THE HUNGARIAN NATIONAL SPATIAL DATA INFRASTRUCTURE

Enikő KOVÁCS and Dr. Szabolcs MIHÁLY, Hungary

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1. INTRODUCTION

Throughout the world, Geoinformaton is being recognised as one of the most critical elements underpinning economic and social development as well as environmental management. This growing awareness has driven governments to assign resources to establish effective information infrastructures. Such information aim at encouraging spatial data sharing integration among different organisations, simultaneously avoiding the costly duplication of datasets.

In 1994 the Mapping Science Committee (USA), considering, that the major challenge over the next decades was to increase the use of spatially referenced data to support as wide variety of decisions at all level of society, conceptualised a National Spatial Data Infrastructure (NSDI). The proposed concept was: "the total ensemble of Geographical Information at our disposal that describes the arrangement and attributes of features and phenomena on the Earth as well as the materials, technology and people necessary to acquire, process, store and distribute such information to meet a variety of needs". The Mapping Science Committee defined that the infrastructure, in its broadest sense, also included the cultural, environmental, economic, political, legal and educational values and institutions that supported, facilitated and shaped its character, including the form in which spatial data were represented and utilised through society.

The Hungarian way to solve the basic governmental tasks in geoinformatics is presented in the paper: the status of elements of geoinformatics is overviewed, the status of a National Strategy for Geoinformatics in Hungary is presented and a plan to establish the National Spatial Data Infrastructure is given in the following paragraphs.

2. OVERVIEW OF THE ELEMENTS OF GEOINFORMATICS IN HUNGARY

During the past couple of years the map-based information systems became well-known and widely used in Hungary. The geographic information systems with most complex functionality and data content have been developed in the field of operating the public works, settlement administration, road registration, environmental protection, water management, statistical data service, but. development of countrywide geoinformation systems for the land management sector, territorial planning and tourism is also well under way.

The National Project for Geoinformatics performed between 1993-96 and co-ordinated by the National Committee of Technological Development proved to be a good catalyst and gave important progresses in GI industry in Hungary. Beyond its several other achievements the project supported consolidation of the GIS - developing companies, too. At the same time, the emerging of geoinformatics strongly affected the development of digital mapping, remote sensing, image processing and satellite positioning, therefore providing the basic framework one can built on in any GIS.

In Hungary, it was a significant step ahead, when the Resolution No. 13/1997 (X. 15.) of the Governmental Commission for Informatics and Telecommunication has been issued. The Resolution has recommended managing definite actions (programmes, projects) to provide basic framework data needed for creation of different GIS and has aimed to elaborate a National Strategy for Geoinformatics in Hungary (see chapter 3.).

As a consequence of the intensive development several professional and organisational problems raised. This statement is especially valid for the public administration which is one of the most important users of geoinformatics and which is especially sensible that its various sectors' development be well-balanced and co-ordinated. Recently, the experience accumulated up to now enables us to identify the major problems and to plan the opportunity of stepping forward.

To find solution as soon as possible for those problems is vital, because nowadays in the modern economic, cultural and political life, in public administration, the quick case management, careful service of customers, creating up-to-date information, their maintenance and servicing, professional and precise preparation of decisions, correct decision-making is unimaginable without using geoinformatic technology.

Components of the geoinformatic infrastructure are hardware, software, network, data, value-added products and services, human resources and skills, technical and legal regulation environment, education-training, technological development and the institutional-organisational background. The present overview is built up on these components.

2.1 Information Technology

The technological infrastructure of geoinformation systems — similarly to other information systems — is formed of hardware, software and network environment. Considering the environmental components, the map-based systems are differing from other information systems: they are using some kind of geoinformatic basic software as well. These basic software-types provide the most frequently used special geoinformatic functions in the systems.

Concerning the hardware, Hungary is a "recipient" country. Concerning the software, database management systems, graphical data management and display systems the leading geoinformatic software systems (e.g. ArcInfo, MapInfo) are all accessible and applied according to the international standards. for the Hungarian public administration. The achievements of the home development are all available, too.

