The Future of the Survey of Israel – On Line Services

Haim SREBRO, Israel

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ABSTRACT

National Geospatial Organizations play an important role in the arena of land management and commerce as well as in support of location based services including communication. The importance of these two areas is growing very fast in global and national economy. In parallel, the fast expansion of the use of internet and fast transactions of capital desire fast support of reliable data and services with regard to geospatial data.

According to the author's opinion, the only way for NGOs to cope with the requirements and to be relevant is to keep the high standards of accuracy and reliability of data and to increase on-line access to geospatial services and data. This refers to on line availability of data, both to professionals and to the public as well as to on-line professional services.

The Survey of Israel adopted this approach and is moving fast in this direction. The achievement of this goal requires external rearrangements as well as internal reorganization. Both are required in order to achieve the goal.

This article discusses the internal and external activities at the Survey of Israel that were already made and those which are in progress in order to achieve the required goal to enable online access to the data bases, to improve the transparency of data, to improve the services using fast channels of communication and to save money to the government and to the public. The article shows current models of operation of government and public users with the National Geospatial Portal, modes of on line operation of surveyors with the Active (Satellite) Permanent Network (including GPS and Glonass) as well as future modes of operation with a suggested Coordinate Based Cadastre and models of on line access of the public to the National Archives of Maps and Photographs.

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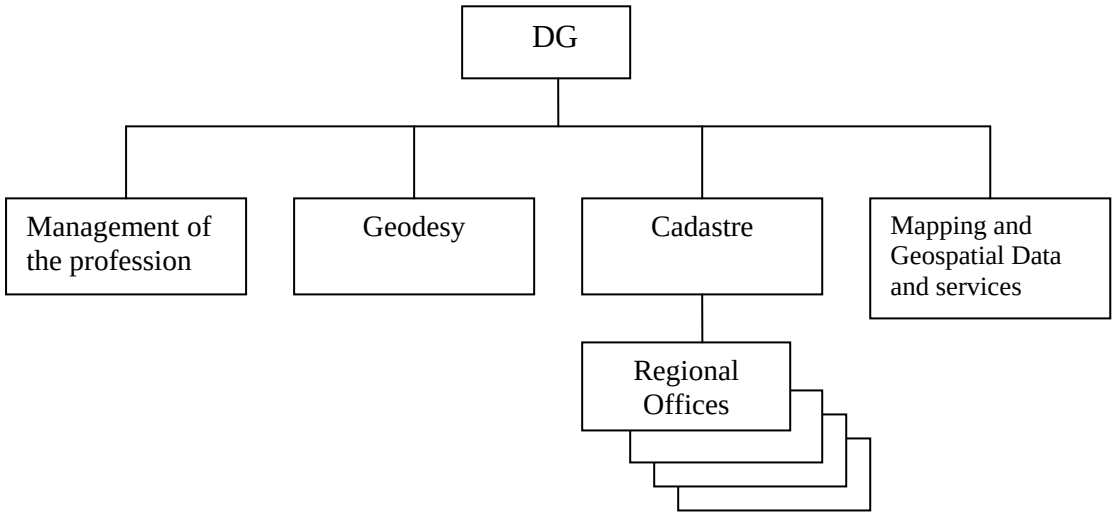
THE TRADITIONAL ENVIRONMENT AT THE SURVEY

The Survey of Israel (SOI) is a governmental agency responsible for four basic areas:
- Responsibilities with regard to the profession, regulations, professional guidelines of the director, licensing of surveyors, inspection and enforcement and promotion of the profession.
- Geodesy, including the geodetic network.
- Cadastre, including regional offices.
- Mapping and geospatial data and services.



The traditional responsibility with regard to the management of the profession was characterized by preparing new regulations to cope with the changing technologies managing the practice of new surveyors and licensing surveyors. The survey Ordinance of 1929 has been the basis of the legislation since 1929. During the last decades, survey regulations are published every decade. The last version was published in 1998. A new version of regulations is in process (Steinberg G., 2006). Since 1998 the Director General is publishing guidelines to enable surveyors to cope with technological advances. An additional responsibility is the maintenance of international boundaries.

