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Programme review: developing a statistical-spatial framework in national statistical systems

Background document
Available in English only

Developing a Statistical Geospatial Framework in National Statistical Systems
Survey of Linking Geospatial Information to Statistics
Analysis of Questionnaire Responses

Prepared by the Australian Bureau of Statistics

Developing a Statistical Geospatial Framework in National Statistical Systems

Survey of Linking Geospatial Information to Statistics

Analysis of Questionnaire Responses

The second meeting of the UN Committee of Experts on Global Geospatial Information Management (UN-GGIM) in August 2012 identified the need to link geospatial information to statistics as one of the key issues. As an initial step in establishing mechanisms to creating such a link, the United Nations Statistics Division agreed a Programme Review be undertaken to support the development of a Statistical Geospatial Framework in National Statistical Systems.

The Programme Review was undertaken by the Australian Bureau of Statistics with the following objectives:

1. To present a review and analysis of current geospatial capabilities and capacity within NSOs, and the institutional arrangements for geospatial information within member countries;
2. To propose roles for NSOs in geospatial activities, with a particular focus on integrating statistical and geospatial information;
3. To propose how geospatial activities could be further developed by NSOs within countries, and understand user needs driving particular geospatial data developments;
4. To explore how NSOs do, or should be doing, geo-coding of their data; and
5. To explore how to set standards that integrates data between the two communities.

To inform this Review, a detailed questionnaire was circulated to NSOs to identify:

1. The national trends and current situation in what is driving the need for 'integrating' and developing geospatial information and geospatially enabled statistics;
2. What capabilities exist in countries to undertake this activity;
3. The role of NSOs in geospatial activities and how NSOs interact with national geospatial organisations;
4. What governance exists to support geospatial enablement activities; and
5. What national benefits may result from linking geospatial information to statistics.

The review has been completed and the Review Paper provides a high level overview of the responses to the questionnaire. This document provides a more in depth analysis of the responses and provides a baseline of capability, interest and needs for providing a link between statistics and geospatial information.

A total of 53 NSOs responded to the questionnaire, and the list of responding countries and their responses is provided in Attachment A.

Analysis of Questionnaire Responses

1. Introduction

The questionnaire was a combination of yes/no answers and also questions requiring a more detailed response. An analysis has been undertaken to identify the common threads and ideas and also the unique and outlying responses. As a consequence, the analysis below describes some of the responses in numerical terms, and others as brief summaries of one or more countries' views.

The sections below are sequenced and numbered in the same way as the questionnaire.

2. What is driving the demand for Geospatial Information?

a. What programs, initiatives, activities or interests are driving the demand for geospatial information?

i. Source of Demand

There are many different stakeholder groups creating the demand for spatial information. Over 75% of countries indicated that the demand is coming from central government agencies. A smaller percentage of countries saw demand coming from state governments, although no analysis was undertaken to determine how many of the respondents had this tier of government. Most countries do have some form of local government and this community also demonstrated a high level of demand for spatial information, with more than half the respondents acknowledging this.

Almost 70% of countries also indicated a demand from the academic and research communities. A similar percentage of countries indicated that the commercial sector were also requiring more geospatial information. This is probably a reflection of the increasing use of 'location based business intelligence' capabilities being used to increase markets and provide more targeted commercial services.

Slightly less than half the countries indicated that the public were requiring access to geospatial information. Three countries felt that the European Union's INSPIRE Directive (the geospatial initiative) was the reason for some of the demand.

Other areas for demand came from non-government organisations with Botswana, Namibia and Swaziland indicating that there was demand from the utility sector. Other countries including Barbados, Columbia, Finland, France and Singapore all indicated that urban planning organisations had a demand for geospatial information. Ghana suggested that development partners (international agencies such as the World Bank) were another source of demand and Romania suggested Eurostat was a driver of demand for geospatial information.

ii. Sectors Driving the Demand

The questionnaire responses identified many different sectors and communities of interest that are driving the demand for geospatial information. The main sectors listed as driving this demand cover the following areas:

- Environmental services
- Health and social services
- Traditional mapping and surveying agencies
- Agriculture
- National Security
- Government
- Private sector

Almost half of all responses listed these seven sectors as areas of demand for geospatial information.

Other sectors identified in the responses included:

- Resource management
- Research and education
- Tourism
- Industry (in general)
- INSPIRE
- Land sales and land tax
- Culture
- International agencies
- Police
- Science and technology
- Weather forecasting
- Mobile location services
- Postal services

iii. Commercial Sector Involvement

Only Bangladesh and the Seychelles indicated that there was no participation from the commercial sector in relation to national geospatial information, either as a producer or user. More than 50% of the responses indicated that the commercial sector is a producer or provider of geospatial information in their countries while about a third of the countries indicated that this sector is a consumer (user) of geospatial information.

b. Changing Demand for Geospatial Information.

There is a large diversity in the reasons why NSOs saw a change in demand for geospatial information. The increasing and changing demand is described as coming from many different directions, and increasingly from many sectors that traditionally have not been users of geospatial information. This change is described as being driven by a number of factors, but the increasing sophistication and availability of lower cost technology such as the internet in general and technologies such as web services in particular are seen as a significant contributing factor by Australia, Cyprus, Ecuador, Italy, Lithuania, Mexico, Netherland, New Zealand, Poland and Sweden. One of the technologies that underpin this growing demand is the increasing availability of technologies to provide geo-codes to administrative and statistical data. With a location attached, such data has many additional uses as was recognised by Chile, Israel and New Zealand.