The object-oriented approach, the relational DBMS, the multi-media, the 3-D and the opportunity of using the virtual reality are also property of the geoinformatic applications. Also the internet/intranet solutions are spreading more and more.

2.2 Data, Products, Services

Concerning spatial data, the most fundamental ones are the spatial framework data and that data which are used most generally. They are called basic geoinformation data. They represent the basic data-infrastructure which naturally includes the system of standards, regulations, and services. Based on world-wide agreement the elements of basic data-infrastructure are mostly the followings:

- Reference system and control network data,
- Cadastre,
- Aerial photos, orthophotos,
- Administrative boundaries,
- Relief, terrain relations,
- Traffic network,
- Hydrography,
- Landcover and its subsystems,
- Population, census,
- Environmental protection,
- Geology.

2.2.1 Framework Basic Data Infrastructure

The framework of basic data infrastructure contains the reference system and the geodetic control network, also the cadastral and topographic base maps. The family of airphotographs and satellite images belong here, too.

Concerning the reference systems, forming the basis of the countrywide space-related data infrastructure and technical-measuring systems: the reference system data and the basic control networks are existing and convenient in use, they are accessible through servicing, also in on-line mode (horizontal and vertical geodetic controls, controls of the National GPS Network, integrated into European reference systems). However, their product-profile and prices have not been calculated in a way that would stimulate their use.

The administrative boundary data are available in the service in such packaging that is acceptable for users: administrative boundaries in single form or integrated into more complex products, for a price that follows the market, separated the geometric data and their identifiers.

The whole area of Hungary is covered by analog cadastral basic maps in scale 1:1000, 1:2000, 1:4000 depending on data density. Approximately 40% of the rural area cadastral maps are in digital form as a consequence of the compensation act 10 years ago. However their formats are not regular, inhomogenous. Some 7% of Hungary is covered by digital cadastral maps produced in the frame of so called National Cadastre Program and with data content and format defined by a new Hungarian digital map

standard MSz 7772-1:1997 harmonised with CEN and ISO GI standards. Recently, an IT development of the Hungarian land offices has been finished providing their computerisation (called TAKAROS system) and connecting them with a nation-wide intranet (called TAKARNET).

As basic data, the digital topographic map at scales of 1:50 000 and 1:100 000 is serviceable, together with the related digital terrain models and various datasets, representing the traditional data acquisition methods. The 1:10 000 scale topographic maps are under digitalisation. Recently a Hungarian Topographic Program is under acceptation to carry out modernisation of digital topographic datasets.

The following tasks are partly ready and partly under way as supported by the Acquis National Program (EU-harmonisation program) of the Ministry of Agriculture and Regional Development:

- Digital conversion of the relief of topographic base map at scale 1:10 000 of Hungary prepared in the Uniform National Mapping System of Hungary,
- Taking aerial photographs of the whole country in one phase at scale of 1:30 000, resulting colour aerial photographs, preparation of digital datasets from them, producing also orthophotos.

Further themes, traffic-network, hydrography, land cover etc. can expect wider use, in connection with the visible environment. For revising them, the preparation and servicing of an orthophotographic standard set of data is representing the first imperative development element of the infrastructure. This is the first module of the Hungarian Topographic Programme at the same time. This module had to be started as an independent one, considering the relatively homogeneous datasets to be acquired, the refined processing techniques, and the explosion-like progress of internet-services and, the urging application development requirements. As a result of extensive discussions of the home professionals, an agreement was born concerning the digital topographic map standard (MSz 7772-2:2000), the data content and way of servicing. This agreed solution is decisive, when developing this element of infrastructure.

Owners for framework basic data are:

- Institute of Geodesy, Cartogtraphy and Remote Sensing (FÖMI): reference system, geodetic control network, topographic maps, aerial photographs, satellite imageries, analog cadastral maps
- Mapping Office of the Hungarian Army (MH TÉHI): 1:50000 scale topographic maps (analog and digital)
- National Cadastre Program Non-profit Co.: digital cadastral maps in standardized form.

