

# Organizational issues of integrating statistics and geospatial information - the Slovenian example

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Abstract

Slovenia has a long tradition in producing geospatial statistical information. The Statistical Office of the Republic of Slovenia (SORS) initiated the process in cooperation with the Surveying and Mapping Authority (GURS) in the early 1970s as a part of the development of register-based statistics. The paper presents good practices Slovenia has developed in the last 40 years and the remaining challenges by focusing on the issues, such as the importance of registers and records for integration of geo-referenced information and statistics, challenges in developing user communities, inter-institutional coordination at national and EU level with emphases on INSPIRE and the European Forum for Geo-Statistics, good practice achieved in cooperation with GURS in establishing the national hierarchical grid system, and last but not least coordination within SORS between GIS, subject-matter and IT experts and the training provided for inside and outside users, all resulting in better quality of statistics and better effectiveness of the production of data and services. The paper also presents the main geo-statistical products and services, such as web mapping application KASPeR and the Interactive Statistical Atlas of Slovenia, which enable visualization of statistical data, electronic publication Slovene Municipalities in Figures, GIS data as geo-referenced statistical data in vector format, and pre-prepared thematic maps of Slovenia.

Key words: geospatial information, integration of geospatial information and statistics, inter-institutional cooperation, quality, effectiveness, geospatial products and services.

## **1. Geo-statistics are broadly used for policy purposes**

Geo-statistics (i.e. statistics in space) are increasingly important for effective implementation of various national and European policies. Strategic planning in the various policies (development of country as a whole, social and economic development, urban planning, etc.), implementation and monitoring of various policies, scientific research and spatial statistical analysis are no longer imaginable without the use of geo-referenced statistical data and information. A geographic information system as a system designed to capture, store, manipulate, analyse, manage, and present all types of geographical data<sup>1</sup> does not work without the (statistical) data.

The integration of spatial and statistical information is one of the objectives of national statistics where we strive to ensure the greatest possible number of timely and quality spatial statistics from various fields of statistics at a detailed territorial level. We disseminate geo-referenced statistical data in different formats and applications in order to respond to users' needs and in order to make this information useful and understandable to the general public. Geo-statistics must be easily accessible – all in one place – and reusable. Integration of spatial and statistical data is a step forward to increase the usefulness of statistics. SORS has been performing this integration over the last forty years. In practice, the results (geo-referenced statistical data and indicators) of the integration of spatial and statistical data and information are disseminated in a variety of products, such as interactive mapping applications, data in vector format (on hierarchical grids and at the level of different administrative units), tabulated data and analyses.

## **2. Register-based micro data as the basis of national statistics in Slovenia**

In the 1970s a decision was adopted that Slovene statistics will be based on official records and registers. SORS was interested in developing central registers because of more rational data collection and decreasing the burden of reporting units, since in this way it would be faster and easier to collect great quantities of micro data that SORS needed for implementing its tasks. The beginnings of central registers go back to the time around the 1971 population census, when information technology advanced to the point where it became possible to process large quantities of data and keep large data collections. Common identifiers which were introduced at that time enable linking of data in public and legal records for statistical and administrative purposes.

The first step in this direction was the establishment of three base registers in the 1960s and 1970s: the Register of Territorial Units was set up in the 1960s. For the purposes of statistical surveys, a statistical cadastre was introduced in 1959. Its basic spatial unit was the statistical district. The statistical cadastre was first used for the 1961 Census of Population, Households and Housing.

After the revision it was the basis for the 1971 Census of Population, Households and Housing. On the basis of the statistical cadastre and in collaboration with GURS and geodetic administrations of municipalities, SORS created a new record-keeping methodology and a cartographic section for the Register of Territorial Units for the 1978-1981 period. This became the basis for conducting censuses of population, households, housing and agricultural holdings in 1981 and 1991 and for other statistical surveys since 1981. The register covered the data on spatial units defined in legislation. Until 1995 it was kept by SORS. Since 1995 it has been kept by GURS. In the Register of Territorial Units data for territorial units, streets and house numbers are kept and maintained. Data from this register enable the development of GIS as they present geometric basis for georeferencing data (statistical and others) in space. In the Register of Territorial Units basic and supplementary spatial units are kept. Basic spatial units, such as spatial districts, settlements, municipalities, statistical regions, etc., homogeneously cover the whole country and have a defined hierarchy. Supplementary spatial units, such as streets, school districts, etc., are optional content of the register. Different spatial units vary according to the typology (point, line, polygon), the coverage of country (homogeneous, nonhomogeneous), type of the data (attribute, graphical), hierarchy and competence of maintenance for each variable.