The geodetic infrastructure is consisted of a network of tens of thousands of control points out of hundreds of thousands of control points of the triangulation, which were constructed and surveyed since 1920 when the Survey of Palestine was established by the British Mandatory regime. The traditional geodetic grid used to be the Israeli grid, which was based on the Palestine Grid. In 1995 this grid was replaced by the New Israeli Grid, based on new survey and triangulation.

The cadastre in Israel was established in 1928 based on Torrence principles. As for today, more than ninety five percent of Israel already went through the basic process of land settlement. In addition to the slow advance in the settlement process of the rest of the lands due to complicated land claims, most of the cadastral activities include reparcellation due to economical activities and land development. These activities require the control and certifications of the SOI for land registration. Since all the professional documents and data are managed by the SOI, the private surveyors, who inherited the traditional job of the government surveyors in preparation of blocks and plans, are required to visit physically the archives of the SOI in order to look for old data, including hard copy block plans, field sheets and field books, or in order to acquire data from the geodetic and cadastral digital data base of the SOI.

This process requires a lot of time, both of the surveyors and of the government employees. In addition, the quality of the hard copy materials continues to deteriorate and surveyors face unavoidable problems of in accurate data due to low quality and due to inconsistencies in traditional data. These problems resulted in slowing the process of survey and preparation of land mutations, including the process of control and evaluation of the mutation plans. Thus, influencing the process of land development as well as causing long delays in land registration.

In spite of the high quality of the traditional SOI maps, the development of an independent national GIS at the SOI extracted from 1:40,000 aerial photography since 1991 caused problems of compatibility between the GIS and the hard copy maps, as well as problems of parallel investment in updating. Customers were required to come to the SOI in order to purchase data from the National GIS. The selling models were rigid and not user friendly. This did not satisfy the dynamic developing GIS markets and especially the location based industry. This situation was counter productive in spite of the recognition of the customers of the high quality of data.

THE CURRENT STATUS

The requirement of the market both the private market and the government and public environment led the SOI to the understanding that there should be a major change towards better response to user requirements.

The result of this understanding was to change products, to increase the variety of products, to update the database more frequently and make data available to users faster, preferable on line. In addition, there was a requirement to improve accuracies.

Other results were: to adopt most advanced technologies, to change the production processes and to shorten the production times; to define or adopt standards and specifications for data transfer and for digital products; to improve quality control and data management; to improve the availability and accessibility of data services to the users, either internal or external, and to define new models of service.

The leading requirement and basis for integrated geospatial management is to handle the geospatial information on the basis of accurate coordinate based reference.

Technology enables this process, and new network was established based on satellite permanent stations (APN-Active Permanent Network) including 18 stations, and will increase this year to 19 stations. Half of the stations will operate with GPS satellites; the other half will work both with GPS and GLONASS satellites. This will improve the effective coverage of the existing stations, especially for RTK (Real Time Kinematic) mode of service. In addition to RTK the permanent stations supply also VRS (Virtual Reference Stations) service and DGPS service.

Fig. 1: The Active Permanent Network

The permanent stations are the nucleus of the current Israeli geodetic grid, called ISRAEL GRID 2005 (IG05), (Steinberg G. and Even Tzur G., 2005).
The new grid consists on three components:

G0 – The permanent stations

G1 – 150 stable control stations constructed in cooperation with the Geological Survey of Israel, (GSI) used originally for monitoring the geodynamic movements of the earth. These stations are measured periodically (every 5 years since 1997) with reference to G0 stations.
G2 – 1,300 control points measured with reference to G0 stations.

These points define the formal national geodetic reference system, and are of highest accuracy.

Additional control points will also be incorporated in the new geodetic data base. These are control points measured by private surveyors and controlled and certified by the SOI. These points will be considered at lower quality than the main points (G0, G1 and G2).

In addition to the new network a series of professional guidelines were published by the Director of the Survey of Israel in the interim phase before new regulations are prepared and enter into force.