The best known framework basic data infrastructure collected by Central Office of Statistics of Hungary is MATÉRIA, which was ready in 1993, updated yearly since then. This can be used in PC Mapinfo environment, and is figuring in the product list of the Firm MapInfo. Its basis is a digital map at scale 1:500 000, which contains administrative boundaries, objects of road and railway networks and hydrography etc., its alphanumeric data according settlements include the Population Census data, address lists of mayors etc.

2.2.2 Thematic Basic Data Infrastructure

Nowadays, there are numerous databases of the thematic basic data infrastructure. A list without aiming at completeness:

- TeIR database as a Territorial Information System for all over of Hungary (owner: VÁTI, a settlement planning institution)
- Budapest Base Map in 1:25 000 scale (owner: Topolisz Ltd.)
- Population Census Data of Hungary (owner: KSH, Central Statistical Office)
- Digital geological maps (Zala County Complex Database, Minor Plain Database, Paks Atomic Energy Plant Geological Database, Geology of Budapest, Uniform Geological Digital Database, River Danube Geological Database), (owner: MÁFI, a Hungarian State Geological institute)
- Soil Scientific Database of Hungary (owner: TAKI, a Soil research institute)
- Settlement Addresses Database (owner: Geogroup Infograph Ltd.)
- OTAB as a 1:200 000 scale digital geographical map database (owner: Geometria Ltd.)
- Budapest-4000 database (owner: Infograph Ltd.)
- Budapest CD Atlas (owner: Cartographia Ltd.)
- HALIS database of the Budapest water supply (owner: Budapest Water Works Company)
- Database for Optical Backbone Network of Hungary (owner: MATÁV)
- KIR and KÖFIR electric supply database (owner: Budapest Electric Works Company)
- TIGÁZ database on gas supply
- Voting District Database (owner: the Gallup Institute)
- Environmental Protection Sample District of the Lake Balaton and the Hortobágy
- Local Government Managing and Geoinformation systems for the settlement Zugló, Szombathely, Debrecen, Hajdúszoboszló, Nyíregyháza, Pilis, Orosháza, Szeged, Pécs
- Budapest Green Area Cadaster.

2.2.3 Metadata

The importance of Metadata —which puts datasets "on show" in the shop window. — was recognised very early in Hungary. Metadata describe all important features of the dataset. The user can have all necessary information for decision-making concerning the possible use of the dataset.

In Hungary, the following metadata are available:

- FISH metadata — prepared in the Institute of Geodesy, Cartography and Remote Sensing (FÖMI) — contains metadata on geodetic control networks, reference system, cadastral maps, topographic maps, coverage by aerial photographs and satellite imageries, institutional data for the institutional network of the state lands and mapping agency of Hungary
- METATÉR comprising metadata —coordinated by the Prime Minister's Office— collects metadata of several institutions (e.g. framework basic data, territorial information system data, geological thematic basic data).

- At the Prime Minister's Office, the building up of the metadatabase called KIKERES (Search) for public administration is under way.

2.3 Human Resources

During the past 10-15 years of geoinformatics, a wide group of professionals has been formed, who possess significant knowledge on software, being data owners or data users, partly on the urging effect of the spreading geoinformatics, partly supported by the international practice and the continuously developing geoinformatic education/training.

2.4 Technical and Legal Standardisation

Concerning legal background of GIS, the most important is the Act LVXXVI/1996 on surveying and mapping activity and the related Ministerial decrees. The status of the copyright of intellectual products is still to be revised. Legal protection of the databases of maps and the related mapping data are to be solved in an EU-conform way. The Hungarian GIS umbrella-organisation, HUNAGI, co-operating with the Hungarian Union for Industrial Right Protection have elaborated an action programme with the participation of the Department of Lands and Mapping of the Ministry of Agriculture and Regional Development, the Mapping Office of the Hungarian Army and the HUNGIS Foundation. The action programme was produced considering the surveying results in EU member countries and recommendations made by the corresponding European organisations (DG XIII LAB, EUROGI and CERCO).