Today many office, home or mobile electronic devices have some geospatial capability and it is now much easier to link information to a location than a decade ago. As a consequence expectations for some location capability to be available are now much higher and this is driving the increasing demand.

Changes in demand were also described as coming from various formal drivers, such as those arising from the European Union's INSPIRE (Geospatial) Directive. Demand is also coming from the academic and research communities reflected in the responses from Botswana, Malaysia, Mexico and Madagascar. Social welfare needs such as health and health research is also recognised as a driver in the Seychelles. Many sectors are requiring access to data of relevance to their interests for smaller and smaller geographic areas and this is driving demand for more accurate and timely geospatial information. This was reflected in the responses from Australia, Austria, Estonia, France, Malaysia, Netherlands, New Zealand, Seychelles, Singapore, Slovenia and Sweden. The environment and emergency management are also important drivers for geospatial information in a number of countries.

c. Significance of Geospatial Information to Governments

Over half of the responding countries indicated that geospatial information was considered of significance to their governments. There were many reasons given for this but most of these related to better and more accurate information to improve evidence based decision making e.g. New Zealand saw that geospatial information contributed to economic growth. Other responses included specific activities where geospatial data was seen as being significant and these included the need for base mapping of a country and providing support for natural disaster mitigation and response. A number of EU countries indicated the significance of geospatial information was driven by the needs of INSPIRE.

3. NSO Geospatial Information Capability

a. Organisational Structure for National Geospatial Information Capability

The organisational arrangements for spatial activities at the national level vary considerably in each country, although over 70% of countries indicated they had a lead spatial organisation. Many of these lead organisations have their genesis through traditional land administration responsibilities. Land administration is usually the foundation on which most national spatial development capabilities are developed. Additionally, many countries have more than one agency that undertake some national level spatial activity and these are usually based on specific government requirements to address the information needs of priority sectors such as urban planning, environment, security, disaster management and land administration.

b. Does the primary geospatial organisation support enablement of geospatial enablement

Where countries have an identified lead spatial agency, it is mostly these agencies that provide the support for national geospatial enablement activities. Also, support for geospatial enablement occurs in many different ways, with Belarus, Colombia, Ecuador, Finland, Mexico, Namibia, New Zealand and Portugal describing the application of common geospatial policies, standards, infrastructure and regulations as the approaches used in these countries. Almost half the countries saw spatial enablement support as being provided through access to geospatial data and broad stakeholder engagement.

c. Relationships between NSOs and Geospatial Agencies

The majority of NSOs have a collaborative and cooperative relationship with the lead spatial agency in their country, with over 80% indicating this linkage. The type of relationship varied considerably, ranging from being linked organisationally with spatial and statistical responsibilities being in the one organisation (Mexico and Brazil) through to linking via joint projects, data sharing and representation on national geospatial coordination committees. There were also many different areas (topics) for collaboration. For example, the concept of geographic boundaries was an area of collaboration identified by New Zealand, Serbia, Singapore and Slovenia. Ecuador and Sweden identified formal agreements existing between the NSO and the national geospatial agency. Other countries had less formal arrangements, but some of the EU countries were involved with the spatial lead agency as a consequence of the NSO supporting the national requirements for the statistical elements of the EU INSPIRE Directive.

The levels of relationship between each country's spatial and statistical organisations were also very dependent on the level of capability and sophistication that existed in the respective organisations. Where a greater capability exists, the linkages are usually closer and more collaboration takes place.

d. NSO Leadership Role in Geospatially Enabling Statistics and Administrative Data

More than 75% of responding NSOs take a leadership role in the geospatial enablement of statistics and administrative data. Much of this leadership role takes the form of providing and maintaining standards and frameworks which often include geographic boundaries for statistical information.

e. Spatial Capacity of NSOs

Most (85%) NSOs indicated that they had some form of internal group that provides a level of spatial support to their agency. The capacity of these internal geospatial groups varied considerably. This appeared to be dependent on the level of spatial demand within the country and also was linked to the overall capabilities of NSO. The spatial functions in NSOs provided support for internal activities predominantly, but many also provided spatial support to external agencies. Almost all NSOs with a geospatial group produced map products.

There was a great diversity of the specific activities of the geospatial units within NSOs. For example Australia, Colombia, Mozambique and New Zealand NSOs had responsibilities for developing and maintaining statistical standards and frameworks for the dissemination of statistical and administrative data. Some NSOs including Bangladesh, Estonia, Iran, New Zealand, Portugal and Sweden are involved in developing web based spatial applications and associated internet tools. Other activities of the geospatial units within NSOs include geocoding, spatial analysis, training, development of address registers and some, including Chile, Czech Republic, Germany, Ghana, Italy, Israel, Malaysia, New Zealand, Poland, Portugal and the United States, indicated that they had responsibility for the production, update and dissemination of elements of the national geospatial database. Ghana indicated that their geospatial unit was working on the conversion of hard copy maps to a digital format.