An innovative approach was implemented in the professional directives for the vertical reference based on implementing a statutory undulation model (Steinberg G. and Even-Tzur G., 2006).

The current status of the cadastral activities includes a computerized environment of the land survey and office work for the production of the mutation plans. The historical archives are partly computerized and the management of the cadastral data base is integrated in a cadastral GIS which serves the requirements of management, but since most of the data of the traditional block plans was digitized from the graphic hard copies it is not accurate enough for the registration itself. The field survey is performed by private surveyors, who have to come to one of the SOI offices in order to assemble the required reference data, and in order to get confirmation for the specific produced control points.

In Addition to the approval of the control points, an approval of the mutation plans is required as well. Two major measures were taken last year for acceleration of the control and approval of the mutation plans. One was internal, including a development of a unified overall command and control system (Forrai J. et al., 2004 and 2008). The other one was external, refers to outsourcing the assessment and confirmation of mutation plans by nomination of supervising surveyors (Forrai J. et al, 2006) to cover up to now third of the annual amount of mutation plans. In addition, first functions of direct access of the public to cadastral managerial data were launched successfully using the internet.

A few pilot projects were executed in order to progress toward a digital coordinate based spatial cadastre. These projects included an R&D 3D cadastre comprehensive project (Shoshani U. et al., 2004) followed by a few implementation projects, required for planning multi dimensional sites, which include in part of the cases accommodation and/or commercial complexes above or beneath archeological sites,

underground traffic tunnels and interchanges, preparing the multilayer cases for spatial land registration. The planning, the management and the land registration in these cases should be handled on a coordinate based reference usually on a GIS platform. For the time being only few special cases are taken care of under cooperation between the Survey of Israel, the Land Management Authority and private surveyors. Up to date the results enable 3D registration but this is not accomplished because the legal arrangements are not prepared yet.

There is a wide understanding that an accurate coordinate based cadastre (CBC) should replace the existing hard copy databases. This understanding is shared by the three components of the professional community in Israel: The Survey of Israel, the academy and the private surveyors. A CBC would contribute to handling lands as a commodity in the commercial market. It would accelerate the registration process, increase the precision of land management and reduce friction which leads to courts.

The current geodetic infrastructure based on the APN supports a CBC enabling real time and high accuracy. The required legal change is challenged especially because of the problem of differences between the registered parcel areas and the accurate parcel areas, as computed from the coordinates. This is relevant to property rights and requires legal solutions. But there is an option to accomplish most of the migration from the hard copy data base to a coordinate based database without the registration itself. This will enable a surveyor who prepares a new mutation plan to refer to the coordinates and just to check for the existence of authentic points in the area saving him the current requirement to look for old hard copy files and to execute a complicated time consuming research.

Due to the high cost of the project of transforming legacy cadastral data into CBC a few feasibility studies were carried out as well as an economic assessment.

The economical assessment showed high revenue in such a project. The feasibility projects showed a requirement for different approaches in different areas like state open deserted areas, agricultural areas, low density populated areas and highly densed populated areas. The fastest and cheapest areas to take care of are state owned, unpopulated lands, where it is easy for the state to change limits and areas. The most complicated areas are private owned areas in the cities, where the economic significance of any change may be dramatic […where any change may have high value significance]. In addition, the pilot projects showed the importance of locating and surveying old authentic points which disappeared due to accelerate development and are required as anchor points for future transformations.

As a result of the pilot projects the Survey is leading an effort of transforming around two thirds of the lands which are state owned unpopulated lands. This should be a relatively low cost project, which can be accomplished in 4 to 5 years. Meanwhile conducting additional pilot projects and the accumulated experience will improve the assessment and support a program as to the way to proceed in more complicated areas.

The existing cadastral GIS will be improved gradually by accurate coordinates produced through the CBC project and every node point will be attached an accuracy grade to support surveyors.

Since 1991 a National GIS was created by the Survey of Israel (SOI) to serve the government ministries and agencies as well as to support the community of nation-wide geospatial consumers.