The first data collection of the Central Population Register was set up on the basis of 1971 census data. Before 1971, population registers existed only at local level. In cooperation with registration services and municipal registers of permanent population, the Central Population Register has become the basis for population statistics and mass dissemination of its data started.

In 1976 the Business Register was set up with the help of data collected with the census of businesses.

### **3. Coordination of stakeholders for better quality of geospatial statistical information**

#### *3.1 Monitoring user needs*

As a complex challenge, monitoring of user needs at SORS is performed by different tools. The most important are described below.

#### Statistical Council

The Statistical Council is a professional advisory body for strategic and development issues of national statistics. Its members are high representatives of users and the professional public. Even

though its role is of advisory nature, it is very much respected due to the high authority of its members.

The members of the Statistical Council are three representatives of the National Assembly of the Republic of Slovenia, one representative of the National Council of the Republic of Slovenia, two representatives of the Government, one representative of the Bank of Slovenia, one representative of employers' organization, one representative of employees' organization, one representative of the judiciary, two recognized experts in the field of statistics and two representatives of SORS. One representative of employees and one representative of employers are appointed by the Economic and Social Council of the Government of Slovenia, whereas the Statistical Society of Slovenia appoints two recognized experts in the field of statistics.

#### Statistical advisory committees

Members of statistical advisory committees are appointed by different public institutions and civil society. Statistical advisory committees have a long tradition in the national statistics in Slovenia since they were established in 1981 and formally introduced by the National Statistics Act in 1995. Their work has a significant impact on the development of national statistics in Slovenia. At the moment there are 23 statistics advisory committees with around 400 outside members and 100 SORS members. For development of geo-statistics, the most important ones are the Regional Statistics Advisory Committee, the Real Estate Statistics Advisory Committee and the Administrative Sources Statistics Advisory Committee.

#### User conference

An annual user conference where statisticians and users of statistical data from ministries, other public administration bodies, the scientific and research community and businesses come together has valuable input in getting opinion about our products and services. In 1987 SORS and the Statistical Society of Slovenia organized the first statistical conference in Radenci, Slovenia. The conference became a traditional annual meeting known as Statistical Days. From 1993 on it has been attended by representatives of the national statistical offices from around the world and international organizations, too,

#### User surveys

User satisfaction with statistical data and services is monitored with user satisfaction surveys. The results of these surveys are an important source of information about the needs of users and problems they face. They are accompanied with improvement action plans and disseminated.

### *3.2 Coordination at the institutional level in Slovenia*

Inter-institutional cooperation in the field of geo-referenced data and information began in Slovenia in the early 1970s. At that time first activities for the Register of Territorial Units began as a collaborative effort of SORS and GURS. Institutions have been regularly cooperating in exchanging of vision, data and information for many years and in recent years the biggest common achievement has been the establishment of the National Hierarchical Grid System, which was from the very beginning understood as a part of the Register of Territorial Units. In that project the Geodetic Institute of Slovenia as a third partner cooperated to provide technical support and solution. GURS is also responsible for implementing the INSPIRE Directive in Slovenia and for establishing a national infrastructure for spatial information that is part of a European data infrastructure. SORS was involved in the process of preparing the Directive and now cooperates with GURS (national contact point for the implementation of the Directive).

Besides the Register of Territorial Units, SORS established two other base registers – the Central Population Register and the Business Register. Latter on SORS turned over all registers into keeping and maintaining to institutions involved in different administrative activities in the country.

With all the institutions which are data providers for the system of official statistics SORS signed so-called inter-institutional agreements for data provision. Contents of the agreements are organizational issues, the content, the legal protection and the technical protocol of data transfer. The system of arrangements is one of the pillars of managing data quality.

SORS is actively involved in many inter-institutional working groups which are preparing expertise as a basis for directing and monitoring the development in different fields of society and economy. It is also the case in preparing of different methodologies where integration of spatial and statistical data is important.

SORS often provides methodological and data support to different institutions, for example cooperation with the Institute of Macroeconomic Analysis and Development by defining border problem areas and the development deficiency index for municipalities and regions. Similar tasks are going on with the ministry responsible for regional development in Slovenia.

