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Country Report of Israel *

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Report of Israel

The National Spatial Data Infrastructure

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Abstract

The Israeli National Spatial Data Infrastructure is undergoing fast changes due to the rapid development in spatial data technologies and the high demand from government and citizens for advanced location based services.

Four efforts are made in that respect: updating and improving the core national geospatial data bases, upgrading the national geo-portals, Improving common language and interoperability by defining national geospatial standards, including standards for cartographic representation and promoting integration of geospatial data with thematic data such as statistical data, in multipurpose location based applications.

An intensive revision is made to the core national geo-spatial databases to meet the new requirements of location based technologies and the rapidly growing needs of governmental users. The revised spatial database was formatted according to the latest state-of-the-art database standards and is undergoing geometrical and thematic improvements.

The above mentioned spatial data revision is linked to a geodetic network which is based on an Active Permanent Satellite Stations Network and on an ongoing initiative of transfer to a coordinate based cadastre.

Three national standards are in development based on international ones in addition to a ISO based metadata standard. These include: land-use/cover layer content and specification standard, quality measures and procedures for spatial data, and data transfer format between CAD and GIS.

Key efforts are made with reference to on-line services. These include an upgrade of the National Geo-portal to enable fast and user friendly web services to the public and to government offices. The new Israeli national Geo-portal has the ability to store user created content and maps. This ability may encourage small governmental agencies to use GIS technology for the management of their assets and operations. This Geo-portal provides a new set of tools for data sharing and integration among governmental agencies and the public. Another activity with respect to the ISDI is a new project of developing a geodetic-topographic-cadastral on-line information sharing centre for professionals and an initiative for a national Land Information Centre, including relevant location based information and data from across the government and public organizations.

These activities are led by the Survey of Israel (SOI) with the Israeli Inter-Ministerial Committee for GIS that comprises of representatives from all the Israeli government including the Central Bureau of Statistics. The Survey of Israel and the CBS have strong partnership in addition to the general cooperation regarding the national SDI. That includes an initiative of a Unique Spatial Identifier (USI), the New Atlas of Israel and the dissemination of detailed census data within the National Geo-portal. The paper will elaborate on the above mentioned activities.

1. Introduction

Governmental agencies and organizations all across the world are making great efforts to improve their Spatial Data Infrastructure (SDI) in local, national, regional and global level. This diverse range of activities created multiple definitions and different extents of SDI components.

The development and maintenance of the Israeli Spatial Data Infrastructure (ISDI) is led by the Survey of Israel, the national mapping agency, in close corporation with the Israel Central Bureau of Statistics, the Interior Ministry, the Construction and housing Ministry, and many more governmental agencies and public organizations collaborating under the umbrella of the Israeli Inter-Ministerial Committee for GIS .

The ISDI goal is to consolidate governmental activities in collecting, maintaining, displaying, analyzing, sharing and distributing spatial data to support state activities and improve services to the public. Four key elements were identified in the ISDI, these are (see Figure 1):

1. Common language is critical for the success of SDI and includes the following items:
    - Uniform Reference Coordinate System
    - Metadata Standard, data search and discovery tools
    - Unique Spatial Identifier
    - Standards for spatial data terminology, formats and services (quality, transfer and sharing)
2. Core geospatial data layers
3. A national on-line geo-portal that displays the core geospatial data layers as well as thematic data from governmental and public organizations
4. Partnership, coordination and policies, developed for sharing spatial data, services and knowledge.

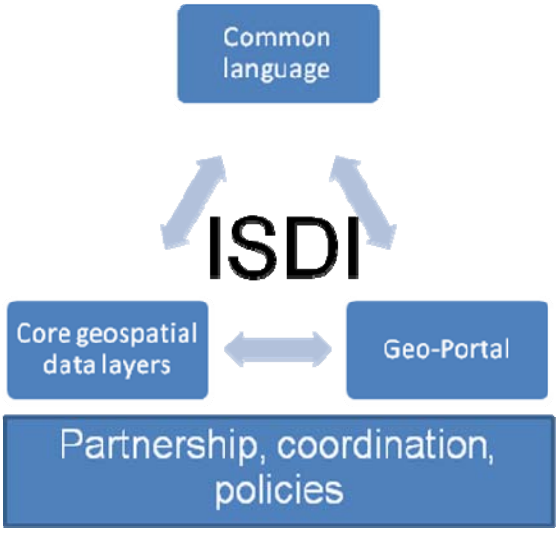

Figure 1: the four elements of the Israeli Spatial Data Infrastructure

The following sections provide more details about the current stage of each ISDI element and the future plans for it.