The data source of the National GIS was based on triangulated aerial photographs, taken at 20,000' altitude, using analytical and digital photogrammetry. The current revision cycle is 3-4 years except roads and orthophoto which are revised annually.

The National GIS of the Survey of Israel consists of a topographic data base including ten topographic layers: orthophoto, elevations, roads, buildings, hydrographic features etc., a cadastral database including blocks and plans, and a database of addresses.

The National GIS infrastructure consists of the infrastructure of the Survey of Israel and many government offices as well as medium and large cities and towns, utility companies and public organizations.

Orthophoto production and data collection is carried out by the private sector. This is the main trend, and Israeli companies provide integrated geospatial for satellite imagery, orthophotography, mapping, GIS, cadastre, visualization tools and more.

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

THE GEOSPATIAL PORTAL

Around two years ago a SOI launched National Geospatial Portal (NGP) (Srebro H. et al., 2006 and Srebro H., 2008). This portal has been developed in cooperation with the Inter-agency Committee for SDI. The portal is already working for a year. It is part of the e-Government initiative and will serve simultaneously as a geospatial portal for the public and a governmental GIS clearing house. For the time being it serves the public free of charge. Following a thorough analysis of the options, the decision was made to build a geospatial data warehouse at the first stage, in order to improve the quality control of data. This approach was adopted because of the variety of data sources. Though the quality of data based on the National GIS is very good, one cannot assure the quality of uncontrolled data coming from all ministries and agencies, so that integrated applications of the simple end web-user may not meet the expected standards.

Following the resolution of the Inter-agency Committee with reference to the national geospatial meta-data standard based on ISO19115, this standard was adopted for the

portal as well. Meta-data for 400 layers of geospatial data has already been prepared and is accessible in the system.

The system works quite fast and passed successfully loading simulations. Potential users are exposed to the portal and are very satisfied with it, including the education community and potential emergency applications.

Main Objectives:

The first objective of the portal is to consolidate, to integrate and distribute geospatial data following the e-Government policy of making the data available to the public.

The second objective of the portal is to serve as a clearing house of geospatial data between governmental offices and thus to save governmental investment and to improve compatibility and integrativy between governmental offices regarding geospatial and location based applications.

The expectation is that the exposure of data will also stimulate processes of improving the quality and precision of the data.

Organization:

A steering committee of the two organizations headed by the Director General of the Survey of Israel (who chairs the Inter-Agency committee) defines the goals and confirms the planning. A working team of the committee defines the requirements and controls their achievement while working teams of the Survey of Israel are responsible for their execution.

The main components of the system are: data collection, data integration, simple web operational search mechanisms, national geospatial meta-database, data sharing and data distribution mechanisms and a variety of links to GIS and mapping web sites.

The architecture of the NGP is based on servers in the SOI, which operate as a Data Warehouse supporting, via intranet, internal users of SOI and distributing the data to an identical environment at the central web site of the government using its services, including security of data. The government site data is distributed to the various government offices including web services and via Fire Wall and the internet to the public.

The mode of interaction between the SOI, the government offices and the public is as follows (see figure 2): The SOI collects GIS data of various government offices and public organizations using the coordination of the Inter-Agency Committee for SDI, checks the data and integrates it into the Geospatial Data Warehouse of the Portal. The public (the web users) can either query the NGP directly for pure geospatial subjects, or access via the government portal, a portal of a government office for a complicated issue. The portal of the government office will integrate its internal IT

and GIS data extracted by the NGP using API (Application Programming Interface), see figure 3.

