 3. Common geographies for the dissemination of statistics

A spatial geographic database, with polygonal and attribute information for the enumeration areas of the country (i.e., the units for which the territory is allocated to canvassers during the census). A common digital base can assist with censuses of agriculture and population. Census data can be released at the EA level or aggregated into new small-area dissemination units, such as population clusters. The division has a lot of products that are made available to MDAs and the general public; some for free and some for a fee which is basically on a cost recovery basis. Some of the products developed include:

- The new Map of Sierra Leone showing Regions, Districts, Chiefdoms and sections (these can be in A0, A1, A3, A4 and customized sizes);

- Shape files for a wide range of GIS data;
- Geospatially enabled statistical databases:
    - For all educational facilities across the country;
    - For all health facilities across the country
    - Of census data and other household survey datasets.
- For all localities, major roads, rivers, and social amenities.

Principle 4. Statistical and geospatial interoperability

A library of digital administrative boundaries, ranging from the provincial to the municipal levels (perhaps even at the level of the land parcel). Digital census atlases, dynamic atlases and spatial analysis techniques have been deployed.

Principle 5. Accessible and usable geospatially enabled statistics

Know the ease of accessibility (geometry, perimeter, compactness) within districts as well as the dentification of gaps and overlaps of the already existing district and locality boundaries.

South Africa

Name of Agency: Stats SA

Submission From: NSO

The Overall Implementation of the GSGF

At Stats SA, the GSGF, is a strategic initiative of the organisation, to deliver the organisation's vision namely …improving lives through data ecosystem. It will form the framework to collect, maintain, disseminate, and analyse spatial-statistical information.

Note, all Principles of the frame are incorporated in the organisation's GIF (Geo-spatial Information Frame). GIF is what our geographical frame is commonly known as at Stats SA.

The Implementation of the Principles of the GSGF

Principle 1: Use of fundamental geospatial infrastructure and geocoding

The address data is getting focus currently for the upcoming census. Focus on maintenance and updating. Fundamental base data is continuously received to update the address data. In this was the Enumeration Areas will be updated where change is required. A geographic hierarchy of features representing the country's configuration has been adopted as a framework for the geodatabase.

Principle 2. Geocoded unit record data in a data management environment

The upcoming census requires the update of enumeration areas and place names. The address data and other fundamental data (like satellite and other photography) are used. Following the onset of Covid-19, a strategic decision was made to adopt a multi-purpose frame to facilitate multi-modal data collection using face-to-face, telephonic and web-based self-enumeration approach. Such a frame would comprise geocoded contact details of households and institutions to enable remote data collection.

Principle 3. Common geographies for the dissemination of statistics

Stats SA works closely with the national demarcation board. Geographies are continuously maintained. Small Area Layer (SAL) was adopted for dissemination purposes. Since the President of the Republic announced the District Development Model (DDM) approach, the plan is to transition our dissemination using the DDM. The DDM is the sub-regional approach intended to provide data and planning at a more granular level of geography.

Principle 4. Statistical and geospatial interoperability

The address data and enumeration area will enable linking with census, survey and other data. In institutionalising the interoperability, an organisational structure alignment has been adopted where the Geography unit has been moved into the integrated bigger branch comprising Methodology, Standards, Business Register, Research and Innovation, thereafter renamed Methodology and Statistical Infrastructure. This development is aimed at getting Methodologists and Geographers to collaborate and work closely in ensuring the geospatial statistical frame (modified GIF) is effected.

Principle 5. Accessible and usable geospatially enabled statistics

2011 census data and its spatial information is still the main data used in analysis currently, especially in the case of low-level spatial analysis. Preparations to adopt the DDM layer to replace SAL are underway.

Your National Response to COVID-19

How has the GSGF supported your national response to COVID-19?

YES. Stats SA has used spatial and statistical data to create a COVID Vulnerability Index.

How could the GSGF have supported your national response to COVID-19, if it had been implemented? What were/are the barriers in its implementation?

Face-to-face data collection was suspended during COVID lockdowns for a few months. Face-to-face collection was resumed following the adoption of the Standard Operating Procedure that incorporate Covid-19 safety protocols. A mixed-mode data collection strategy was developed. It is dependent on a high-quality address frame linked to contact information like telephone numbers. The availability of contact numbers is a barrier to implementation, as well as the availability of standardised, updated geo-spatial addresses.

Uruguay

Name of Agency: INEGI

Submission From: Combined NGIA/NSO

The Overall Implementation of the GSGF

In Uruguay there is the Spatial Data Infrastructure (SDI), a decentralized body of the Presidency of the Republic, with technical autonomy, created by Law 19149 of 2013.

It has the articulating function regarding the production, documentation, access and use of the geographic information of Uruguay.

The Implementation of the Principles of the GSGF

Principle 1: Use of fundamental geospatial infrastructure and geocoding

The SDI generates documents with technical specifications to be fulfilled by the GI producers, which they publish through geoservices that are made available on the institutional portals and the SDI portal.

Principle 2. Geocoded unit record data in a data management environment

The address base and internal addresses are being implemented in SDI with the participation of the state agencies that work on the issue.

Principle 3. Common geographies for the dissemination of statistics

At the level of the National Statistical System, it seeks to promote the same

Principle 4. Statistical and geospatial interoperability

Work is being done at the level of the National Statistical System.