### *3.3 Coordination on international level*

Common standards for managing geo-referenced statistical data are necessary for their integration into a seamless cross-border infrastructure supporting various policies of sustainable development. There are many international activities aiming to harmonize geo-referenced statistical data where SORS actively participates with the focus on the European Forum for Geo-statistics (EFGS) and the GISCO Working Party at Eurostat.

Activities of the EFGS are mainly concentrated on the development of best practices in the production of geo-referenced statistical data in Europe. Annual EFGS conferences and meetings offer the opportunity for GIS experts from national statistical institutes and other institutions to share their practical experience and present case studies of the application of geo-statistics by the users. EFGS partners proposed several actions that are being executed through ESSnet projects GEOSTAT. The GEOSTAT projects aim to develop guidelines for datasets and methods for the European Statistical System to link 2011 population census data to a common harmonized European grid and to find best solutions for their dissemination following the INSPIRE recommendations.

Recognizing the importance of EFGS initiatives, SORS actively participated in GEOSTA 1A project in WP 1 on user needs. Additionally to methodological issues, GEOSTA 1A is also a major step forward towards a 1km population grid data set using a bottom-up or improved disaggregation method. In GEOSTAT 1B which follows, SORS acts as a partner providing methodological descriptions and data.

Despite the fact that geo-referenced statistical data of high resolution have been available and commonly used in Slovenia, experience shared by other national statistical institutes greatly contributed to a better integration of geography and statistics, especially regarding the dissemination of geo-referenced statistical data.

### *3.4 Managing the production and dissemination of geo-statistics in the system of official statistics and at SORS*

Optimal efficiency in the provision and dissemination of geo-referenced statistical data is achieved with inter-institutional cooperation between all partners in the system of national statistics in exchanging knowledge, best practices, visualization and other tools, in coordinating programmes of work and with participation in working groups.

### *3.4.1 Inter-institutional coordination of programming of national statistics*

Operational annual and medium-term strategic programmes of statistical surveys are acts describing statistical requirements for national and international needs. These programmes specify main tasks of SORS and of authorised producers of national statistics. The National Statistics Act defines the role and cooperation of SORS and authorised producers concerning the organisation, preparation, execution of statistical programmes and reporting about them as well as respect of the fundamental principles, data dissemination and international cooperation. In 2012 there are six authorised producers besides SORS: the Bank of Slovenia, the Ministry of Finance, the Agency of the Republic of Slovenia for Public and Legal Records and Services, the Institute of Public Health, the Pension and Disability Insurance Institute, and the Employment Service of Slovenia. The Institute of Public Health, the Pension and Disability Insurance Institute and the Employment Service of Slovenia disseminate a lot of geo-referenced statistical data. We cooperate in exploring the best ways of presenting and disseminating these data for users. Also medium-term targets in statistics are discussed and agreed among all partners in the national statistics system. Statisticians of authorised producers take part in SORS's internal training system, see 3.4.3.

### *3.4.2 Internal coordination in data production and dissemination*

Efficiency in production of geo-statistics is a demanding challenge. A right step in this direction we try to make is to organize the work process at our office so that geo-referenced statistical data are prepared only once to be reused for different tools and purposes. By stimulating interactions among GIS (regional statistics) experts, subject-matter experts and IT experts within SORS, we search for optimal solutions in presenting and disseminating geo-referenced statistical data. Regional statistics experts are actively encouraging subject-matter experts to release as much as possible statistical indicators and not just absolute data as that is important for comparability of data when disseminating them at the level of different administrative territorial units. But the production of indicators remains a challenge as from user surveys we know that our users need more of them than only the ones currently available. Regional data and indicators are stored in a dissemination database on SORS's website and can also be downloaded from different visualization tools.

### *3.4.3 Internal coordination in managing confidentiality*

Dissemination of geo-referenced statistical data is sensitive since the location of the data is information that could potentially lead to disclosure of the unit of observation, particularly when dealing with data of high resolution, e.g. enumeration areas or small grid cells. To assure the confidentiality of the data, SORS defined a set of confidentiality rules that consider sensitivity of

variables. Procedures for managing confidentiality are typically produced with coordination of subject-matter specialists, regional statistics specialists and statistical disclosure control experts.