Over half of the NSOs responding indicated that they provided some form of spatial support to external organisations. This support ranged from providing specific products to providing advice on how to spatially enable statistics and administrative data.

f. NSOs Geospatial framework

Less than 50% of the countries responding indicated that they used a geospatial framework to support their geospatial activites within the NSO. There were many different responses to this question, ranging from Australia, Colombia and Mexico who are operating geo-statistical frameworks; other countries who have a register of spatial units; and the USA who operate within their countries National Spatial Data Infrastructure. A number of countries use existing national administrative boundaries as their geographic areas for statistical purposes.

g. The Use of Different Levels of Geography

The majority of countries (over 80%) link their statistics to a range of geographic levels or scales. The number of levels of used by different countries varied although the common theme is that most countries use existing administrative boundaries rather than statistical or population centric boundaries. The numbers of boundaries vary between countries depending on the physical size and population and population distribution of each country. Number of boundaries is also influenced by the number of tiers of government with countries having national, state and local governments generally applying more administrative geography levels than those countries with only two tiers of government. Bangladesh, Barbados, Cape Vert, Croatia, Lithuania and the Republic of Moldova indicated that they do not use a hierarchy of geographies for the geospatial representation of their statistics.

h. Linking Spatial Attributes to Unit Level Data

Almost 90% of countries indicated that they link a spatial attribute to the unit level information from which they generate statistics. This puts most NSOs in a great position to exploit the spatial elements of their statistics and potentially provide a wide range of spatial outputs. However, many NSOs use a geographic area such as an administrative area boundary as the spatial attribute rather than a specific coordinate (latitude and longitude). This approach makes it more difficult to provide statistical information describing other geographic areas. Only a few NSOs use latitude and longitude attributes to provide the spatial context for unit level records. This approach requires a higher level of spatial capability but it does provide considerable flexibility when linking the statistical information to any type of geographic area of interest.

i. What types of attributes

The questionnaires described a wide range of types of geospatial attributes that are used to provide the location element to unit level data. A number of countries use addresses, building and dwelling registers, personal IDs or coordinates to provide the location. In many cases this information could be geocoded to provide latitude and longitude positions for the unit level records. Other approaches used include Mexico where the NSO uses polygons; Japan uses grid squares and Columbia applies a thematic based geospatial classification. More than half of the NSOs use a unique code attached to their unit records. This code links the record to a specific geographic boundary such as an administrative boundary.

ii. What Geocoding Systems and Approaches are Used

As with many of the other questions, there is considerable variation in the responses to the geocoding systems and approaches taken by each NSO. The systems and approaches taken to geocode vary from the use of GIS software by Austria, Croatia, Cyprus, Czech Republic, Lithuania, Mexico, Namibia, Netherlands and the Slovak Republic to the use of registers of buildings, dwellings and addresses by Australia, Austria, Estonia, Finland, France, Israel, Palestine, Poland, Slovenia, Sweden and Switzerland. Portugal uses a system of 1km grids to geocode buildings with Mexico applying imagery and in the field GPS techniques. Again, the geocoding approaches used are dependent to some degree on the level of geospatial capability and maturity within each country. For example, if a country has every address recorded and this is geocoded, then the ability of the NSO to geocode their unit record becomes easier.

iii. Are any specific admin boundaries applied

Most countries apply some form of administrative boundary based on political boundaries or administrative units such as districts, provinces, counties etc. About a quarter of the responses described the use of urban and rural defined boundaries aligning with population centres such as municipalities, towns, villages, cities, settlements etc. Finland and Mozambique use postal boundaries with the United Arab Emirates using a range of boundary types such as service areas, fire and law enforcement districts, medical service areas and school districts.

The clear message from these responses is that in many cases the boundaries used are not population density based which makes it extremely difficult to make any direct population based comparisons within countries and it is almost impossible to find commonality of population numbers in statistical geography areas to make comparisons between countries.

iv. Changing Geospatial Boundaries

Over 65% of responses indicated that the geographic boundaries they use for statistical purposes change over time for a wide variety of reasons. This obviously makes the production of location focussed time series very difficult for these countries. Also, the management of these changing boundaries is an essential but additional workload for many NSOs.

i. Map Based Statistical Outputs

The majority of NSOs (almost 90%) indicated that they produce some form of map based statistical outputs.

j. Other Spatial Outputs

Over 60% of NSOs also provide spatial outputs other than map based outputs.

k. Using Spatial Capabilities as Part of the Statistical Creation Process

Around two thirds of the responding NSOs stated that they use some form of spatial capability in the process of creating statistics. The level of input from the spatial component is very dependent on the overall spatial capabilities of each NSO with most spatial input relating to supporting the survey collection activities. Some NSOs indicated that spatial capabilities were used in quality control and analysis activities, but this was not wide spread across the responding NSOs.

4. Institutional Arrangements

a. The Level of Integration Between Statistics and Spatial Capabilities

Seven in ten NSOs indicate that integration between the statistical and spatial capabilities in their countries is occurring to some level, although like most other questions, there was considerable diversity in what constituted this integration.

i Approach to Integration of Statistical and Spatial Capabilities

The approaches used in each country to integrate statistical and spatial capabilities varied considerably. In some countries, integration occurred through formal channels, such as those arising from the EU INSPIRE Directive for some EU countries through to common interests and linked working activities and collaboration as expressed by Germany and Slovenia. Croatia, Slovenia, Sweden and the United Arab Emirates indicated that there were national agreements, legislation and MOU's in place to ensure there was a level of integration of spatial and statistical capabilities. Other countries indicated that they achieved the integration through stakeholder engagement, collaboration, joint working groups, committees and workshops. Cape Vert, Chile, France, Mexico and the United States saw that integration was resulting from geo-coding and geo-referencing data.

i. The Need for More Integration

Over half the responding NSOs suggested that there was a need to further increase and improve the integration between statistical and spatial capabilities to better meet national needs.

ii. Who is Driving the Integration

A wide range of mechanisms are being used to drive the integration of statistical and geospatial capabilities across the responding countries. 35% of responses indicated that the NSOs were directly involved in trying to improve this linkage and other countries including Australia, Ecuador, Finland, France, Germany, Ghana, Jordan, Portugal and Sweden had other coordinating bodies and committees (including INSPIRE) to support and drive this integration activity. Botswana, Cape Vert, Croatia, Hungary, Lithuania, Malaysia, Slovak Republic, Swaziland and the United States all had direct government department or institution responsibility and involvement for driving this integration activity. Austria, Chile, Egypt and the United States suggested that the user community was one of the driving forces to progress this integration.

b. The Need for Integration Standards and Frameworks

This is considered a key question for the Review, and almost 80% of responding NSOs agreed that there was a need for standards and frameworks to support the integration of statistics with location. The responses also provided some insight into what these standards or frameworks should encompass. For example, such standards and frameworks should cover consistent approaches to geocoding and on how the spatial attribute was attached and stored with the statistical data.