2. Common Language

Critical to the success of the development of SDI is common language to be used by organizations to share data and information

2.1 Uniform Reference Coordinate System

The national spatial data infrastructure relies on a strong geodetic infrastructure that provides a uniform and accurate reference coordinate system which is used by all the agencies in the country. The modern geodetic infrastructure in Israel consists of a four level network (See Figure 2)

- Level 1: G0 – A network of 20 Active Permanent Satellite Stations. Real-time and post processing services are supplied to surveyors with no restrictions, using various models of payment either by subscription or per-use.
- Level 2: G1 – A network of 150 stable (down to 12m deep) control points constructed in cooperation with the Geological Survey of Israel used both for the geodetic network and for monitoring the geodynamic movements of the earth. These points are measured periodically (every 5 years since 1997) with reference to G0 stations.
- Level 3: G2 – A network of 1,500 control points measured with reference to G0 and G1 stations. These points were measured during the last years and serve actually as a three dimensional network.

- These points define the formal national geodetic reference system, and are of highest accuracy.
- Level 4: Thousands of control points measured by private surveyors (using the G0, G1, G2 network) and controlled and certified by SOI. They are denoted as S1 and S2 points. These points will be considered at lower quality than the first three levels of geodetic points (G0, G1 and G2).

Figure 2: The basic levels of the Israeli geodetic infrastructure

2.2 Metadata

In 2009 Israel has adopted a modified version of the ISO 19115 Metadata standard. The modifications included the requirement for database field descriptions and the addition of more elements to limit the distribution of the data (censorship and classification). The work on the Israeli metadata standard was carried out by SOI and the metadata sub-committee of the inter-ministerial committee for GIS. Following the adoption, software tools were developed for metadata file creation and an on-line program to enable efficient search and discovery of metadata information. The metadata software is integrated into a geo-portal to allow advanced search capabilities that utilize graphical user interface. The software development is near to completion and a beta site was already published. The metadata standard is already in regular use by the CBS.

In addition to the adoption of the standard and development of software tools, the SOI and the inter-ministerial committee for GIS established a metadata operational team. The tasks of the team are: to promote the creation of metadata information within the governmental and public sector, to educate and train the various organizations about the value of metadata and about the use of the software tools, to highlight duplications and inconsistencies in governmental data collection efforts, to perform quality control of metadata in metadata system, and to manage the metadata system (see Figure 3).

The SOI and the inter-ministerial committee for GIS seek to get further support for these activities by government regulation measures.