In Hungary, within the framework of the Hungarian Standardisation Board, a Technical Committee on GIS Standardization started to work in 1994. Thanks partly to this, the Institute of Geodesy, Cartography and Remote Sensing (FÖMI) was able to start its standardisation activity, followed soon by the progressive part of professionals. This activity has been parallel with CEN TC287 and also with ISO TC11. The National Office of Technological Development, the Ministry of Agriculture and Regional Development and also Ministry of Defence have efficiently supported these efforts.

As a result of the standardisation activity, the following documents were elaborated:

- MSZK 1066;1996, General requirements on military digital topographic maps,
- MSZ7771:1997, Hungarian GIS data exchange standard,
- MSZ7772-1:1997, Conceptual model of the digital base map,
- MSZ7772-2:2000, Definition of digital topographic database.

The regulation system of digital base maps was built on the standard No. MSZ 7772-1:1997, publicly called DAT standard, namely:

a) DAT1 regulation: Planning, production, quality control and state acceptance of digital base maps, including also the
   - Supplement DAT1-M1: Structure, data exchange and management of databases
   - Supplement DAT1-M2: Digital legend
   - Supplement DAT1-M3: Software for checking the internal consistence

b) DAT2 regulation: Digital transformation, including also the

- Supplement DAT2-M1: Projection transformations.

Recently, the Hungarian Standardisation Board has been working on the adaptation of GIS pre-standards, (which belong to the so-called structural standards category) prepared by CEN TC287 on GIS.

2.5 Education

High-level educational and developing activity is going on in several Universities of Hungary: Budapest Technical University, Debrecen Agricultural University, Szeged University of Science, Gödöllő Agricultural University, Sopron University and its Székesfehérvár College for Land Surveying and Land Management. The preparedness of the lecturers is generally well known. The educational institutions are provided with hardware and software on a relatively good level. They teach geoinformatics in the secondary schools as well, and moreover, trials were made to integrate this discipline into the primary level education.

2.6. Institutional and Organisational Background

Professional supervision and place in the state budget of the state-financed GIS players shows a colourful picture. The Institute of Geodesy, Cartography and Remote Sensing (FÖMI) together with the land office network (115 districts land offices, 19 county land offices and that of Budapest and its districts), and also the National Cadastre Programme Non-Profit Co. funded from a state-guaranteed credit have been operating under the auspices of the Department of Lands and Mapping of the Ministry of Agriculture and Regional Development. The Mapping Office of the Hungarian Army is financed from the budget of the Ministry of Defence, but professional supervision is provided by the Chief of Staff of the Hungarian Army.

Significant data owners are the Hungarian State Geological Institute and the Eötvös Loránd Institute of Geophysics, which - under the umbrella of the Hungarian Geological Service - both belong to the Ministry of Industry, Commerce and Tourism. The Ministry of Agriculture and Regional Development finances VÁTI Non-profit Company. Some supporting institutions behind certain ministries are thematic basic data owners at the same time (e.g. Environment Management Institute, State Road Technical Information Centre Non-Profit Co., National Water Management Office, Hungarian Office for Mining). The local governments, administration are partly belonging to and partly financed by the Ministry of Inner Affairs. All these make the data management, the development of data market, the elaboration of adequate regulations very difficult but also urge them.

The National Office of Technological Development (and its successor) and the Prime Minister's Office have been playing significant role in geoinformatics for a long period in Hungary.

At the beginning of the 90s, when the traditional land surveying, mapping and the new discipline of informatics found each other, common conferences were organised and professional periodicals started, for instance (among others):

- The monthly Térinformatika (Geoinformatics) started in 1988, accompanied by an Annual Source Book of Hungarian Geoinformatics, in one year in Hungarian, in the other in English,
- From 1991 annually National Conference on Geoinformatics has yearly been organised in city of Szolnok, first for local governments, but soon became a national geoinformatic conference,
- From 1992 on, a conference on "Geoinformatics in Higher Education" has been organised jointly by HUNGIS Foundation and the Department for Landscape Planning of the University of Food Industry. It is an annual meeting not only for lecturers of geoinformatics in higher education, but also for teachers in middle and basic level. In addition to the issues of education, the recent professional achievements are shown, and the results of the competition for the best thesis, invited by HUNGIS Foundation are announced.
- The HUNGIS Foundation plays the significant role of the organiser in the Hungarian geoinformatic forum.