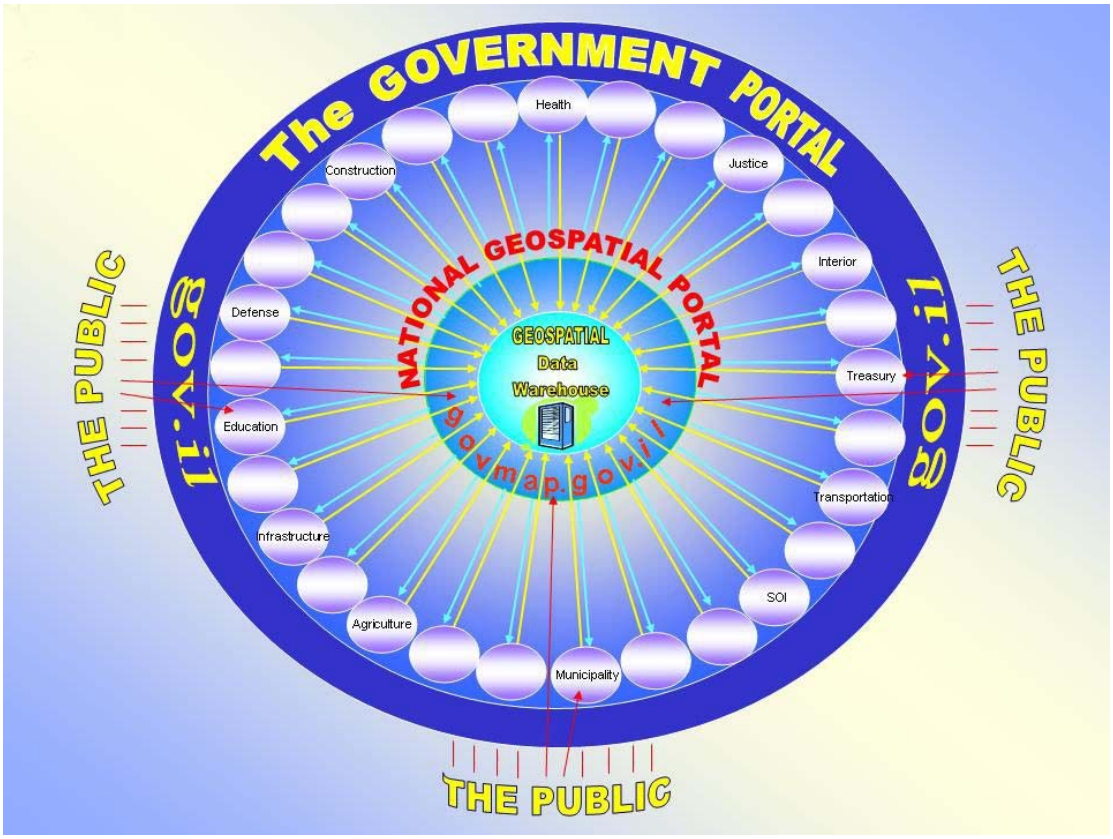


Figure 2: The Online Geospatial Configuration

Data Included in the Portal:

The core of the National Geospatial Portal is a Geospatial Data Warehouse that includes more than 120 layers of geospatial data collected by governmental organizations, thirty of which are from the SOI.

The Portal represents data with great variability and richness that enable the system to sort the layers under main topics and the user to extract relevant metadata. The portal is integrative and the data includes many topics, such as basic mapping (roads, buildings, addresses, orthophoto, contours, hydrology, institutes, various scales of raster topographic layers etc.), layers of cadastre and planning (blocks, plots, town plans, master plans, land reserves, etc.), tourist information (national resorts, national parks, hiking trails, forests, woods, parking areas, etc.), administrative boundaries, transportation, infrastructure, security and national emergencies. The portal enables simultaneous presentation of multiple layers of information, with high cartographic fit, linked to attribute information in various formats according to the spatial entities.

In addition, and based on the general data in the system, there are engines that enable links to other databases, that might give specific information in special operative applications in the future, for internal governmental usage.