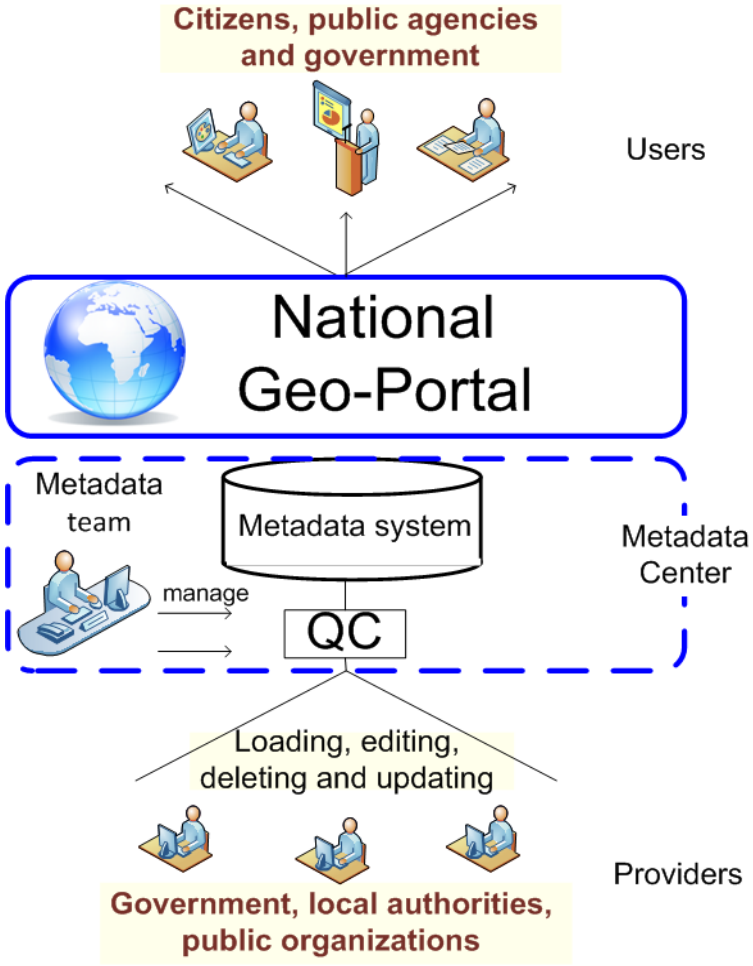

Figure 3: Functional scheme of the metadata center

2.3 Unique Spatial Identifier

The concept of a unique identifier for every record of information is inherent in the application of databases and was developed in the early days of relational databases where the term primary key was used.

The same concept of primary key was used by SOI in the development of the Israeli national spatial database (NSDB) during the early 90's. Every record in the database got a unique primary key to identify it. Nevertheless, relying on the Database Management System (DBMS) identifier alone proved to be problematic both from a technical and a conceptual point of view. Technically, the DBMS unique key was unstable and changed during major initializations of the system. Moreover, different spatial operations such as split or copy created duplications. These technical problems necessitate the development of a stable and supervised method to create and maintain the uniqueness of a primary key termed Unique Spatial Identifier (USI).

To add more complexity to that, there are various other numbers that are published in addition to the municipal address by different governmental offices. These numbers include: the unique street code by the Israeli Central Bureau of Statistics, the zip code with 7 digits that will be issued per house and entrance by the Israeli post-office in many areas, highway number by the transportation ministry, sub-parcel (apartment), lot and block number given by the SOI and the Land Registry and so on.

Conceptually, the goal of these efforts is to manage these various numerical identifiers in a national spatial database which will be used by all levels and for all purposes (emergency management, census poll, real-estate market evaluation and so on). Thus, any identification for the location such as; place name, address, zip-code, database number, parcel number can be traced by coordinates.

An additional benefit of these efforts is the ability to efficiently manage spatial data revision, integration (with attribute data), and analysis with the possibility of historical examination.

2.4 Standardization

Standardization is an important component of ISDI. The Technology and Standards team of the inter-ministerial committee for GIS performed a comprehensive study to analyze ISO/TC211 standards with respect to the needs and priorities of the State of Israel.

Four requirements were highlighted as necessary:

Quality standards (i.e., ISO 19113 and ISO 19114 which form the new standard ISO19157) were selected as first priority for adaptation in the next year. To accomplish this goal the team has hired experts to assist in writing implementation

rules and in translating statistical and mathematical algorithms of the standard into practical procedures. These experts and the team have prepared the framework for the adoption of the ISO19157 Standard in Israel next year when ISO procedures to approve this standard internationally are finalized.

Another standard that was selected as imperative was for land cover/use layer coding and feature content. A team of governmental members was chosen from different organizations to represent environmental (green) factors such as the specification of forest density and vegetation type as well as urban development factors such as the classification of industrial areas, neighborhoods, quarries etc. The team review international standards such as the Food and Agriculture Organization of the United Nations specification (FAO, 2009 or the work of ISO/CD 19144-2), finished a draft standard, and tested its feasibility in a pilot project. This standard will obtain its final approval next year and will be adopted by the CBS to produce a land use layer.

Interoperability standards are very important however, a survey of the different agencies showed that commercial data transfer protocols are adequate and satisfy for the basic needs of the Israeli spatial data market. Nonetheless, it was still essential to develop a national coding schema along with tools to convert data from standard GIS file format (e.g., Geodatabase) to standard CAD file format (e.g., DWG). A company was hired to develop the specifications and tools to meet these requirements and the project is in final stages.

The Forth standard that was chosen is for multipurpose and device independent cartographic data representation. This standard was developed as a project with the following goals: to defines a national data representation model (content, generalization and sources), to develop symbology and cartographic rules for paper, computer displays and cell phone displayed maps and to provide the GIS files (*.LYR) to support these. This project was completed and first version was distributed to the Technology and Standards team of the inter-ministerial committee for GIS.