Apart from the textbooks published for the education, professional books have also been published in the topic of geoinformatics:

- Detrekői, Á. - Szabó, Gy. - Introductory to Geoinformatics, Budapest, 1995, 2997, 1998.
- Kollányi, L. - Prajczer, T.: Geoinformatics in Practice, Budapest, 1995.
- Kertész, Á.: Geoinformatics and its applications, 1997.

All three volumes of National Center for Geographic Information and Analysis (NCGIA) Core Curriculum, used as textbook in general, being the most popular handbook on geoinformatics was published in Hungarian in 1994, and was supplemented with a fourth volume especially adapted to the Hungarian situation.

3. NATIONAL SPATIAL DATA STRATEGY (NSDS) IN HUNGARY

An action plan for a Hungarian Spatial Data Infrastructure and the National Information Strategy has been discussed by experts for the Government for several years. The Prime Minister’s Office in the Hungarian government has decided to pursue the formulation of an Information Society action plan and a National Spatial Data Strategy. The Resolution No. (13/1997. (X.15.) of the Governmental Commission for Informatics and Telecommunication prescribed the elaboration of a comprehensive National Spatial Data Strategy. According to the Resolution, the Secretary of Public Administration of the Prime Minister's Office was responsible for that, involving the corresponding ministers and leaders of national institutions. The deadline was June 30, 1998.

The reason for developing the National Spatial Data Strategy was — among others — that the gathering of mapping data is costly. Therefore the organizations that share similar requirements for commonly needed data in the special discipline areas of surveying, photogrammetry, global positioning systems, and remote sensing have to develop plans that accommodate joint development and maintenance programs.

In addition, the wider distribution and use of spatial data in geographic information systems and related technologies requires the development and use of standards derived

through effective strategies. It also requires the application of map-based information systems professional skills and related knowledge.

The cost effective implementation of the NSDS and use of this advanced technology is important to support the widest possible dissemination of map-based data in the government administrations and other areas of the society.

The preparation of the NSDS has been divided into five phases:

- elaboration of the concept of the National Geoinformatic Strategy,
- surveying the current situation both on national and international level,
- specifying the requirements,
- starting from the current situation, consider the newly formed mission statement for elaborating the potential ways of development and variants of strategy,
- After decision making: elaboration of the action plan in details.

The participants, who elaborated the concept of NGS, preliminarily studied also the National Informatics Strategy (NIS) that was prepared in 1994/95 as the government strategy for the realisation of the information society. Accordingly, the following projects and the respective preliminary studies have been completed:

- The first study focused on the macro-economic relationships. It investigated the impacts and anticipated benefits for the general administration and the private sector generated by investments in the spatial data infrastructure and use of service. Special emphasis was given to the issue of effectiveness based on investigation of larger spatial data application projects to clarify the National Spatial Data Infrastructure (NSDI). measures and actions needed to meet the requirements of the European Union and NATO accessions based. A detailed review of national spatial data strategies and infrastructures of the USA, EU, UK, and the Netherlands was conducted in this study.
- The second study analysed the legal issues related to mapping data and map-based information with the objective to localise the legal barriers that are partly based on relevant international legal practices.
- The third study investigated the regulation issues. The investigations included the data gathering, mandatory and optional tasks of the central government, the role of the local administrations in the establishment of the NSDI, and in the area of research and development. Recommendations resulting from this study identify: ways to share tasks and responsibilities between the main market players; ways to strengthen public private partnership (including outsourcing); tools and organisational actions that are needed to achieve better performance through co-ordination.
- The fourth study investigated spatial data management issues concerning base data sets, their production, quality, maintenance, scheduling, and financial resources needed. Further investigations included spatial data accessibility, establishment of metadata services, applicable pricing policy and the economic interests of the data owner(s).
- The fifth study targeted quality-assurance and related standards. Approved international practices and standardisation efforts of European and global organisations such as CEN, ISO and the Open GIS Consortium were analysed.
- The sixth study emphasised the marketing and public relation issues, inevitable for widening the dissemination of the spatial data and related services. The

objectives to be achieved were described as follow: raising awareness, popularisation of the use of this technology as well as the development of more user-friendly and market-oriented systems, services and products.