The use of standard or common geographies for statistics was suggested by Australia and New Zealand. Botswana, Malaysia, Netherlands and Singapore indicated that standards were also important for data collection and data sharing activities. Other countries identified the need for standards to be given considerable strength with a view that they should be covered by national legislation and also form part of the national spatial data infrastructures.

Metadata standards were considered important by Australia, Germany, New Zealand and the Seychelles, with New Zealand also suggesting that a UN SD geospatial statistical integration framework was required.

Seven countries suggested that there was no need for standards or frameworks to support the integration of statistical and geospatial information.

In response to this overwhelming recognition for the need for standards and frameworks, the UNSC Review Paper has proposed the development of an international methodology to provide a consistent approach to linking statistics to location. Based on the responses to this questionnaire, it is considered important that all aspects of the statistical process identified as requiring standards be considered when discussing or creating an international framework.

Also supporting this need for a common approach to linking statistics to location was the broad recognition that through applying a location context to statistical information many national and also international benefits would be achieved. It was agreed by almost all NSO's that establishing this link would improve the quality and relevance of information available to their governments to make more informed decisions (similar benefits would accrue to the research and commercial sectors). A common approach would also enable more accurate comparisons to be made between areas within a single country and also between countries. The international benefits of having a standard approach would more effectively inform many international bodies that rely on statistical information to underpin their decision making processes.

c. Consultative Mechanisms to Support and Promote Spatial Enablement.

Only half the countries responding indicated that there are existing national level consultative mechanisms to support the spatial enablement of administrative and statistical data. Those responses that identified a mechanism described many different forms of consultative mechanisms that are in place ranging from formal and legislation based (eg. INSPIRE) to less formal approaches such as outreach programs for data users. The Netherlands indicated that there were also commercial channels for promotion through relevant spatial system vendor solutions.

Consultation is one area where many countries felt that national efforts could be strengthened, building on the relationships already established in many countries between the NSO and the lead spatial organisation. Additionally, at this time there is no internationally agreed common methodology that countries can use as their focus when promoting spatial enablement. A recommendation in the Programme Review paper is aimed at addressing this gap.

5. Benefits

a. The Benefits of Spatial Enablement

There were a large number of benefits derived from spatial enablement identified by the responding NSOs. These range from strategic and national level benefits to more specific and targeted agency level benefits. Improved evidence and better information for decision making was a common theme in most of the benefits identified, but efficiencies and improved understanding were also considered important. For example, the concept of using spatially enabled information as a planning tool was recognised by Bangladesh, Barbados, Japan, Portugal, Serbia, Slovenia and the United Arab Emirates.

Cape Vert suggested that spatial enablement of data opened up the possibility for new types of data analysis for small areas and Chile, Seychelles and Singapore all identified improvements in more easily recognising patterns and trends in statistical data through the spatial relationships presented in map forms.

It was also suggested that putting information into a map form made it more interesting for the users. This benefit was also relevant in the comments made about increasing the size of the user community for statistical information. Many people were intimidated by large statistical tables but were more likely to use statistics if they were available in a more understandable way which can be achieved when provided via maps. By improving access to statistics through maps, the number of users may increase and this would encourage wider debate.

b. Better Information for Government Decisions

Almost all (96%) of responding NSOs believed that the spatial enablement of statistical and administrative data would provide improved information for their country. This would help address many new emerging demands for information that is coming from many different areas of the community and across most sectors. Most NSOs also believed that this ‘improved’, spatially enabled information would be of benefit to the national economy.

There were a wide range of responses as to what constituted better information for government decision making but in broad terms the spatial enablement of almost any information would increase its usefulness to governments. For example, Barbados indicated that spatial enablement would make the information more user friendly and therefore would appeal to, and be used by, a wider audience. Portugal suggested that spatial enablement ‘enriches’ statistical information and Cyprus, Singapore and the United States suggested that it would enable organisations to better model alternative solutions, providing a range of views. Germany and Ghana both indicated that spatially enabled information would assist in more transparent planning and decision making.

c. Helping the Community and Economy

Almost all (96%) countries agreed that spatially enabling information would have economic and other societal benefits. Mexico suggested that this would make it easier for the community to understand local and regional issues; with Singapore saying that it would raise the awareness of the community's geographical surroundings and the geographic relevance of community issues and government policies impacting local people. A number of countries including Barbados, Belarus, Botswana, Croatia, Cyprus, Ghana, Israel, Jordan, Lithuania, Malaysia, Mexico, Mongolia, Mozambique, Palestine and Singapore all agreed that spatial enablement would provide more targeted (and effective) allocation of resources and services to the areas were these were most needed.

There was also a strong view across many of the responses that providing information, including statistics within a location based context, added value to that information in many different ways. The increase in value to information through spatially enabling the information is one of the reasons that demand for such information is increasing.