3. Core geospatial data layers

The Israeli national spatial database has been developed by the SOI since the early 1990s to meet a variety of needs and purposes including the requirement for buildings and transportation layers for census conducted by the CBS in 1995. It consists of the basic data layers defined as a national infrastructure.

Ten layers are part of the NSDB as follows:

1. Geodetic Control
2. Transportation (Roads, Rail)

3. Buildings (structures and addresses)
4. Hydrography
5. Land cover
6. Elevation (hypsography)
7. Orthoimagery
8. Cadastral Information
9. Marine Information
10. Administrative boundaries

The first nine layers were created and are maintained by SOI.

Layers 2 – 6 (the topographic data) are based on triangulated aerial photographs, taken at 20,000' altitude, using analytical and digital photogrammetry. The current revision cycle is 2-3 years, except for roads and buildings which are revised annually.

Orthophoto (layer 7) production and data collection is carried out by the private sector. This is the main trend, and Israeli companies provide integrated geospatial products and services, orthophotography, mapping, GIS, cadastre, visualization tools and more.

The usual mode of cooperation between SOI and the private sector is that SOI defines the specifications; private companies carry out the data collection and the staff of SOI do quality control and integration of the data into the NSDB. Then, SOI provides data and services directly to organizations and the end users.

The implementation of imagery technologies is highly developed in Israel since 1973. This led to development of the local industry. Israeli manufactures supply satellite imagery all over the world. Recently, Israeli digital aerial cameras influence the photogrammetric market. These developments caused SOI to update the regulations in order to certify the use of non traditional aerial cameras for mapping applications, and last year a new national orthophoto layer at a 0.25 meter resolution and higher accuracy was created as part of the NSDB.

The cadastral layer (layer 8) is undergoing major changes as part of the SOI decision to move to an era of coordinate based cadastre including a three-dimensional cadastre. These changes include a new classification of parcel corners according to their accuracy, new quality control procedures and a novel paradigm of that put priority to the recorded database coordinates over the physical mark on the ground.

The layer of administrative boundaries was developed and maintained jointly by the ministry of interior and SOI. Layers are exchanged using commercial GIS software

formats (e.g., shape files, geodatabases, dxf) following the recommendation of the inter-ministerial committee for GIS.

Further changes in the content and structure of the framework data layers that are in development include:

1. Change in the transportation datasets to meet the requirements of Geographic Data Files (GDF) standard, referred to as GDF version 4.0 (ISO 14825:2004).
2. Modifications of the database structure according to modern principles and latest computer format (ArcSDE geodatabases in ST-Geometry data type which is OGC/ISO 13249-3 compliant)
3. Restructuring marine Information to integrate the hydrographic data which was collected for the production of the nautical charts, with the topographic data in order to create a continuous database covering the land and the sea. The main challenges of this activity are to overcome the difference of standards between land information and hydrographic information and to enrich the marine data.

These changes will make the NDSB better suited for modern applications and will make it a true framework data on which users can add or attach their own added value thematic data.

4. Geo-statistical data

The Israel Central Bureau of Statistics (ICBS) operates under the Prime Minister's Office is responsible for the creation and maintenance of geo-statistical data. The ICBS provides each street name in Israel with a unique code to be used by other governmental and non-governmental offices, organizations and firms (streets list within commercial internet sites for example).

The Israeli Population Registry is geo-coded and all the population is divided spatially to polling stations by the ICBS GIS. The spatial division of the population to polling stations serves the Ministry of Interior for election purposes, serves the ICBS to produce statistics and serves other ministries as well.

The ICBS GIS established a Geo-Statistical Infrastructure for the 2008 integrated census. This Geo-Statistical Infrastructure had special importance since the 2008 Integrated Census, unlike traditional censuses, was based on an integrated use of data from administrative sources along with sampled data gathered by enumeration in the field. Since the field work was aimed to collect only data of 20% of the population, the role of the GIS to cover the entire land and to support data collected by field work as well as from administrative file was crucial. The Geo-Statistical Infrastructure for the integrated census simulated the entire land.

Geo-statistical data are disseminated by maps and by GIS applications in the ICBS website as well as by the National Geo-portal. The dissemination using the National Geo-portal is part of the interoffice cooperation that enables the public to receive data from different sources (such as statistical and other data) on the same geographic frame. Most of the data is available for a census tract resolution (about the size of a neighborhood).