These studies provided in-depth investigation on the present stage in Hungary and provided analyses on best practices at the international level. The goals to be achieved and alternatives for the applicable tools and methods for the NSDS have been recommended in a strategic document.

The strategic document contains a balanced system of objectives and corresponding actions that are fully in line with the implementations of the Information Society plan. The document contains 12 strategies and 50 specific tasks to be implemented in the years leading to the planned date of the EU accession.

The document includes recommendations concerning organizational/institutional measures, tasks related to the strengthening of national, regional and global spatial data infrastructure and activities related to the needs of the EU and NATO integration.

The NSDS offers a unified structure for spatial data infrastructure based projects that are being planned, are defined, or are already implemented, such as the following:

- National Cadastre Program
- National Topographic Program
- Aerial Survey of Hungary
- Unified, geo-referenced address registry, a solution to provide interoperability between different address based public inventories and services
- A multipurpose Parcel-based Information System primarily devoted to support agricultural, environmental and rural development related subsidies such as the integrated administrative and control system of the EU's Common Agricultural Policy.

4. TOWARDS THE HUNGARIAN NATIONAL SPATIAL DATA INFRASTRUCTURE (NSDI)

The elaboration of the Government's National Spatial Data Strategy collected the professionals in the interests of preparing documents for making government-level decision. The preliminary studies are already finished, the proposals for submission to the Government are partly ready. Various tasks are still waiting for solution:

- finalization of preparation of the NSDS
- preparation of nation-wide technical plan of NSDI, data policy concept, financing concept, institutional reorganisation
- recommendation on overall regulation providing the effective operation of NSDI.

The solution of the above tasks have been taken by the Geoinformatics Sub-Commission formed within the Geodetic Scientific Commission of the Hungarian Academy of Sciences. The Sub-Commission is expected to submit the documents and recommendations on the NSDI to the Government through the President of the Academy, co-operating with the ministries, the Prime Minister's Office and the respective governmental committees. The Geoinformatics Sub-Commission has

prepared its work plan and selected its members in accordance of and considering the above mentioned tasks waiting for solution.

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BIOGRAPHICAL NOTE

Enikő Kovács
Academic experience*:* MSc. in Civil Engineering, MSc. In Automatisation of Geodesy (Technical University of Budapest, 1970, 1976)
Practical experience: land surveying, participation in numerous national and international R+D projects,

Szabolcs Mihály
Academic experience: Dipl. Photogrammeter-Surveyor (Institute of Geodesy, Aerial Surveying and Cartography, Moscow, 1967), Doctor Tech. (Budapest Technical University, 1982), Ph.D. degree (Hungarian Academy of Sciences, 1981).
Practical experience: Satellite geodetic techniques and GPS, elaboration of satellite geodetic adjustment software systems, elaboration and nationwide harmonisation of the Hungarian "Digital Base Map" standard and "Digital Topographic Map Database" standard, coordination and successful realisation of numerous national and international R+D project, database modelling, National Spatial Data Infrastructure, coordinate system transformation.
Publications: lecture notes, monographs, more than 90 papers published in proceedings and registered journals, similar amount of internal reports, a big part of it on GIS and digital cadastre.
Recent membership: Geodetic Scientific Committee of HAS (subcommission chairman), Chairman of GI Standards' WG of Hungarian Office of Standards, Hungarian Representative to Eurogeographics, Hungarian representative to FIG Commission 3.
Recent position: Director, Institute of Geodesy, Cartography and Remote Sensing, Hungary.

CONTACT

Enikő Kovács and Szabolcs Mihály
Institute of Geodesy, Cartography and Remote Sensing, Hungary
Bosnyák tér 5.
H-1149 Budapest
HUNGARY
Tel. + 36 1 222 5111
Fax +36 1 222 5112
Email: eniko.kovacs@fomigate.fomi.hu
Email: szabo@fomigate.fomi.hu