6. General Questions

a. Additional Ideas on How to Link Statistics with Location

Like many of the other questions, there were a wide range of responses from proposing strategic level responses to very specific examples such as supporting the use of hand held devices for linking statistics to spatial location information. At the strategic level, Australia suggested that the Statistical Spatial Framework that the Australian Bureau of Statistics has developed be considered as an international methodology for linking statistics to a location. Mozambique suggested the integration of statistical and geospatial databases and the United States proposed a common geospatial platform. Common registers and geocoding was seen to be an approach to better link statistics to location by a number of countries including Austria, Belarus, Botswana, Czech Republic, Finland, France, Hungary, Israel, Malaysia, Mexico, Namibia and New Zealand. Increasing data sharing and the provision of common and aligned boundary information was also seen as another approach that could be used to assist in linking statistics to location.

b. Examples of Linking Statistics to Location.

A number of countries provided examples where statistics had been linked to location. Belarus, Botswana, Chile, Ghana and Jordan discussed the spatial enablement of census information from countries such as the USA and Brazil as excellent examples of linking statistics to location. The development of software by Iran for the storage, retrieval, management, analysis and presentation of statistical data in a geographic information system was another significant example and Malaysia used the US Bureau of Census interactive map as another example of what has been achieved.

France identified a range of examples including; the study of urban policy; geocoding of various administrative databases which support the calculation of indicators at the level of small urban districts and also the production of new grid based maps.

There are potentially many examples of the successful linking of statistics to location across many NSOs and there may be benefit in identifying some of the more significant ones and also any unusual example to assist in publicising the benefits that arise from this spatial enablement.

Summary

A total of 53 responses were received to the questionnaire and these responses provided a large amount of information on the demand for geospatial information and also the capabilities and roles of NSOs in meeting the demand for location based statistical information.

It is obvious from the responses that demand for geospatial data is increasing and that demand for statistical and administrative data with a geographic location was also increasing. Many NSOs had geospatial capabilities but there was considerable variability between the levels of capability. However, most agreed that there were benefits in providing more statistical information in a geographic context and most were moving forward to increase their capabilities to achieve this. There is a very good understanding of the benefits of closer collaboration with the national geospatial community and many countries had existing mechanisms in order to pursue this linkage and many believed that further work to strengthen this link was required.

The survey strongly suggests that there are considerable benefits to national governments, the economy and the general population from further developing these links and increasing the spatial enablement of statistics and administrative data. Most also agreed that appropriate standards and frameworks would assist and improve the realisation of the benefits of linking statistics to a location.

A coordinated effort to moving forward with approaches to better link statistical and geospatial information is the obvious outcome from this survey. The proposals outlined in the Program Review for developing a statistical-geospatial framework will assist in establishing such a coordinated approach and help countries to improve their spatial enablement capacity.

Australian Bureau of Statistics
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Attachment A : Responses to Questionnaire

2. National Drivers **– Subjective and Descriptive**

a. What is driving the demand

i. Where is the demand coming from (what areas of government – federal, state, local; commercial sector; academia and research and general public

Response	Number of countries
Federal Government	40
State Government	25
Local Government, municipalities	31
Commercial sector –	32
Academia or research community – research institutes and universities	36
General public – including new applications and technologies such as navigation, orienteering, searching for points of interest, Google Earth	26
European INSPIRE-Directive	3
Non-Government Organisations	6
NSOs	8
Utilities organisations (electricity, water)	3
Environment – rainy season, environmental sustainability; cadastre updates; risk management and prevention; housing supply and demand	1
Planning authorities	5
Development partners – UNFPA, DFID, UNICEF, JICA, World Bank, Millennium Development Authority (MDA)	1
Eurostat	1

ii. What sectors are driving demand: mapping agencies; environment; health and social services; urban planning; disaster; national security; agriculture – land management.

Response	Number of countries
Disaster/emergency management	22
Geomarketing	2
Planning authorities – Urban, regional, health, environment, economic,	26
Land Management	17
National statistics	6
Construction and infrastructure maintenance and planning	2
Mining	2
Road works	**1**
Traditional mapping and surveying agencies	18
Environmental services	24
Health and social services (including education)	19
National security	15
Agriculture	17
Tourism	2
Industry	3
INSPIRE	2
Sales and land tax, culture, international agencies	1
Private/commercial sector (including consultancy)	8
Territorial diagnosis, land settlement, mobility, displacement	1
Services	1
Government	13
Decision Making, public users	1
Cadastre agencies	3

Police department	1
Science and Information Technology	2
Resource management	7
Weather forecasting	1
All sectors, openness of public data	1
Demography	1
Composition, management of plots	1
Postal services	1
Development	1
Mobile localisation services for general public	1
Military	1
Research and education	8

iii. Does the commercial sector contribute or consume.

Response	Number of countries
No	2
Yes	3
Yes – producer	2
Yes - provider	7
Yes – producer and provider	22
Yes – user	18

b. Describe changes in demand – and what is causing the change

Response	Number of countries
Precise point in polygon analysis with customer defined polygons	1
System for the provisions of geodesic information	1
Increase in demand from academia/research	3
Increase in demand from NGOs	1
Increase in demand from government departments, including election offices, NSOs	6
Increase in demand from business community	4
Increasing demand every year	5
Demand within NSO generated by private and public sectors	1
New and better technologies and methodologies,	13
User demands	2
Emergence of new problematics	1
INSPIRE requirements	2
Students, research	1
Statistical data at different geographical levels, improved data quality	3
Geographic information embedded in several statistical operations and processes	1
Higher frequency mapping geospatial data with statistics	2
Postal addressing system, epidemiology	1
Cooperation of providers of geospatial information	1
Increase adoption and use of GIS	2
Digital datasets	3
Accessibility, web services and applications	10
Higher resolution and more detailed, small area data	11
More exposure and growing importance of GIS capabilities	8
Geocoding data	3
Impact studies and management applications/policies for disaster and environmental mitigation	5