Principle 5. Accessible and usable geospatially enabled statistics

With the next census it will be possible to georeference all the information at household level (in 2011, the households and rural establishments were georeferenced with the coordinates, and all the data was associated with administrative paperwork). From the census (which will be based on addresses generated by SDI) the data will be disclosed without violating the Statistical Secret Law.

Your National Response to COVID-19

How has the GSGF supported your national response to COVID-19?

To present the related information, the administrative limits generated by the Military Geographical Institute are used.

Experiences at the Regional Level

Africa

Name of Agency: UN-GGIM: Africa

Submission From: Regional Committee of UN-GGIM for Africa

The Overall Implementation of the GSGF

UN-GGIM: Africa has developed the African statistical spatial framework based on the five overarching principles of the GSGF. The framework is articulated around the following dimensions: Scale; Policy; Institutional; Modelling. Both national statistical offices and national mapping agencies can adapt, adopt, and apply the statistical framework to their national context, for instance in geo-enabling the national strategies for statistical development; in ensuring effective collaboration between statistical and geospatial community; in building basic data themes and use of common specifications and standards; and making geospatial analysis a core competency in any census office.

The Africa region has further gone to develop a strategy for the integration of geospatial and statistical information. The strategy outlines some of the policy principles on how to mainstream geospatial technology into the work of national statistical offices all the way through training, data and processes. UN-GGIM: Africa is now currently finalizing an implementation guide with operational guidelines that will inform on the establishment and implementation of national statistical geospatial frameworks (NSGF) with experiences and best practices for the proper integration.

The Implementation of the Principles of the GSGF

Principle 1: Use of fundamental geospatial infrastructure and geocoding

UN-GGIM: Africa is actively involved in the Second Administrative Level Boundaries (SALB) project, an initiative to provide the international community with a working platform for the collection, management, analysis, visualization and sharing of sub-national data down to the 2nd sub- national level, a very fundamental data for many applications (humanitarian assistance, censuses and statistical analysis, Environment, health, poverty mapping, etc.). The focus is on presenting the historic evolution of the administrative structure in terms of geography and names at the 1st sub-national level since January 1990 and at the 2nd sub-national level since January 2000. Despite challenges of currency and reaching out to all countries, Africa is on its way to have a continental dataset on administrative boundaries.

Principle 2. Geocoded unit record data in a data management environment

Geocoding of census data at the housing unit/building level provides an outstanding opportunity to aggregate census data at different spatial levels with high accuracy using GIS tools. Integration of the geospatial information with census data facilitates the computation of several SDG indicators, and the disaggregation and visualization of all SDG indicators by various levels of geography. The core dimensions of the African spatial and statistical framework have been designed to include the geo-referencing of place of usual residence to a pair of precise geographical coordinates and linked to an address point. Through ECA, the Africa region is currently developing avenues of integrating geocoding and spatial analysis of census data into census project document protocols. The effort will help

- Develop methods of linking geocodes with census tabulation plan

- Develop a procedure for geocoding and integrating geometric data collected during census cartographic phase into the geospatial analytical phase.
- Develop a step by step procedures for geocoding census data according to the following main and sub themes of a census: 1) Population size, distribution and structure; Household size and structure; Population projection; etc.

Principle 3. Common geographies for the dissemination of statistics

UN-GGIM: Africa has based its effort on the GSGF principles to assist many African countries to develop a solid geo-referenced (GPS) database of dwelling locations, clearly delineated enumeration area boundaries and a complimentary set of high-resolution satellite imagery.
Currently the region is developing a standard web-based application to record and edit geographic names in a harmonized manner for all African countries.

Principle 4. Statistical and geospatial interoperability

The benefits of developing, adopting and implementing technical standards and common metadata has been recognized by both statistical and geospatial communities, as they enable interoperability and facilitate the integration and use of diverse sources of statistical and geospatial data and services in all sectors of a global economy.

In an effort to encourage African countries to adopt a common regional framework of standards within the GSGF, UN-GGIM: Africa is developing through the Mapping Africa for Africa (MAfA) initiative, the African Metadata Profile which is a subset of the ISO 19115 Metadata Standard. The profile selects a set of metadata elements which are relevant for Africa. This effort contributed to the development of national metadata profiles at country level.

Principle 5. Accessible and usable geospatially enabled statistics

With the support of the 2030 Agenda for Sustainable Development Sub-Fund of the UN Peace and Development Trust Fund (UN-PDF), the Africa region has developed an online application, a standard web-based application built upon ArcGIS Online software for the storage, maintenance and visualization of national data. It features an interactive web-map interface having data visualization, simple query functionalities and database access, upload and update. Countries such as Cameroon has started making their geospatial datasets available for publishing, sharing and access under this interface.
https://ecageoinfo.maps.arcgis.com/apps/webappviewer/index.html?id=30af39551b2842da875bbe79014b5744

Your Response to COVID-19

How has the GSGF supported your regional response to COVID-19?

Drawing from the guiding principles of the GSGF, the region has built an African Dashboard that tracks the status of COVID-19 in real time. The dashboard is continuously updated with new interface and data. https://arcg.is/5LCSa.
Additionally, combining statistical and geospatial datasets a research study was carried out to map community mobility patterns in Africa. Thanks to the GSGF principles, the study provide the geospatial insights into changes in population movements as a response to policies aimed at combating COVID-19.

How could the GSGF have supported your regional response to COVID-19, if it had been implemented? What were/are the barriers in its implementation?

Should the GSGF being fully implemented both at regional and national level, this would have improved the readiness of Africa region in the use of geospatial information in the tracking of the COVID-19 outbreak and, also countries preparedness to provide tools and dashboard for data geo-visualization and impact assessment.