The confidentiality rules differentiate between statistical data geo-referenced to administrative units and grid data. Grid data namely consider the sensitivity of the data and the area of the grid cell size, which should not be smaller than 100 m x 100 m square (1 hectare). Statistical data geo-referenced to administrative units are on the other hand presented regardless of the area of individual administrative unit only considering the sensitivity of the data. Data suppression is used to protect sensitive cells in the attribute table of geo-referenced data sets.

#### *3.4.4 Managing and monitoring quality of geo-statistics*

The internal training system at SORS is one of the ‘tools’ for providing efficient and quality releases of geo-referenced statistical data. Employees can choose among different in-house and external seminars and workshops at different levels covering all steps of the statistical process. Some seminars such as data protection are obligatory for different or all groups of employees. The training programme is continuously updated. Main elements are statistical literacy, statistical methodology, topical themes related to statistical subjects, data sources of statistics, data analysis and presentation, use of statistical software, data protection and confidentiality and management issues. The programme is coordinated by the training committee and executed by senior employees and external lecturers. The Regional Statistics Department organizes courses for different topics. At present there are two courses on the programme, namely the *Course on efficient presenting statistics in tables, charts and on maps* and the *Course about regional statistics*. In the first one GIS and regional statistics experts are lecturing statisticians about understanding the principles of visualization of statistical data; knowledge of different options when using tables, charts and maps; principles and methods for graphically presenting data (also geo-referenced). Participants also obtain practical advice and solutions (best practices cases). At the course on regional statistics we emphasize the importance of regional data and indicators for our users and we present options for usage of geo-referenced statistical data for various purposes. For quality reasons, we also emphasise the importance of good cooperation between GIS experts and subject-matter experts. Participation in internal courses is available also for employees from authorized producers of national statistics.

At SORS we released the so-called *House style guide for preparing statistical releases* where one part is devoted to efficient, clear and understandable graphical presentation of data where maps are included.



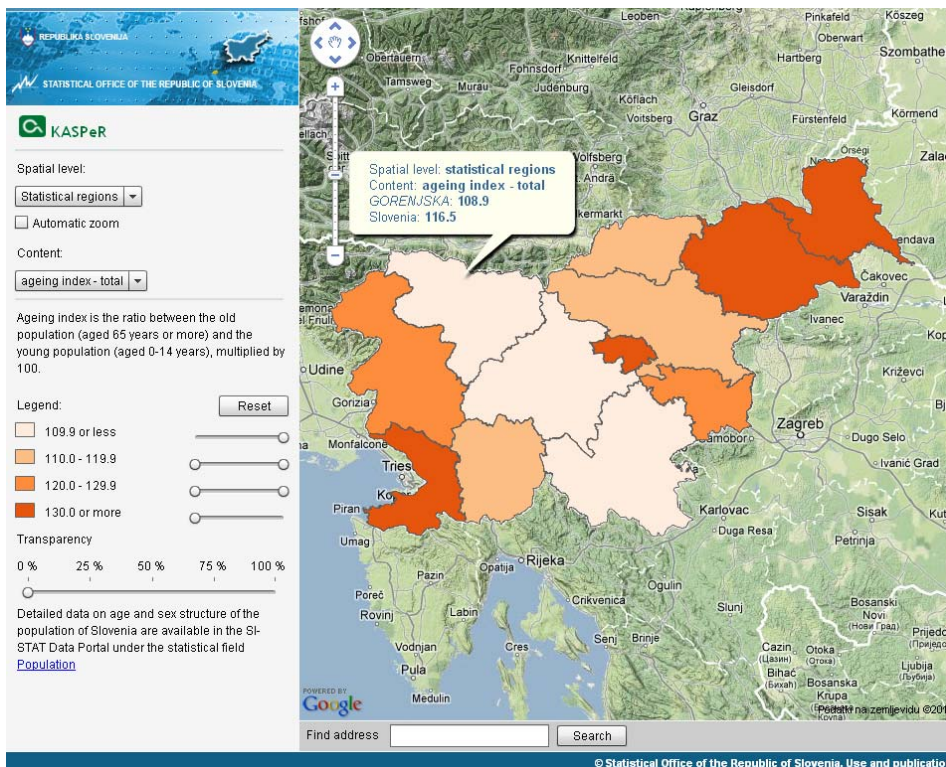
The recurrent theme in most of our internal courses is also to emphasise the importance of respecting the European Statistics Code of Practice, especially the principles of Commitment to Quality, Statistical Confidentiality, Impartiality and Objectivity, Appropriate Statistical Procedures and all other principles that are relevant for statistical outputs.