The ICBS GIS provides internal and external services. Internal services include statistic making for agriculture and transportation, projects for survey taking, construction of a national apartments database as well as projects for the use of other governmental offices, such as mapping of land use in Israel.

The ICBS statistical data is also published in GIS formats. Such GIS publications include thematic maps to describe different phenomena as well as special GIS applications enabling the user to generate custom made maps.

5. National Geo-Portal

The Israeli National Geo-Portal displays the core geospatial data layers along with 100 more layers of governmental data in a user-friendly environment. The rich content of the portal is the result of the extraordinary collaboration between the governmental agencies. Among the layers are 14 geo-statistical data layers (demographics, employments conditions, education, race etc.) , 10 transportation layers (roads and street names, bus routes and stations, trains), 11 tourism and recreation layers (sport facilities, culture centers, parks) and many more.

The Geo-portal has been upgraded recently and new capabilities were added to it including:

1. A simple and wizard-like user interface (see Figure 4) that contains rich functionality but exposes to the user only relevant buttons.
2. Natural language query line for simple data search and retrieval.
3. Faster data retrieval and processing abilities (using caching technology).
4. Advanced spatial querying tools and processing functions.

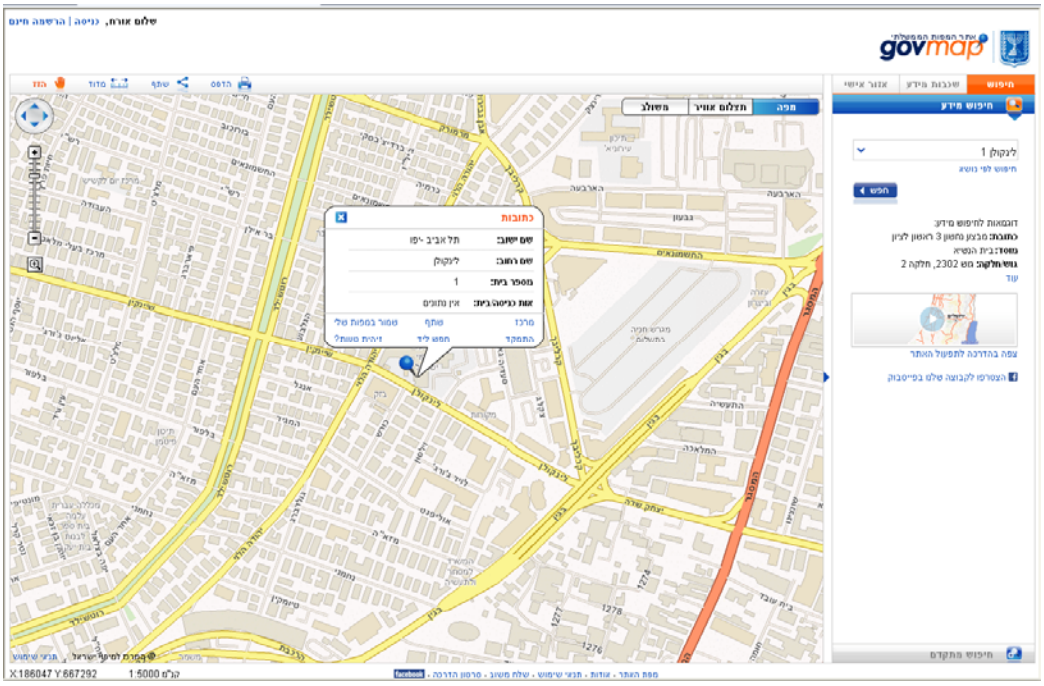

Figure 4: the new geo-portal user interface

5. Customized agency based site. This new capability allows any governmental agency to create its own geospatial portal with a unique URL, its logo, specific data layers, information content and functionality. This functionality is selected from a set of hidden data search and retrieval options.

6. Geospatial web services, the new geo-portal has an impressive set of interfaces (APIs -Application protocol Interfaces) that allow users to link their website to maps (as presented in Figure 5) and geospatial content from the portal using international OGC compliant standards (WMS).