The Americas

Name of Agency: UN-GGIM: Americas

Submission From: Regional Committee of UN-GGIM for the Americas

The Overall Implementation of the GSGF

The project of Statistical and Geospatial Framework for the Americas (MEGA) is developed under the framework of the United Nations Regional Committee on Global Geospatial Information Management for the Americas (UN-GGIM: Americas), to promote and encourage the production of geographic and statistical information, as well as the identification, development and implementation of strategies for the integration and use, based on the strengthening of partnerships of collaboration, cooperation and participation of the Member States.

MEGA defines an information infrastructure made up of statistical and geospatial information connected and conceptually integrated to describe socioeconomic attributes. MEGA allows the integration of statistical and geospatial data in a unified way for the region with principles and standards, strengthening dissemination for decision-making.

MEGA is fully aligned to the five principles that establish the global statistical and geographic framework developed by the global expert group on the integration of statistical and geospatial information and that deal with access and use, interoperability, disposition through common geographies and georeferencing.

The Implementation of the Principles of the GSGF

Principle 1: Use of fundamental geospatial infrastructure and geocoding

The MEGA project is made up of administrative and statistical geographic units that facilitate the integration process.

The administrative divisions are commonly used and defined for all the countries. The statistical information included in the first version of MEGA is disaggregated at the municipal level. Each unit has an identifier that allows its location in a standardized and open cartographic format.

The process includes the spatial reference as one of the most relevant elements to consider geospatial integration. For the specific case of the Americas, the GGRF has the regional component SIRGAS (SIRGAS stands for The Geocentric Reference System for the Americas).

Principle 2. Geocoded unit record data in a data management environment

Most of the countries in the Americas use the political-administrative division for their frameworks. In this sense, the MEGA establishes three levels of territorial disaggregation:

1. Level 1: Corresponding to the country.
2. Level 2: Corresponding to the following territorial level after country.
3. Level 3: The next territorial level after level 2.

About the statistical information, MEGA includes the following indicators:

1. Total housing units
2. Total people
3. Total men
4. Total women

Each of these indicators is registered to levels 1, 2 and 3 defined in the geospatial information of MEGA.

Principle 3. Common geographies for the dissemination of statistics

The MEGA includes the statistical and geographic information available in each country according to the parameters established in the standardization document. The MEGA framework has defined as a unified service for display and to make queries at the local level (country, department/state and any other administrative units) and also at regional (country) levels.

America´s countries disposed of the political-administrative division information and the geographic metadata for each one of the three geographic levels included for the MEGA based on ISO 19115 standard.

Principle 4. Statistical and geospatial interoperability

The MEGA project can be used as support for different fields of knowledge, facilitating the exchange of information based on quantitative data and is a fundamental tool to assist in the tasks of analysis and interpretation by local and national governments.

The MEGA version 1.0 is a unified service, where the participant countries make available through the National Statistics Agencies and Cartographic Agencies, housing units and population data in a standardized format.

Principle 5. Accessible and usable geospatially enabled statistics

The MEGA has a viewer to facilitate the consultation, visualization and download of geospatial information classified by country or whole continent[35].

Your Response to COVID-19

How has the GSGF supported your national response to COVID-19?

Yes, the GSGF has supported our regional response to COVID-19 by allowing harmonized and standardized geospatial information, specifically in the countries of Central America.

[35] http://www.un-ggim-americas.org/mega_en/

These countries calculated the COVID19 Vulnerability Index with the information available in each of them to strengthen the decision-making process of local entities, taking as input the geographic layers provided of the MEGA, whose technical specifications respond to the principles of GSGF.

The barriers are associated with the availability of statistical information at the required levels.

Annex 1 – Elaborations and Supplementary Information

India – Supplemental Note

Activities undertaken by India for the integration of statistical and geospatial information

1. It is well-appreciated that geo spatial layer on official statistics & socio-economic survey data will add visualization and easy interpretation of data by the user. Application of geospatial technology in data visualisation will make monitoring mechanism more effective. If the common geospatial coding structure can be identified and agreed upon, which to a large extent already exists, the integration can make the statistics extremely relevant and pivotal. Different agencies in India are working in a complementary manner to enable and implement the integration of statistical and geospatial information.
2. While ISRO has developed geospatial data standards for India, the Survey of India has developed a High Resolution National Topographic Database (HR-NTDB) that can facilitate the integration. The Ministry of Statistics & Programme Implementation (MoSPI) is also working for adding Geo Spatial layer on various MoSPI data products, like the Consumer Price Indices, Economic Census, Urban Frame Survey in a phased manner etc.
3. Other Ministries, like the Ministry of Health and Family Welfare (MOHFW) and Ministry of Education, have also initiated a range of initiatives for creating geo- databases at micro level for improving overall quality, easy accessibility and better utility of the statistics of their respective domains. In the National Family Health Survey (NFHS) conducted by MOHFW, location (longitude and latitude) of the Primary Sampling Units (PSUs) are being recorded. These Geocodes are particularly useful in linking NFHS data to other important information on population, climate and environment factors etc. A Government to Government (G2G) web-based Monitoring Information System viz., Health Management Information System (HMIS) has also been developed to monitor the National Health Mission and other Health Care Schemes and to provide key inputs for policy formulation and appropriate programme interventions. Under this system, a provision through which a State can map its facilities as per its latitude and longitude and data can be rendered into a map (like heat maps) is under development phase and would be made live soon.
4. Similarly, D/o Higher Education, M/o Education is conducting an annual survey on all higher education institutions in the country in which geographical references (latitude and longitude) of institutions are being collected. Ministry of Tourism maintains geospatial information for approved Hotels and recognized Tour operators (Inbound, Domestic, Adventure), travel agents & tourist transport operators.
5. A more detailed discussion of these efforts is given in Annexure. However, certain proactive measures need to be taken to accelerate the pace of this integration of statistical and geospatial information. The measures can be described under two broad headings – (i) those related to the

digital revolution which is accompanied by 'big' datasets and (ii) those related to the Global Statistical Geospatial Framework.