c. Describe significance of geospatial information to government

Response	Number of countries
Priority/High Priority	31
Development of web based GIS application software of geospatial information with statistical information	1
Not yet high priority, but possibly in future	4
Recently, movement of production of geospatial information to government (rather than outsourcing), reducing government spending	1
Technology and equipment to generate spatial datasets	2
Structuring and updating processes of maps – critical issues	1
Significant but cost is high	1
Cooperation with other mapping agencies weak	1
Priority growing steadily	4
Special government organisation to produce main geospatial information (Royal Jordanian Geographic Centre)	1
More efficient decision making and policy development	9
Acquire knowledge about the current reality/situation	2
Contribution to economic growth	1
Needed for other government priorities eg rebuild after natural disaster,	1
Need for base map to be integrated between all users	1
Potential source of innovation for co-creation between public and private data	1
Other sectors of government slow to take it up	1
Not a high priority	1
Government committee – coordinating geospatial activities and monitoring	2
National GIS infrastructure (portal) for governments to share data	10
National legislation (some as a result of INSPIRE*)	6

7. NSO Geospatial Information Capability
    a. Countries geospatial organisational structure – a single spatial agency (YES/NO)
    b. Does the primary geospatial organisation support enablement of geospatial enablement (YES/NO)

Response	Number of countries
Yes – National Framework	1
Yes – Access to data	23
No	9
Yes – common policy, national policy, standards, infrastructure, regulations,	8
Yes – stakeholder engagement	7
No – advancement succeeded through INSPIRE directive	3
Yes	3
Yes – following international trends and needs	1
Yes – supporting cooperation between agencies	1
Yes – supporting advances in government geospatial information, statistics	3
Yes – it is a contact point for INSPIRE	1

    c. Does the NSO have relationship or collaboration with spatial agency (YES/NO)

Response	Number of countries
Yes – representation on committee, working group, national coordination body,	6
Yes – role in national coordination and implementation of INSPIRE-	4

directive	
Yes – collect data from them, customise as needed; data sharing; knowledge sharing; common services and applications	28
No	5
Yes – NSO regularly overtakes data on spatial units defined by the regular legal procedures	1
Yes – formal agreement	2
Yes – collaboration for the achievement of address referentials. Project of shared dissemination tools	1
Yes – SDI activities, harmonise regional codes	1
Yes – promotion of the use of geospatial information	1
Yes – both branches of a single organisation; facilitates collaboration	1
Yes – joint role in projects (including INSPIRE)	7
Yes – geo-enabling statistics	1
Yes	2
Yes – reviewing/updating datasets, boundaries, papers and standards	4

d. Does NSO take a leadership role in spatially enabling stats and admin data(YES/NO)
e. What spatial capacity does NSO have
    i. Specific spatial unit (YES/NO)
    ii. Does the group produce maps – **(SUBJECTIVE)**

Response	Number of countries
Developing and maintaining statistical standards/framework for the dissemination of statistical data	4
Maintenance of central GIS infrastructure and portal	8
Assisting other statistical outputs of NSO, including Census and field work	20
Development of web based GIS application software and tools	6
Maps for collecting statistical information and statistical output	29
Client requests	1
Geocoding	3
Major role in government activities that use GIS data	1
Training and technical supervision	3
Grid Square Statistics through reorganising the result of the statistical survey	1
Spatial analysis	6
Produces land use statistics	2
Distances to public services	1
Statistical mapping standards/guidelines	1
Geospatial information	1
Retrieval of statistical information of georeferenced statistical units, custom geoprocessing models	1
Production of small area statistics sold with a GIS-tool	1
Geodatabase	1
National address register	1
Production, dissemination and updates to geospatial data	11
Converting hard copy maps to digital format	1

iii. Does the group support external agencies (YES/NO)

f. NSOs Geospatial framework **(SUBJECTIVE)**

Response	Number of countries
SSF – elements that enable the NSO to spatially output statistics; integrate other agencies with our statistics	1

IBM DB2 Database, open source software	1
GIS software – including ESRI	8
National Geostatistical Framework – MGN – to locate and identify statistical units, sources or supports. Designed to reference statistical information to its geographical location. Incorporates other facilities such as cartographic database, economic registers, agricultural sampling units	1
Statistical register of spatial units – for sampling surveys in the field	1
Geospatial information for the organisation of the 2011 Census	1
The Section of General Methodology and Registers, Statistical Registers Department	1
NSO's Geodatabase, in-house software	1
Geospatial framework developed by National Spatial Data Infrastructure – data sharing policy, standard	1
National Geostatistical Framework	1
Geographic frame is text-based and manual with no geospatial capability	1
Geographical data based on aras demarcated in the Urban Redevelopment Authority's Master Plan 200	1
National Spatial Data Infrastructure – aim to assemble geographic data nationwide to serve a variety of users	1
Data structure based on settlement register	1
Originally built for charged services (such as small area statistics and geographic information services); divisions within NSO use and support framework	1
Generally consider spatial reference of administrative units; starting methodological work on address coordinates, grid and grid maps	1
Framework has three components: data, procedures/technology, and institutional relationships to support GIS environment	1

g. Are different levels of geography used (YES/NO)