#### 4. SORS's main geo-statistical outputs

The geo-statistics portal is the entry point to geo-referenced statistical data provided by SORS. The portal joins several applications offering various information and data related to space. They are suitable for users with different needs and levels of statistical literacy.

Web mapping application *KASPeR* enables visualization of statistical data on different administrative units or grids in combination with maps from the Google Maps tool. The application was developed in cooperation with the Geodetic Institute of Slovenia to explore the possibility of including geo-referenced statistical data of high resolution in a mapping application that would bring the 2011 census of population statistics to a living environment of individual. Downscaling from the country level through administrative units to a 100 m x 100 m grid in real time with the help of the transparency slider successfully meets that purpose. The application offers a set of demographic variables that can be presented and downloaded as a thematic map.

Map 1: KASPeR – web mapping application, Ageing Index

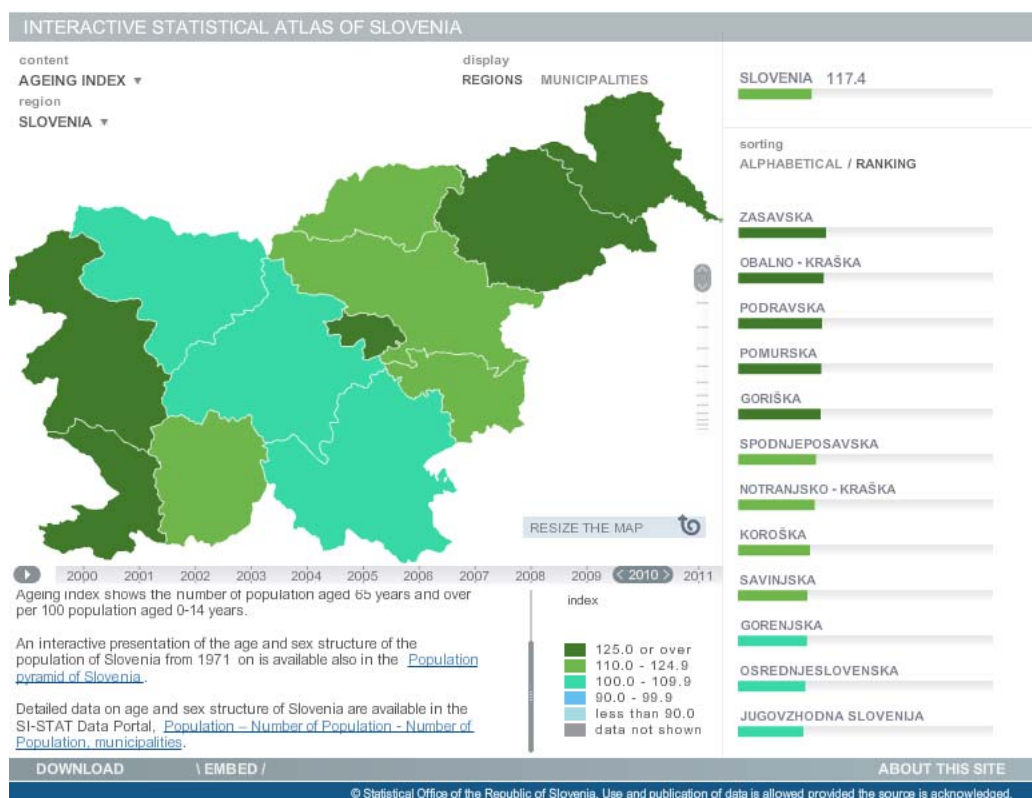


Source: SORS, <http://www.stat.si/eng/KASPeR.asp>

Advanced users appreciate also the *GIS data service* that provides free access to geo-referenced statistical data in vector format (\*.shp). These data are a valuable input for spatial analyses and data presentation.

*Interactive statistical atlas of Slovenia* shows data for selected statistical indicators on interactive maps of Slovenian statistical regions and municipalities, mostly in longer time series. In the tool a user can select indicators, territorial levels (statistical regions or municipalities) and available years. When moving the mouse over the map, data are displayed, same as when moving the mouse over the chart on the right-hand side. When selecting a region, the chart shows only municipalities of the selected region and it also provides an option to sort regions or municipalities by alphabet or by rank.