(i) Measures for taking care of new datasets emerging from the digital revolution

1. There is an immediate need for greater investments in ICT infrastructure.
2. Geospatial industry is moving from analysing and presenting discrete data sets towards working with streams of spatially-enabled data (e.g. real time location-based) so more focus needs to be diverted towards accuracy of field data.
3. To enable tabulations and spatial aggregations of statistical nation-wide datasets, to be referenced to any small geographic or administrative subdivisions up to village level boundary, updated large scale map is required. So, availability of imagery and further feature extraction needs to be carried out at a faster pace. Use of Machine learning and Artificial intelligence techniques needs to be adopted.
4. Institutional arrangements need to be put in place for operationalizing an integrated and coherent approach with other information infrastructures of other organisation.
5. The policy push is necessary at all levels this will help to initiate and harmonise the strategies and related regulations to achieve full integration.
6. It is important to have guidelines and a framework to manage and maintain the geospatial data throughout its lifecycle.

(ii) Measures for Implementation of the GSGF

7. The GSGF is a very good step towards global geospatial data harmonization and exchange.
8. For Global sharing of data, only gridded geography should be considered for all spatial information. For instance, for India, area estimations at Country level are best derived from Albers Equal Area projection.
9. While there is a benefit with gridded geography, some of the thematic information in India is in vector form. Appropriate methodology needs to be worked out for converting these data sets to gridded geographies.
10. Standards for temporal consistency should be achievable with methodology currently available for deriving information about a particular theme.
11. Launching a global level physical infrastructure to host open global geospatial data under GSGF will help preservation & curation of datasets.

Details of work done by different organisations for the integration of statistical and geospatial information

Indian Space Research Organisation (ISRO)

6. ISRO has developed geospatial data standards for India during 2005 and bought out NNRMS standards document with the active participation of experts drawn from various survey organizations across India. The title of the publication is "NNRMS STANDARDS: A NATIONAL STANDARD FOR EO IMAGES, THEMATIC & CARTOGRAPHIC MAPS, GIS DATABASES AND SPATIAL OUTPUTS", ISRO: NNRMS: TR: 112: 2005. This contains standards to be adopted in India for raster and vector data along with theme-wise standards for classification.

7. Under Natural Resources Census programme, geospatial mapping of various themes was carried out. Besides, themes like waste land mapping, ground water resources, etc were mapped with the funds provided by various Ministries. All the thematic information is spatially harmonized and hosted on Bhuvan Geo-platform for public visualization. Download access was also provided to selected outputs like satellite data, Digital Elevations Model, products generated under NICES program.
8. India has good technical infrastructure and institutional collaboration with respect to Geospatial data generation and use. Several national organizations like ISRO & SOI are engaged in geospatial data generation and analysis and are closely working with Ministries for customized geospatial data generation and solutions. Private entrepreneurs are also actively engaged in geospatial industry and have developed customized geospatial solutions to various users. Nowadays most of the detailed Project reports of any major project considers including geospatial inputs for site analysis.
9. ISRO has developed incubation centre at NRSC (Jeedimetla) for geospatial industry to support entrepreneurs interested in geospatial start-up.

Survey of India

10. The major challenge in the integration of statistical and geospatial information is that data from different sources with different semantics, data models, and acquisition methods requires data conversion and/or integration like data conflation. If standard spatial data model structure is not adopted, then integrating all the data generated under different project under one standard Spatial Data Model Structure (SDMS) is the foremost task.

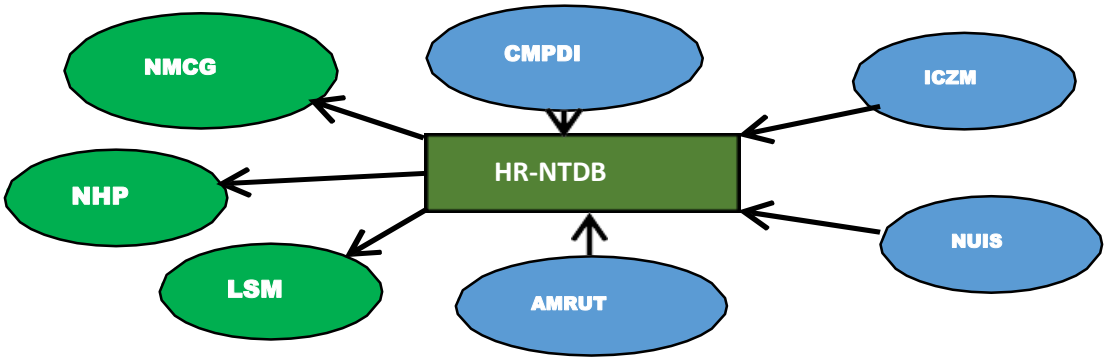


Figure 27 Data Model of the High Resolution National Topographic Database (HR-NTDB)

11. For example, in India, different projects like ICZM, CMPDI, NUIS, AMRUT (shown in blue) were generated with different Data Model structure, required to be integrated in one data model structure by carrying out re-engineering of structure. Therefore, some more features related to large scale mapping were been made integral part of the features in the data model structure and this new model was named as High Resolution National Topographic Database (HR-NTDB). Thereafter, for all new projects (shown in green colour), the features were assigned as subfeatures from the HR-NTDB. Further to above, the ICZM data was reengineered in to HR-NTDB and the data was hosted on the SOI portal over web on g2g.indiamaps.gov.in as shown below.