Response	Number of countries
Yes - Hierarchical structure	28
No	6
Yes – administrative/territorial	3
Yes – different scales (reference to actual map scales)	7
Yes	5
Yes – but no need to relate different geographies	1

h. Are spatial attributes linked to unit level stats (YES/NO)

i. What types of attributes (DESCRIPTIVE)

Response	Number of countries
Address	7
Building and dwelling register and personal ID	5
Data aggregated to grids, used in spatial analysis of user-defined polygons; thematic data packaging	1
Geocodes	1
Data – population by sex, dwelling counts, households, number of address points	7
Thematic classification	1
Coordinates	8
Area, perimeter	1
Grid squares	1
Polygons	1

Unique code relating to other geographic areas	28
Geographic features	5
Points of interest, infrastructure attributes	3
Metadata	1
Code of commune (residence, home, individuals or households)	1

ii. What approach and systems are used to geocode (DESCRIPTIVE)

Response	Number of countries
Coordination system (examples of datum, projection)	
SPSS	2
Geocode administrative boundaries and description of layers	1
GIS software	1
Imagery, GPS in the field	9
No geo-code system	2
Coordinates	4
1km grid to geocode buildings and other units	1
Access data base and .shape database	1
Geodatabase	1
Research into commercial geocoding resources	1
Registers – building, dwelling, address	11
Hierarchical coding for geographies	17
In-house coding tool	2
Look up tables	1

iii. Are any specific admin boundaries applied (DESCRIPTIVE)

Response	Number of countries
Dependent on the collection	1
No	1
Yes – administrative units - districts, sub districts, rural district, province, sub province, parishes, division, regions, county, prefectures, state, canton	26
Yes – municipalities, towns, villages, localities, local governments, cities, settlements	17
Yes – political, electoral, government	6
Yes	9
Yes – buildings	2
Yes – natural areas	1
Yes – postal boundaries	2
Yes – address points	1
Yes – jurisdiction areas emergency (service area, fire districts/zone, law enforcement district, medical service area, school district)	1

iv. Do the boundaries change (DESCRIPTIVE)

Response	Number of countries
No	4
Yes – keeping track of changes	28
Informed/applied (their action on recording change not stated)	3
Yes	6
Some do change, others do not. Any changes are recorded	3

i. Does the NSO produce map based outputs (YES/NO)

j. Any other spatial outputs (YES/NO)
k. Is a spatial capability used in part of the statistics creation process (YES/NO)

8. Institutional Arrangements
    a. Is there integration between stats and spatial capabilities in country (YES/NO)
        i. How is integration achieved (TXT)

Response	Number of countries
Linking geospatial and statistical data in user friendly and easily accessible format to users	1
Framework for 2009 Population Census – different layers for different purposes/representations	1
All data is georeferenced/geocoded	5
Policies and initiatives (issues relating to generation of statistical information and basic geographic information are met)	1
Promotion of using GIS applications in different statistical areas	1
Integrating spatial data and statistical information	6
NSOs	1
INSPIRE directive	4
Existence of statistical units spatial datasets (statistical component embedded initially)	1
Common work between NGIA and NSO	2
National Development Data Centre	1
National agreements, legislations, MOUs	4
Using coordinates	3
Facilitating data and information exchange	1
Basic geospatial and statistical information made available to public	1
Stakeholder engagement – collaboration, working groups, committees, workshops, training	7
Using registers	3

        ii. Is more needed (YES/NO)
        iii. Who is driving the integration (DESCRIPTIVE)

Response	Number of countries
NSOs directly	19
Other coordinating bodies, committees, workgroups (including INSPIRE)	9
Users	4
Government (through various departments/institutions)	9

    b. Is there a need for integration standards and frameworks (YES/NO)

Response	Number of countries
Standards for geocoding	5
Standards for storing spatially related data	1
Use of standard geographies	2
Guidelines and policies for agencies wanting to spatially enable/integrate their data; for consistency; standardisation – across government departments	18
No	7
Standards and framework for data collection and sharing	4
Yes	5
Education	1

INSPIRE	4
National Legislation	1
Applying NSDI (National Spatial Data Infrastructure)	1
Identification of owners of layers and responsible people for updates	1
Standards to ensure quality of work and accuracy	2
Table Joining – allows non GIS-specialist users to create maps from tables	1
A UN SD geospatial statistical integration framework needed	1
Standards and tools for coding, metadata	4
Policies to ensure confidentiality	2
Mapping Standards	1
Normative and legal and organisational arrangements for geo-spatial data	1
NGIA member of international standards organisations	1
Standards for technical formats	1
Standards improve efficiency of making geospatial data more accessible, reliable and less expensive	1

c. Are there consultative mechanisms to support and promote spatial enablement. (YES/NO)

Response	Number of countries
Consultative and coordinating groups; national councils, committees, associations	14
Organisations at federal, state, regional levels	3
Consultative seminars, workshops and conferences	5
No	19
Creation of georeferenced statistical information	1
Making a formal agreement	1
Commercial solutions – ArcGIS online and MS-Office Excel tables; feasibility studies	1
INSPIRE activities	2
Consultation for working plans of the NGIA	1
Active outreach program for data users	1
Providing access to geospatial and statistical data online, or through web-enabled GIS	2
Sharing knowledge and expertise within and between NSOs	4
Promotion of geospatial functionality	3
Participation and support for national infrastructure/framework	2

9. Benefits

a. What benefits to NSO and country come from spatial enablement (DESCRIPTIVE)