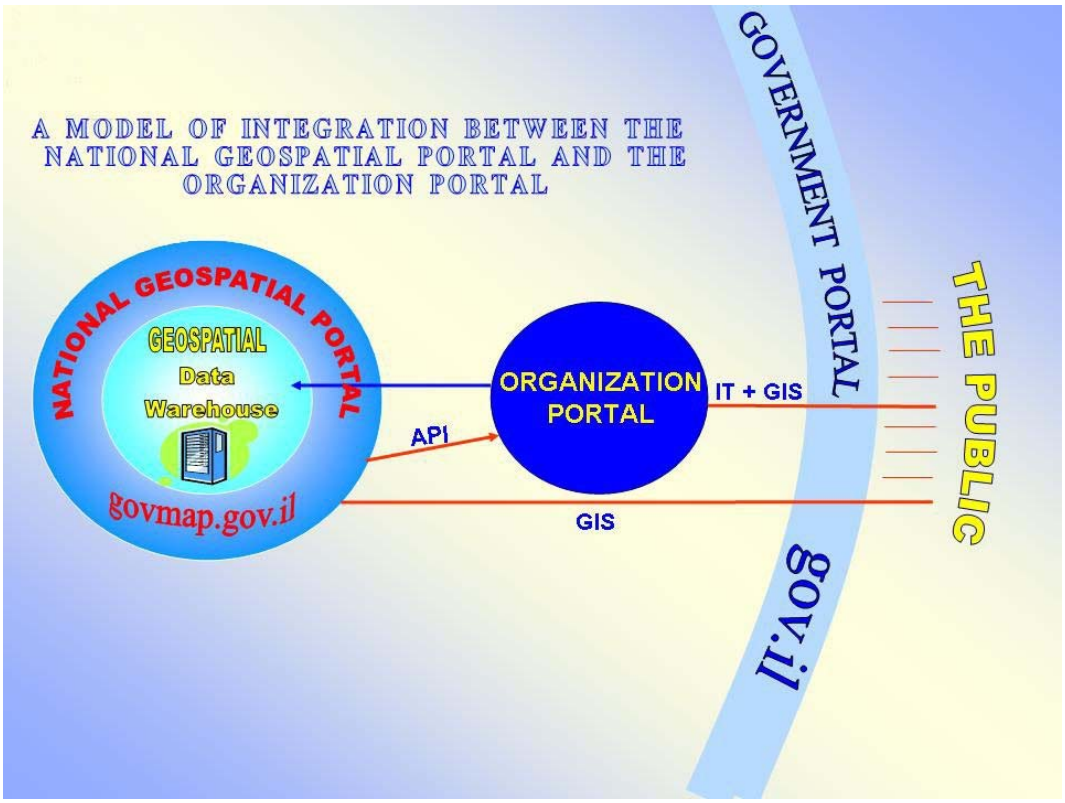


Fig. 3: A Model of Integration between the National Geospatial Portal and the Organization Portal

The Functionality of the Portal:

As mentioned above, the portal's concept allows its operation by any user, professional, or layman, from various disciplines. With this principle in mind the tools are divided into two sets: standard tools, which are presented on the main screen, and advanced tools that are not presented to unskilled users. In addition, the portal includes an external interface to other operation systems (general and flexible API with parameters). User interface allows simple as well as sophisticated modes of operation

The Metadata Component in the Geospatial Portal:

The metadata is an important component in the geospatial portal.

The development of the portal is progressing in accordance with the ripening of the Israeli national geographic metadata standard, as a component of the National GIS standards. These processes are taking place in SOI as a result of the activities of the

Inter-Agency Committee for SDI. The new metadata standard was approved and adopted by the committee.

The development of the metadata component is based on ISO 19115, and was constructed in a way that will enable its direct feeding to ARC CATALOG (An ESRI product), but will be observed (in Hebrew) similarly to other portal components on commonly used web computers/terminals.

All the information in the portal is accessible to the public, with no limitation or a need of passwords or permits. The metadata search engine of the portal can search through 400 layers of GIS of countrywide coverage, or of national interest, in spite of the fact that the information included in the portal includes only a quarter of these layers.

The rest of the layers are not ready for presentation for various reasons: homeland security, intellectual property, privacy and lack of updated data.

The Future Environment:

The Geospatial Portal is the main platform for the online services of the Survey of Israel to Governmental agencies, to the general public and to the professional community including private surveyors.