7. Support user generated content namely allow users to post and manage selected content within a personal zone.

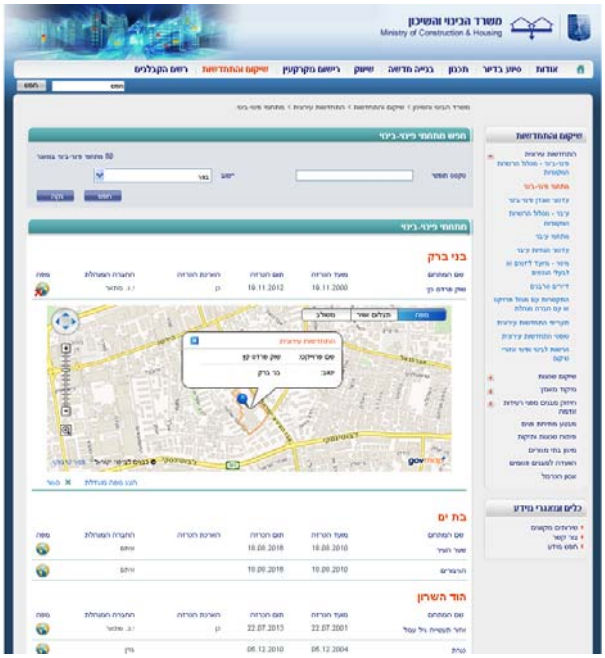

Figure 5: a map in a standard webpage

A new version of the Israeli geo-portal is under development which will include:

- Support of mobile devices and cell phones
- Real –time link to public transportation data from the ministry of transportation
- Support for download of data following an approval process or purchasing
- Support for seamless communication and geographic search and exploration of alpha-numeric governmental data as will be explained in the next section.

6. Partnership, coordination, and policies

6.1 Partnership and coordination through the inter-ministerial committee for GIS

For many years SOI has recognized the need to build relationship and partnership among organizations to support the continuing development of the ISDI. This has led to the establishment of the inter-ministerial committee for GIS in 1997 which was formed from delegates of 44 governmental and public agencies by a Prime-Minister order. The inter-ministerial committee for GIS is managed by the SOI Director General and for the last eight years used to be composed of six teams: the Coordination team, Data collection and Projects team, Emergency Preparedness team, Metadata team, Technologies and Standards team, and Data Sharing team (see Figure 6)

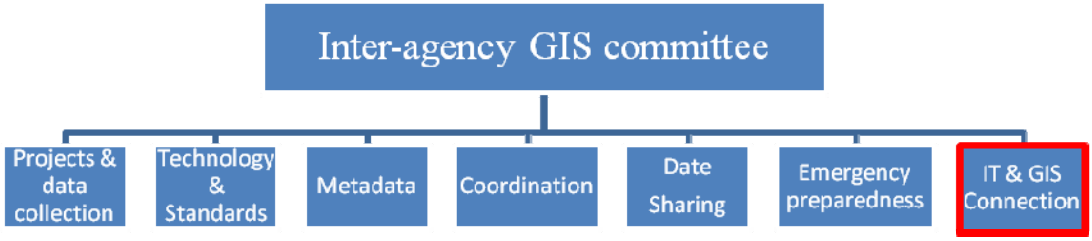

Figure 6: Organizational structure of the Israeli Inter-Ministerial Committee for GIS with the new team for IT - GIS integration.

The initial objectives of the committee were to promote the efficient use of GIS in the national level through data and knowledge sharing, standards and working procedures development. Since 2005 the work of this committee started to be more intensive and was broaden also to include the development of a geo-portal and lately a GIS - IT integration team was formed to support the activities of the committee in this important field. Another team is under construction – the municipal/local government team and another one is under planning – the marine geospatial team. Additional cooperation and sharing of data is also taking place.

The SOI with the Committee are now seeking to expand their partnership with additional public organizations (e.g. the Israel Postal Company) and most importantly with local authorities (cities, villages and so on). These partnerships will broaden the spectrum of applications for the ISDI and strengthen it.

6.2 Strengthening IT and GIS Integration

It is a well known fact that more than 80 percent of the governmental transactions are related to location. Nevertheless only a small fraction of the standard information systems and governmental databases are linked to GIS. While discussing the various venues of development of the ISDI it had become evident that there is a need for better integration of spatial databases and GIS with standard information systems and organization databases.

Recognition of this important concept has instigated idea to develop a National Land Information Center (NLIC) which will integrate information (with geospatial reference) from different governmental agencies into one on-line portal.