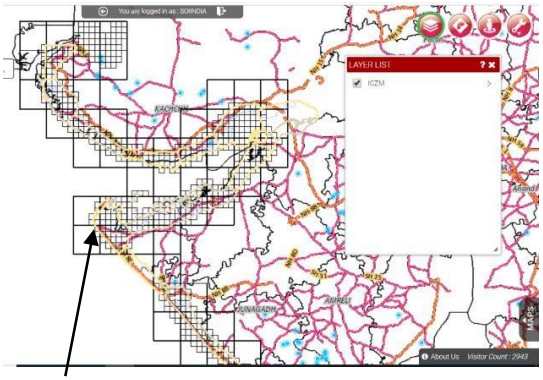


Figure 28 ICZM data on portal on the west side coast

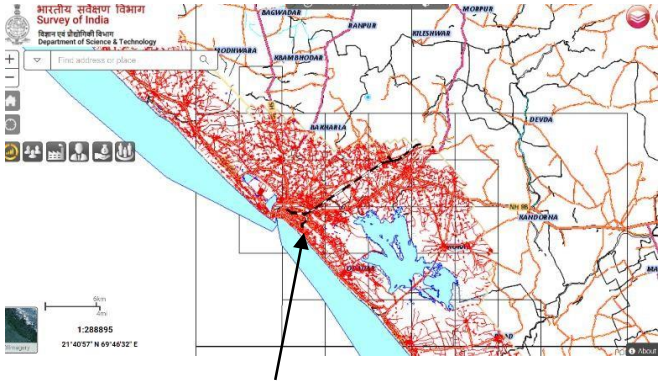


Figure 29 Zoom level

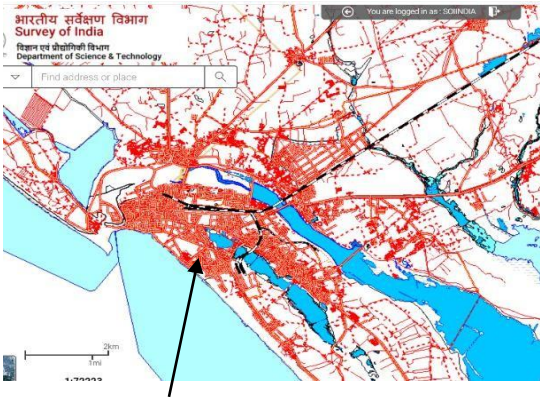


Figure 30 ICZM data

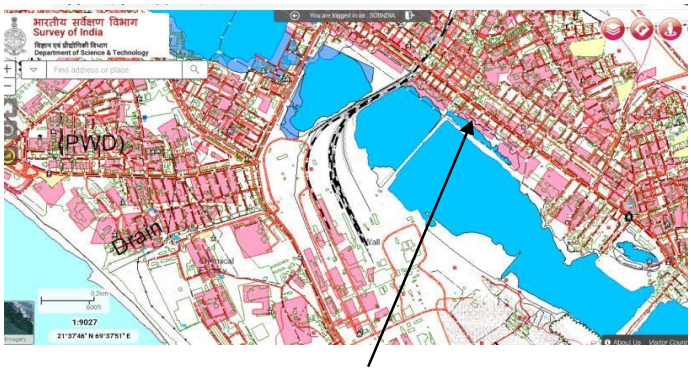


Figure 31 ICZM

12. A similar example of integration of data from varied sources is that of integration of SOI boundary data up to district level with the census data. The result with respect to indicators and year of census can be analysed as shown below.