Response	Number of countries
Assist informed decision making at regional and local levels	13
GIS to store and manage the statistical data in an effective way; GIS can determine and distribute work areas in effective way	1
Efficient – less time analysing due to visibility, better organisation, quicker data collection	7
Maps and charts – easy to communicate statistical data	7
New types of data analysis for small areas	1
Immediate spatial relationships (patterns/trends) can be made and concentration/dispersion in the statistical data	3
Improved statistical research frameworks	1
More interesting	1
More effective for sampling, enumeration, identifying trends/patterns, modelling/projecting population, statistical products, (statistical	7

production process)	
Support GI applications	1
Economic and social benefits	3
Visualisation tools	6
Facilitate advanced data analysis	2
Increase number of users, encourage discussions on relevant questions	1
Providing interactive information	1
Commercial sector – better marketing, improved data for research	3
New insights and products/applications	1
Spatial analysis at any geography, including small area data	2
Enhance dissemination possibilities	2
Exchange of data	1
Creation of new data/databases	2
Know where things happen and why	1
Comparability of statistical output, full exploitation of spatial information inherent to statistical data	1
Useful for all statistics within NSO, not just Census	1
Emergency planning and humanitarian responses; Demands have been a driving force for the development of inexpensive, easy-to-use desktop mapping packages	1
Valuable planning tool	7
Tool to better capture and represent reality; can better identify areas in need (for policy, resources, services)	6
Increase value, relevance and user value of statistics	17
Improved access for users worldwide	3
Geocoding is a flexible way to aggregate statistical units	1
Further develop IT capacity, fast track development of relevant staff skills	1

b. AL Would ‘better’ information be available for government decisions (YES/NO)

Response	Number of countries
If more user friendly, more likely to be wider used	1
Territorial change analysis simplified	1
Visualisation	7
Provides an overview of the country	1
More acceptable for decision making	1
Could use statistical data for rescue system	1
Enable faster decision making	1
Data integration	1
Analysis	3
Enriches statistical data	11
Representation on maps	1
Emergency planning and humanitarian responses	3
Allocate resources more effectively and efficiently; determine areas in need	17
Model alternative solutions, view a range of circumstances	3
Forecast future needs/situations	3
Best decision made on best information/solutions	8
Better and more transparent planning and decision making	2

c. Would this help the community and economy(YES/NO)

Response	Number of countries
Yes – promote wider use of GIS data and technology	1
Yes – general community and economy are affected by statistics	1

Yes – easier for community to understand for local context, and region	1
Yes – helps local and global management	1
Yes – raise awareness of geographical surroundings and how issues and polices affecting them are spatially related.	1
Yes – increase safety of life and provide better business	1
Yes – more targeted responses for allocation of resources and services	15
Yes – better foundation for better decisions, policy development and planning	9
Yes – better visualisation for spatial analysis and for the determination of services	7
Yes – more efficient and accurate	1
Yes – decision makers will access more detailed spatial information about economic and social circumstances of planned investments, helping make the right decisions, benefiting the community	1

10. General Questions
    a. Any thoughts or ideas on how to link stats with location (DESCRIPTIVE)

Response	Number of countries
Statistical Spatial Framework	1
More training and expertise	2
Spatial data infrastructure	1
Prepare graphs/maps and data together	1
The National Cartographic Centre of Iran sells geospatial information – need to provide this with statistical information	1
Linked in each statistical phase	1
Better cooperation with data management institutions	1
Integration of statistical and geospatial databases	1
Political will and government funding	2
Implementation of Open Geospatial Consortium standards for Table Joining Services; more research on Open Linked Data principles	1
Software in NSO and other departments	2
Hand held devices to directly link attribute data with spatial data	1
A body/group to support this	1
Geospatial Platform – common geospatial data, services and applications	1
Registers (address, building) and geocoding	12
Need to overcome issue of confidentiality in the release of small area statistics	2
Allocation of hierarchical codes for the smallest level of geography	5
Development of relevant and responsive statistical geographies to which administrative boundaries are aligned	1
Increase data sharing and access to data and boundaries online (online GIS)	4
Need to consider legal and federal conditions	1
Need to convert all hard copies of maps to digital format	1

    b. Any examples. (DESCRIPTIVE)

Response	Number of countries
Geocoding building approval and vital statistics to geographies	1
The NSO system	1
Other NSOs and government departments around the world	2
Censuses around the world – including US Census Bureau, Brazilian,	5
Other NSO products	2
NGIA products such as geocoding systems	1
Colombian Infrastructure Data	1

Rescue Systems, noise zones, radon zone, flood zones	1
Disseminating census data	1
Single coding system for settlements and street codes used in Israel	1
Iran software – PARS for storage, retrieval, management, analysis and presentation of statistical data in a GIS	1
Allocation of regional codes to the basic unit blocks to then be corresponded to statistical data	1
Brazilian population Census 2010	1
Integration of data registers for Census	1
US Bureau of Census interactive map	1
IGBE – Brazil	1
Table Joining Services researched in Canada and France	1
Open linked data used in England	1
Contract mapping NZ; Auckland District Health Board	1
Hand held devices to directly link attribute data with spatial data in Egypt, United Arab Emirates, Saudi Arabia, Qatar	1
Last Census – address point location for collection	1
Collaboration between NSO and Geospatial Data Fund for census	1
Some LGAs have a complete GIS for their area	1
Georeferenced dataset with direct linked statistical data	1
Web mapping applications	1
Geodata Cooperation Agreement – improving land use statistics	1
State of Marylands internet map	1
UN Census Bureau	1
Nordic register based system	1
Studies in the field of urban policy: geocoding of various administrative databases, allowing calculation of indicators at the level of small urban districts and production of new maps (grids)	1
Maps to visualise statistical data	1