The system will support decision making in all levels with respect to land transaction and development. It will enable data search across many platforms and databases using spatial queries and functions.

Figure 7 depicts the key information that will be integrated in the NLIC.

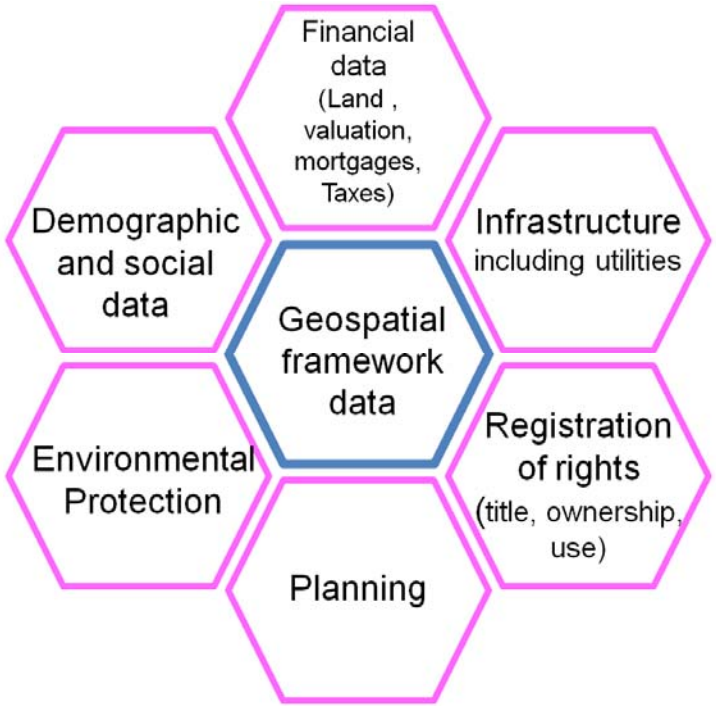

Figure 7: Information which will be integrated in a National Land Information Center

The first step of the NLIC is under development including a Topographic and Cadastre Information Center (TOPOCAD) which will integrate all the data sources and databases of the Survey of Israel. This step is budgeted for this year as presented in Figure 8.