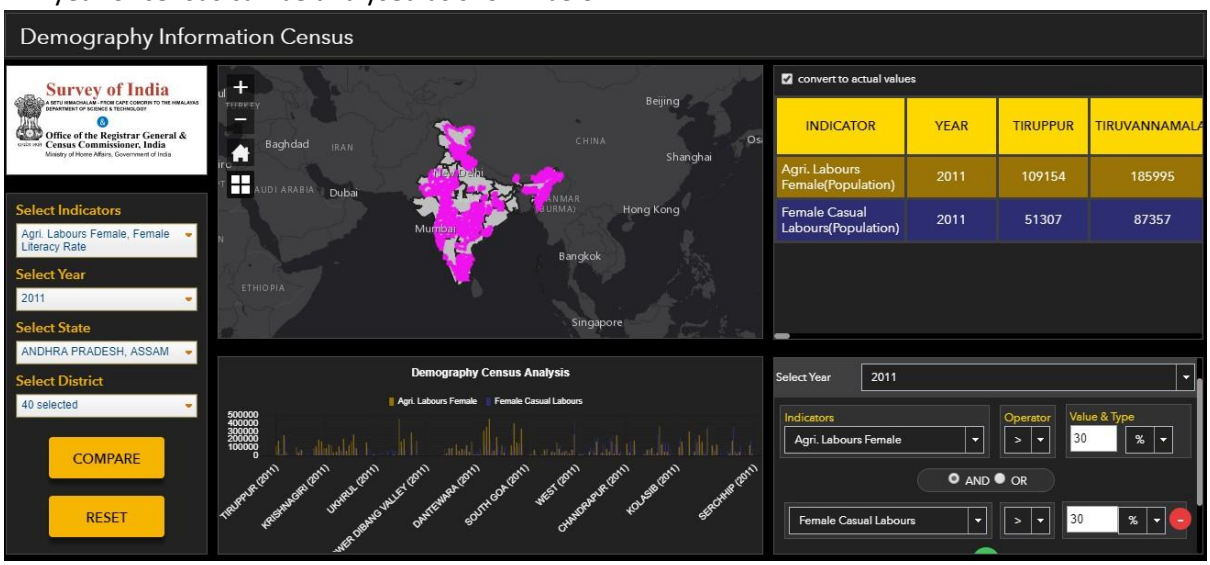


Figure 32 The integration of Survey of India boundary data up to district level with the census data

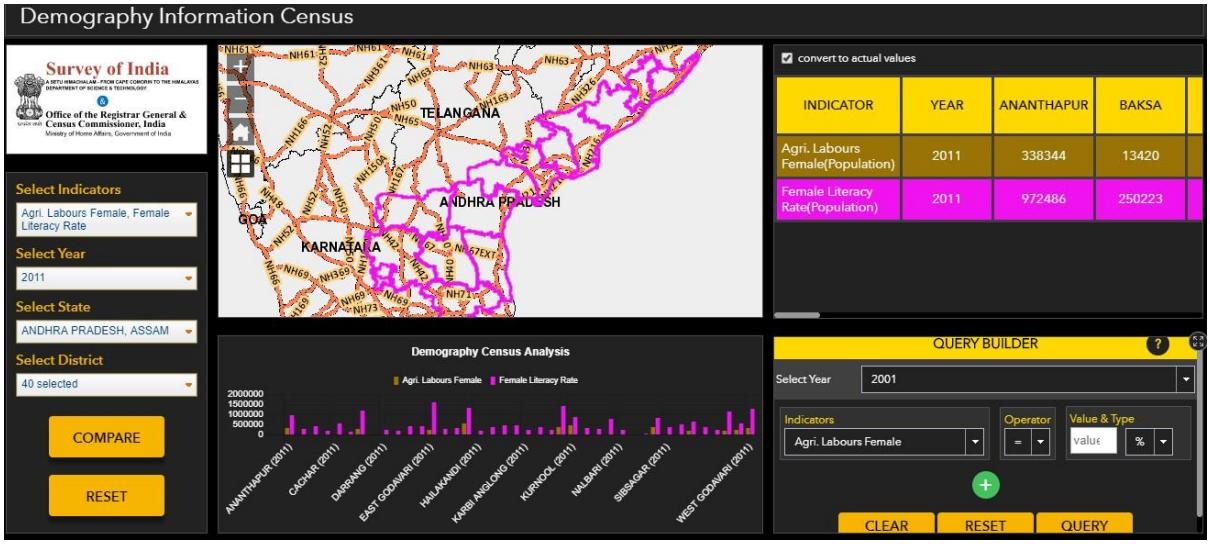


Figure 33 Analysis of Census data over base map of Survey of India on indiamaps.gov.in portal

13. The main purposes of this data-sharing framework are two-fold: one is to facilitate users to access data at the feature level from distributed sources, and to automatically propagate the updated features to users through portal web service, i.e., when the data are updated at one data source, that update would be automatically reflected in any data or applications that connect with it through web services.