Map 2: Interactive statistical atlas of Slovenia, Ageing Index



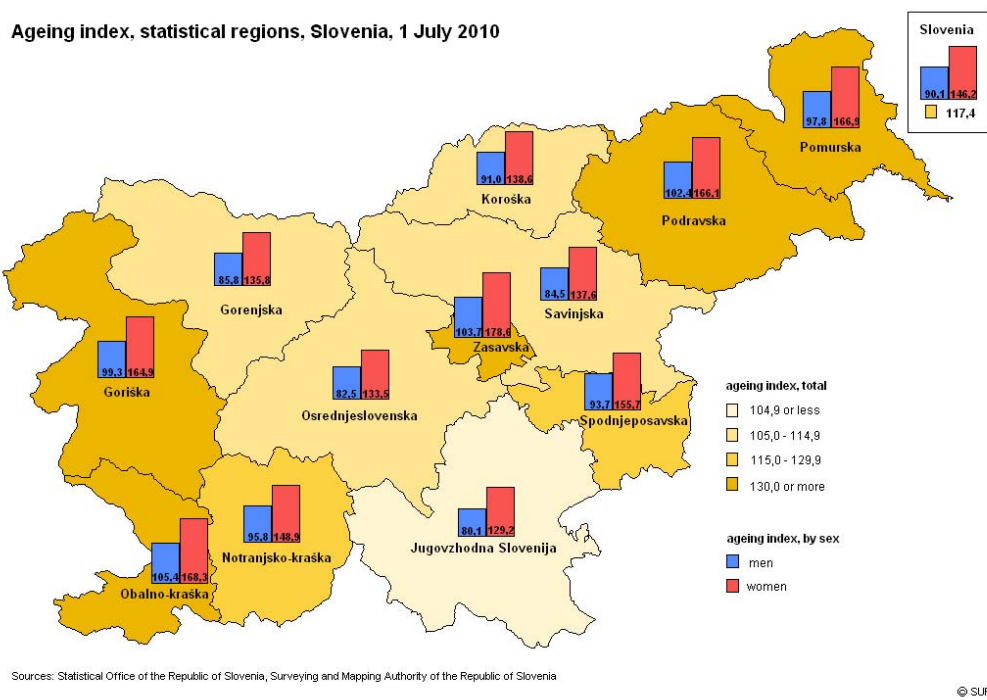
Source: SORS, <http://www.stat.si/eng/iatlas.asp>

The interactive electronic publication *Slovene Municipalities in Figures* provides insight into differences and similarities between Slovene municipalities, as well as their position in the country. Each municipality is presented with a short article. Selected statistical data and indicators can be

compared in tables. The population pyramid offers a view of the basic demographic picture in the municipality.

The application *Thematic Cartography* allows users to browse pre-prepared thematic maps of Slovenia. Thematic maps enable a clear and efficient review of phenomena at a selected spatial level (municipalities, regions, grids) for several statistical fields. The maps are prepared to be viewed on screen or downloaded in higher resolution for printing.

Map 3: Thematic Cartography, Ageing Index



Source: SORS, <http://www.stat.si/TematskaKartografija/Default.aspx?lang=eng>

*Place names* - the tool enables browsing of the database with the names of Slovenian settlements. The map shows the location of the selected settlement, how many settlements with the same name there are and where they are located. In the same manner browsing of streets is enabled.

## 5. Conclusions

SORS provides a wide range of products and services to fulfil data user's needs for geo-statistics. Preconditions for the quality of geo-statistics are good knowledge of user needs we get from a series

of activities (Statistical Council, statistics advisory committees, user conferences, user surveys), ability to get administrative data with standard identifiers and the vision of dissemination of information. Key words in our activities are managing, coordination, cooperation and communication at different levels (international, inter-institutional among different stakeholders in Slovenia, internal within SORS) and with different stakeholders (users, data providers) and the Surveying and Mapping Authority.

Many challenges lay ahead of us, including making access to geo-statistics easier and more user friendly, developing a more efficient system of production of geo-statistics, and providing more indicators. If we show the vision and motivation SORS has shown in the past, the above-mentioned goals are achievable.

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<sup>1</sup> [http://en.wikipedia.org/wiki/Geographic\\_information\\_system](http://en.wikipedia.org/wiki/Geographic_information_system)

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