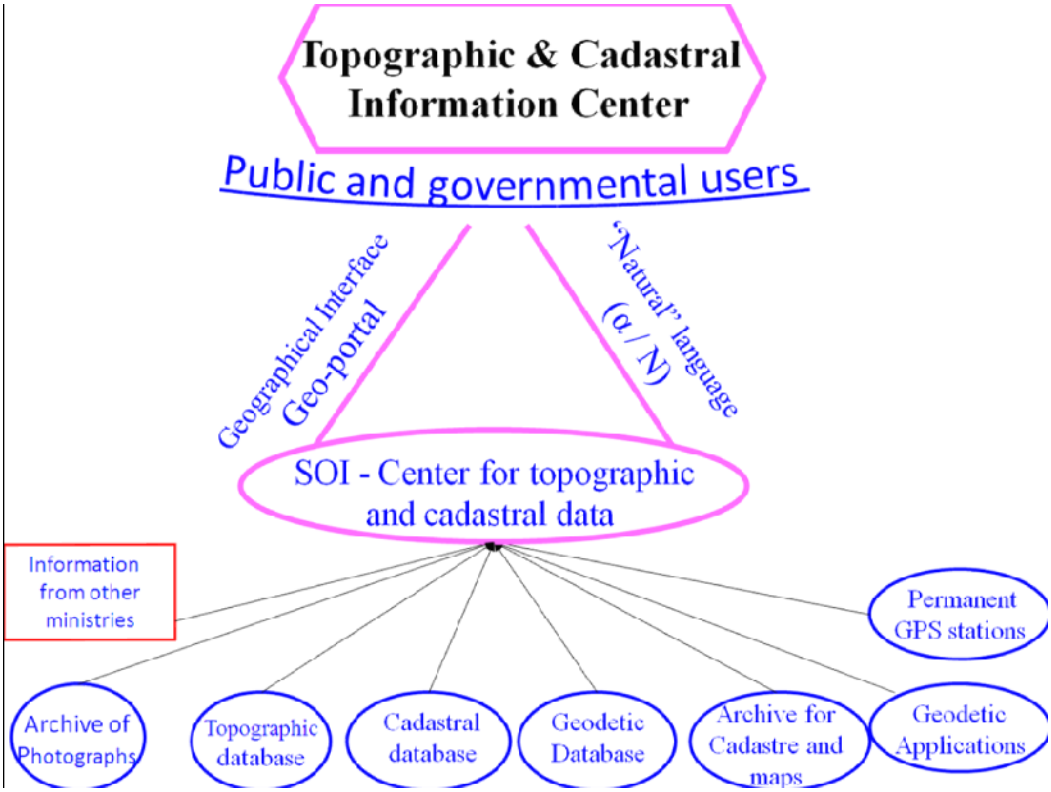

Figure 8: The first step in the development of the NLIC is the topographic and cadastral information center which will provide a complete e access to SOI data .

7. The New Atlas of Israel

In addition to the collaboration between SOI and CBS regarding the ISDI, the address database, the census related data, and in the development of the USI; both organizations hold close cooperation in the production of the New Atlas of Israel. This Atlas, published recently in English, is a joint product with the Hebrew University of Jerusalem and with contribution of many top-scientists. Advanced GIS technologies, the NSDB and the Geo-statistical data from the CBS were used in the production of the maps, graphs and visual diagrams in the Atlas. The Atlas is an important contribution to the public and especially for education in the field of Geography and it was highly praised by geography teachers and students. Figure 9 shows a few examples of the maps and pictures

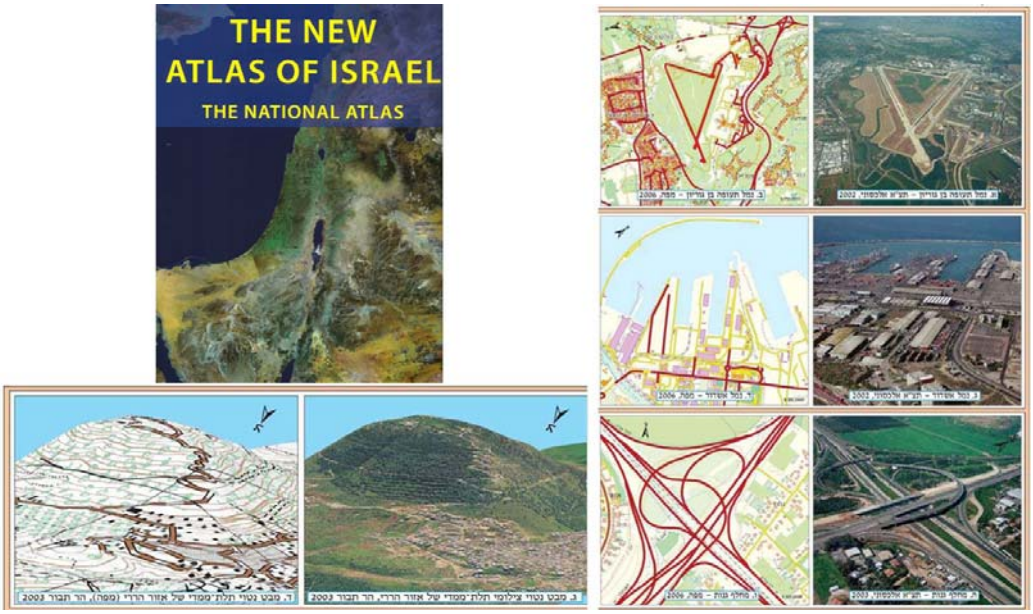

Figure 9: Examples from The New Atlas of Israel.

8. Conclusions

Much progress has been made in the last decade toward the development of spatial data infrastructure in Israel. In some areas the development is satisfying (e.g., geo-spatial portal development, core spatial dataset developments) and care should be taken to maintain the development current and up-to-date.

However, supplement to the existing government decisions, additional activities should be even more articulated into national policies for spatial data sharing and partnerships among governmental agencies. The National Land Information Center is another major endeavor that will require effective partnership, organizational and financial resources in its implementation.

A strong spatial data Infrastructure for the State of Israel is an attainable goal that can be achieved in the next few years with proper collaboration among governmental agencies in technology, data sharing and policy development.

The collaboration between the Survey of Israel and the Central Bureau of Statistics proved itself to be very successful and beneficial for national needs.