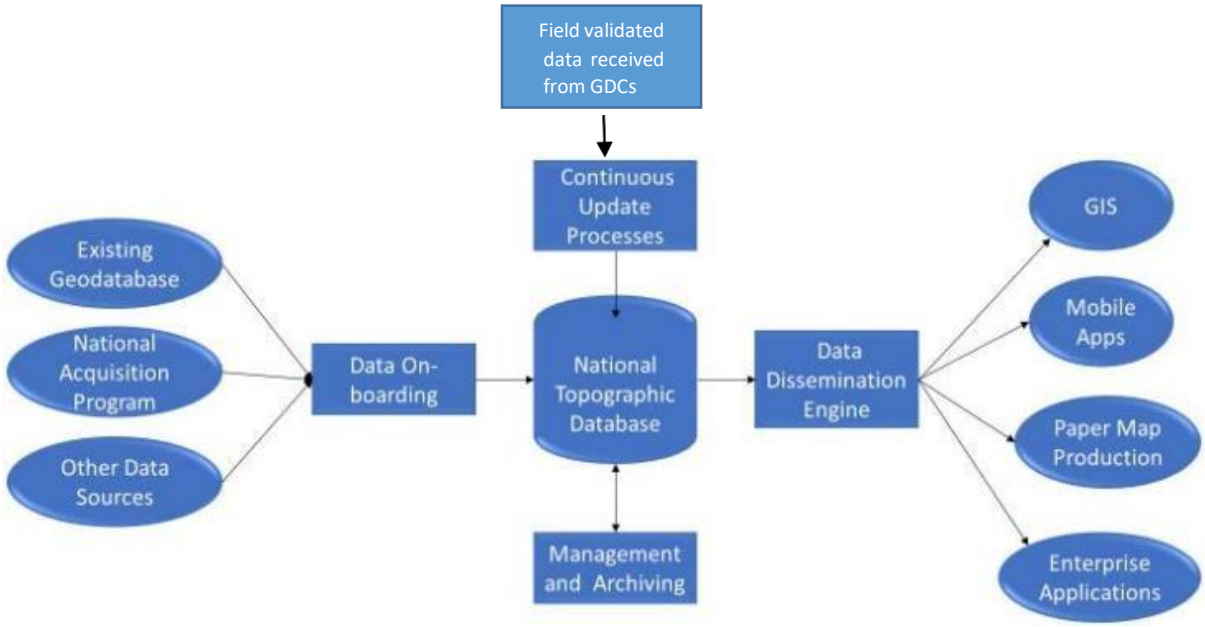


Figure 34 Database integration and standardization

14. To address the above issue, the main challenge is database integration and standardization were in data integration is a process of assimilating data from different sources and formats into a uniform format.
15. Several Ministries of the Government of India have undertaken the task of integrating statistical and geospatial information and are working on adding the geospatial layer to their data

products in a phased manner. Assuming that similar frameworks are adopted by these initiatives, these data products can allow for analysis across domains, enabling better decision making. Some of these initiatives are given in the following table:

Name of the Ministry	Name of the initiative	Remarks
Ministry of Statistics and Programme Implementation (MOSPI)	Consumer Price Indices	The future roadmap for CPI compilation includes collection of consumer prices through a Generalised Survey Solution (GSS) wherein the geo reference of surveyor as well as that of the surveyed outlets/markets are to be captured
	Seventh Economic Census	**The Census is a door-to-door enumeration exercise to locate establishments and obtain information on various economic parameters relating to them from each EC House across length & breadth of the country. In the seventh economic census, in addition to economic and locational details, each record also contains geospatial information.**
	Urban Frame Survey	Geo-referenced maps are being developed for UFS blocks, wards and towns for all the towns in India
Ministry of Health and Family Welfare	National Family Health Survey (NFHS)	In NFHS-4(200-15-16) and NFHS-5 (2019-20) survey, location (longitude and latitude) of the Primary Sampling Units (PSUs) were recorded using GPS instruments. These Geocodes are particularly useful in linking NFHS data to other important information on population, climate and other environment factors.
	Ayushman Bharat scheme	to help in identifying the underserved locations for establishing the health and wellness centers and tracking the effectiveness of various initiatives such as child immunization, management, control and pre-emptive steps taken to contain vector-borne diseases such as dengue and malaria[36].
	Health Management Information System (HMIS)	the sub-national governments can map their health facilities and track their performance for framing appropriate programme interventions under the National Health Mission and other Health Care Schemes.
Ministry of Education	Annual Survey on Higher Education	Geographical references (latitude and longitude) of all higher education institutions are collected.
	UDISE+	A data collection mechanism of School Education System in India, this records the location of each school. The location of schools is analysed by the Government vis-à-vis the population to find out sufficiency/ requirement of different types of schools (primary/ upper primary/ secondary/ higher secondary) as per norms fixed for this purpose.

[36] Ayushman Bharat PM-JAY, Best Practices and Innovations, 2019-20

Name of the Ministry	Name of the initiative	Remarks
Ministry of Tourism		The Ministry maintains geospatial information for approved Hotels and recognized Tour operators (Inbound, Domestic, Adventure), travel agents & tourist transport operators.
Ministry of Animal Husbandry, Dairying and Fisheries	Integrated Sample Survey (ISS) for estimation of livestock products	The survey is now being conducted online through an ISS App developed for the purpose and in this App, the location of each surveyed household is recorded by device GPS.
Ministry of Agriculture & Farmers Welfare	CHAMAN (Coordinated Horticulture Assessment and Management using geo-informatics)	remote-sensing datasets are combined with ground level data for better horticulture assessment and development[37]
	PM Fasal Bima Yojana	Under this scheme for agriculture insurance, geocoded information is used by insurance companies in assessment of the damage to crops by location, and faster and accurate processing of insurance claims in the event of a loss to farmers when their crops are destroyed due to flooding or drought.
	Soil Health Card Scheme	Soil Health Card provides information to farmers on nutrient status of their soil along with recommendations on appropriate dosage of nutrients to be applied for improving soil health and its fertility. The geo-tagged information has been used to develop and publish Soil Health Maps.[38]
Ministry of Rural Development	Watershed management	The Ministry has deployed Mobile App and Web Applications for online monitoring and evaluation of about 86,000 micro-watersheds in the country.
		Geo-tagged information to monitor the implementation of the programmes aimed at generating employment and socio-economic development of the area by creating/ monitoring infrastructures & assets in rural area of India and providing services for amenities.
Ministry of Jal Shakti (Water Resources)		GIS is an integral part of various water sector initiatives, from the perspective of not only planning the network from 'source to Tap' but also for effective water resources. Some States have established GIS based state level water data centers for addressing all water management issues – like, watershed management, aquifer mapping, surface and ground water management.

[37] https://www.ncfc.gov.in/chaman.html
[38] https://www.soilhealth.dac.gov.in/

Name of the Ministry	Name of the initiative	Remarks
	Accelerated Irrigation Benefit Program	Satellite data is used to monitor the inventory of canal network and other irrigation infrastructure.
Ministry of Environment, Forest and Climate Change	National Forest Management	Forest Survey of India has a regular system of integrating all forest-related information with geospatial information, to provide robust forest inventories
Ministry of Housing and Urban Affairs	National Urban Information System (NUIS)	Under the NUIS, geospatial thematic database (comprising of 12 layers) for 152 towns on 1: 10,000 scale and Aerial survey of 132 towns at 1: 2,000 scale have been developed for enabling formulation of Master Plans by state town planning departments.