Additional on line channels will be used in order to augment the Geospatial portal. The goal is to supply within three years all the services on line. This will include:
- The use of the Active Permanent Stations.
- A direct access to the National Geodetic Data Base (NGDB) (see figure 4).
- An on-line communication with surveyors for the evaluation of surveys made by private surveyors.
- A direct access to the cadastral data base.
- An on-line communication with surveyors for the evaluation of mutation plans.
- A direct access to the National Archive of Maps and Aerial Photographs.
- A direct access to the cadastral GIS, to the topographic GIS, to a cartographic data base and to the geospatial data of the Survey of Israel and of other governmental and public organizations.

Figure 4 shows the Survey of Israel on-line data and services model.
Figure 5 shows the system Interface configuration describing schematically the relationship between the internal production environment and the external service environment.

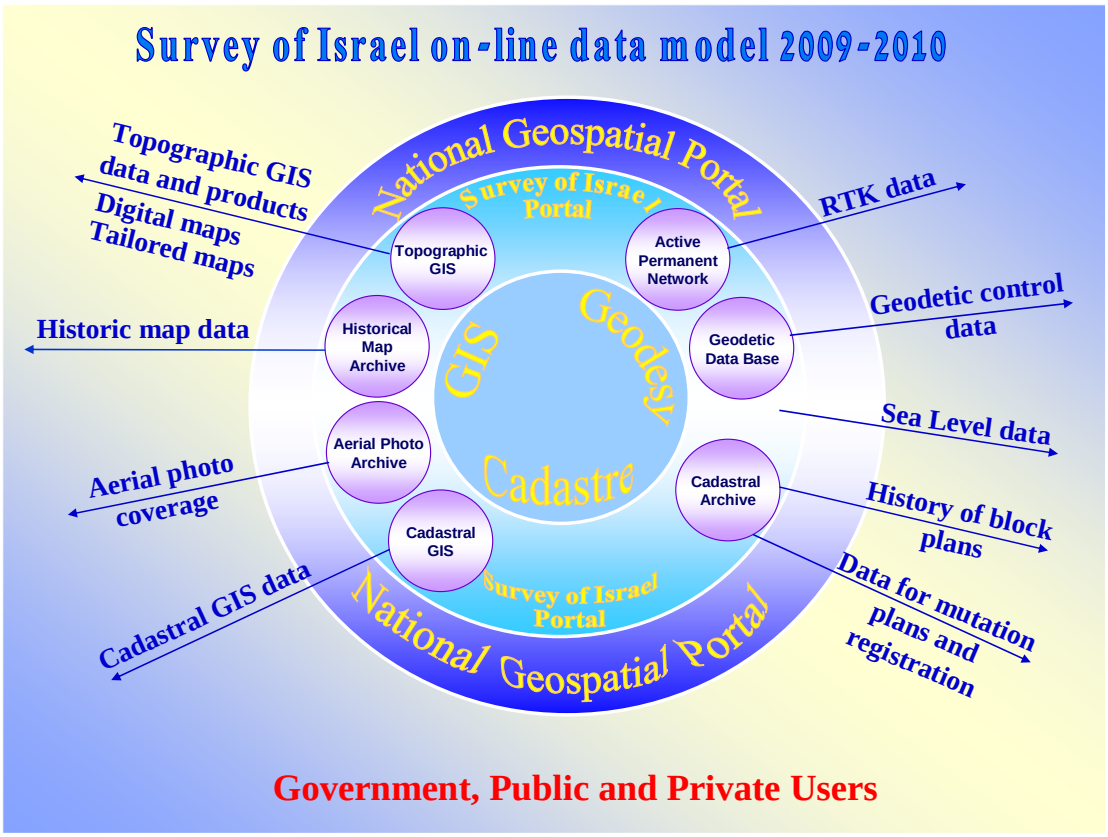


Figure 4: The Survey of Israel on-line data and services model.