16. **Geo-Portals**

Many Ministries/Departments of Government of India have developed various Geo-portals for data sharing, services and strengthen the E-learning process. Brief description of the few is as follows:

- **E-Nakshe** (https://soinakshe.uk.gov.in/Home.aspx) has been hosted by Survey of India, as a part of their web map service. This enables the Indian users to download SOI authenticated Open Series Map (OSM) on 1:50,000 scale free of cost for any part of the country.
- **BHARATH Maps** (https://bharatmaps.gov.in) is a Multi-Layer GIS Platform depicts core foundation data as "NICMAPS", an integrated base map service using 1:50,000 scale reference data from Survey of India, ISRO, FSI, RGI and so on. This encompasses 23 layers containing administrative boundaries, transport layers such as roads & railways, forest layer, settlement locations etc., including terrain map services. NIC established RS & GIS Division, in 1996 to carry out innovative projects in the emerging areas of Geographical Information System and Remote Sensing.
- **India Geo portal** (https://nsdiindia.gov.in/nsdi/nsdiportal/index.jsp) developed by NSDI has been increasingly making accessible the data holdings of various national agencies through interoperable geographic information services like Catalogue Service on Web (CSW), Web Map Service (WMS), Web Feature Service (WFS), and Web Processing Service (WPS). The metadata of the various States having State Geoportals have been also being linked to the Portal.
- **BHOOMI Geo Portal** (http://www.bhoomigeoportal-nbsslup.in) is developed by National Bureau of Soil Survey and Land Use Planning (NBSS&LUP) which is maintained on the digital India platform by the name of soil information system maintained by National Centre of Geoinformatics. In the Geo-portal Bhoomi the soil and site characteristics in terms of polygon, line and point data and administrative division of the country are arranged in systematic manner and the database structure is kept open to link cadastral boundary.
- **BHUVAN Web portal** (https://bhuvan.nrsc.gov.in/bhuvan_links.php)
- NRSCISRO launched the beta version of its web-based GIS tool, Bhuvan. It evinces the Indian Earth Observation capabilities from the Indian Remote Sensing (IRS) series of satellites. It is an interactive versatile Earth-Browser which showcases multi-sensor, multi-platform and

multi temporal images with capabilities to overlay thematic information, interpreted from such imagery as a vector layer, along with near real-time information from Automatic Weather Stations (AWS), Potential Fishing Zone (PFZ) information, disaster support related information like forest fire alerts, periodic agricultural drought assessment etc.

- **KRISHI Geo Portal (**https://krishi.icar.gov.in **)** is Knowledge based Resources Information Systems Hub for Innovations in agriculture, is an initiative of Indian Council of Agricultural Research (ICAR) to bring its knowledge resources to all stakeholders at one place. It is being developed as a centralized data repository system of ICAR consisting of Technology, Data generated through Experiments/Surveys/ Observational studies, Geo-spatial data, Publications, Learning Resources.
- **VEDAS** (https://vedas.sac.gov.in) **-** Visualization of Earth observation Data and Archival System (VEDAS) developed by ISRO. VEDAS is an online geo processing platform using optical, microwave, thermal and hyper spectral EO data covering applications particularly meant for academia, research and problem solving. It also offers Mobile applications particularly Solar and Wind Calculator.
- **Biodiversity Information System** (https://bis.iirs.gov.in/) - National Biodiversity Characterization at Landscape Level, a project jointly sponsored by Department of Biotechnology and Department of Space, was implemented to identify and map the potential biodiversity rich areas in India. This project has generated spatial information at three levels viz. Satellite based primary information (Vegetation Type map, spatial locations of road & village, Fire occurrence); geospatially derived or modelled information (Disturbance Index, Fragmentation, Biological Richness) and geospatially referenced field samples plots. This relatively large spatial information on the above-mentioned facets of biodiversity has been organized in a web-based Biodiversity Information System (BIS) for prioritization, conservation and bio-prospecting. The major products are Vegetation Type, Fragmentation, Disturbance Index, Biological Richness spatial data on 1:50,000 scale for entire India and Phytosociological database for 16,000+ sample plots for entire India.
- **Indian Bioresource Information Network** (http://ibin.gov.in/) – IBIN, a project funded by the Department of Biotechnology (DBT), Government of India, has bio-resource data from distributed systems and online data search utility with geo-locations on dynamic maps.
- **India-WRIS** (https://indiawris.gov.in/wris/**) -** India Water Resources Information System developed using technologies like GIS and remote sensing, is a centralised platform to act as a repository of water resources and related data at National level with administrative granularity up to the smaller units of governance at state level as well as hydrological level such as basin and sub basins.

Annex 2 - Template Questions

The Overall Implementation of the GSGF

The Implementation of the Principles of the GSGF

Principle 1: Use of fundamental geospatial infrastructure and geocoding

Principle 2. Geocoded unit record data in a data management environment

Principle 3. Common geographies for the dissemination of statistics

Principle 4. Statistical and geospatial interoperability

Principle 5. Accessible and usable geospatially enabled statistics

Your National Response to COVID-19

How has the GSGF supported your national response to COVID-19?

How could the GSGF have supported your national response to COVID-19, if it had been implemented? What were/are the barriers in its implementation?