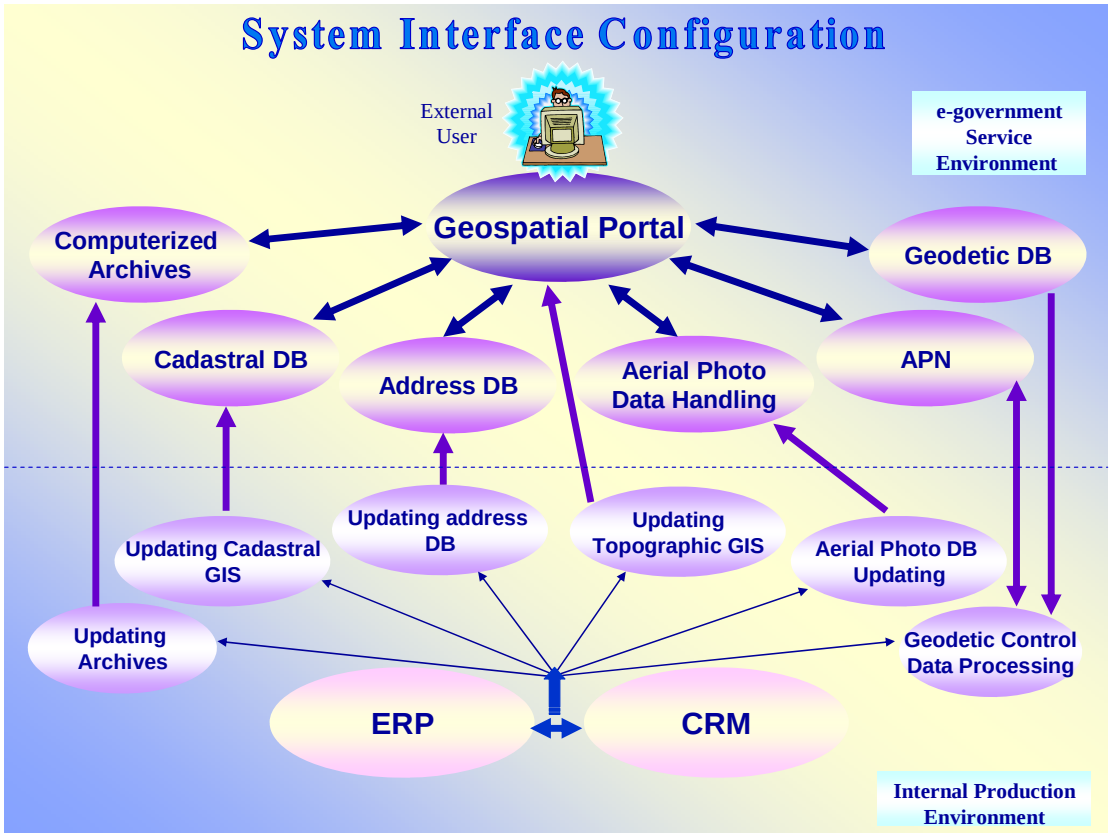


Figure 5: The relationship between the internal production environment and the external service environment.

CONCLUDING REMARKS

Following the current trend, the future of National Mapping Agencies will be based on online services both to the general public and to other government and public organizations. This refers to geodetic services based on satellite permanent stations (combining GPS, GLONASS and GALILEO) both for horizontal and vertical references. It refers to coordinate based cadastral framework, databases and computerized archives as well as supporting control of cadastral mutations based on the permanent stations. This refers also to geospatial databases including rectified imagery (either from aerial photographs, or satellite images), topographic data, addresses and more.

The data integrated in GIS should be accessible through the web, through geospatial portals, either free of charge, or selectively accessible due to security, or payment policies.

The geospatial data should be accessible to government agencies for integration with the IT infrastructure for integrated web services through web portals. A special attention should be paid to the use of geospatial information by portals of learning geography for the full range between kindergartens and university graduates.

These activities should be taken care of by partnership between the government and the private market. The government should define the vision, the goals, the specifications and supply budgets if necessary, while the private sector should be the contractors and sometimes also promote initiatives.

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CONTACT

Haim Srebro
Director General of the Survey of Israel.
Survey of Israel
1 lincoln st.
Tel-Aviv
ISRAEL
Tel. +972-3-6231901
Fax + 972-3-5610866
Email:haim@mapi.gov.il; Web site: www.mapi.gov.il