Abstract of PhD thesis

INFORMATION AND GEOINFORMATION SYSTEMS USED IN HAJDÚ-BIHAR COUNTY FOR MANAGING REGIONAL DEVELOPMENT TASKS

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1. THE THESIS: ANTECEDENTS AND OBJECTIVES

ANTECEDENTS, JUSTIFICATION OF THE SUBJECT

Regional development is primarily expected to create an ideal system and structure of relationships within the domestic spatial structure and to meet the sustainability criteria. A key objective of regional and urban development is to enable each citizen to maintain the values of their domicile or to create new values by harnessing their own resources. The purpose and orientation of the development efforts are determined by the target area and the demand of the local inhabitants. The top-to-bottom principle of development can usefully and suitably be applied in many cases, however, the way the local inhabitants perceive their problems and express their needs plays a key role in regional development. Only decisions made with due regard to development priorities and confirmed also by the local communities can be implemented successfully. Obviously, the same concept applies also to decisions made at the level of the cities, special-purpose regions, counties, regions and countrywide. According to a fact recognized by the decision-makers and confirmed in numerous cases since the year of millennium, almost every information needed to make decisions has had spatial relevance of some sort. The use of GIS (Geographic Information System) devices has become an indispensable tool in organizations that rely on advanced methods of regional development and public administration. At the regional level, a town/municipality and its neighbors located within a shorter or larger distance constitute a special-purpose region or a county or a region. Certain tasks can obviously be completed only after having understood and mutually acknowledged the system of relationships that evolves in such neighborhoods. Evaluation of the broader perspectives (macro-level approach) and their comparison to the local interests (micro-level approach) is an indispensable prerequisite in the course of making any prudent decision. Modeling of the existing parameters and development potentials of certain settlements in terms of physical geography, human geography, economy or environment protection and urban development furthermore conversion of the settlements' urban development plans into map images has become an inconceivable task without the use of advanced GIS systems. GIS is expected to manage information available regarding the spatial position of a specific object or event (including any related information and relationship) and, in consequence, to offer new opportunities for the investigation of the problems and for tackling the tasks at hand. The use of this tool supports the well-founded and innovative completion of tasks in the most diverse fields of life, with specific regard to issues related to regional development, urban planning, operation of municipal facilities, functioning of authorities, etc.

OBJECTIVES

In the course of examining and researching into three application environments interpreted at different levels of public administration, I decided to focus on the following issues:

- Research into application opportunities of GIS in urban planning. I will use cases chosen from among applications implemented locally or in settlements in order to develop a viable environment and methodology for the GIS supported processing of urban rehabilitation plans. A practical example shall be provided to present the functions of the GIS system developed by me to facilitate the daily utilization of urban regulation plans.
- Identification of a theoretical and practical model for the GIS support of certain election-related tasks. I will present possibilities for shaping the boundaries of constituencies, relying on a GIS application developed and tailored by me to being used primarily in towns of more than 10,000 inhabitants.
- I will explore a yet unpracticed combination of GIS and regional development. I develop the potentially implementable functions of a GIS system suitable for modeling, at the level of counties, the problems perceived and the development tendencies demanded by the citizens.

I consistently endeavored to improve comprehension of the processes and the use of GIS tools needed to facilitate such comprehension. I attempted to reconcile the scientific approaches applicable to the processes, methods and programs developed to accomplish my objectives with all the aspects underlying their practical utilization.

In the course of accomplishing my primary objective (i.e. providing GIS support to urban rehabilitation tasks), I expended particular care in developing theoretical processes and methodology. In respect to the two areas of secondary importance, I focused on ways of practical implementation, relying on the experience gathered and results achieved responding to the first set of problems.

Each segment of the processed issues represents a separate and independent set of problems. He objectives, background and degree of justification of their processing is different and they are interconnected by the integrating capacity of the Geographic Information System.

2. RESEARCH METHODS

2.1 URBAN REHABILITATION – GIS SUPPORT PROVIDED TO THE COMPLETION OF TELEPÜLÉSRENDEZÉSI TASKS

I chose the case of Balmazújváros from the history of development of 12 towns of Hajdú-Bihar County as to examine possibilities of practical use of Geographic Information System for the benefit of processes of urban rehabilitation and urban regulation governed by the Municipality.

The following steps of GIS-supported tasks can be distinguished in the comprehensive process of preparation of the urban rehabilitation plans:

- preparation of maps for digital planning
- structuring of GIS database
- preparation of mapping components of surveying
- preparation of mapping components of structural plans
- preparation of mapping components of urban regulation plans
- development of user program(s).

In order to put the planning process into a broader context, the first step of data processing involved mapping of the various phases of preparation, designing, reviewing, reconciliation and approval of the plans and the settlement's local construction regulations furthermore visualizing of the same phases in a consistently structured process chart.
This method and the process model enabled me to analyze (irrespective of the available to tools) and arrange in a methodical system both the urban rehabilitation plans and the data relevant to the local construction regulations furthermore I could create the GIS-supported data base.

2.1.1 Initial database

Initial data used for processing:
Description: Balmazújváros downtown, cadastral map
Number of sections involved: 159
Description: Balmazújváros downtown, cadastral map
Number of sections involved: 39
Description: Balmazújváros, outskirts, cadastral map
Number of sections involved: 42
Description: Balmazújváros downtown, cadastral map

Number of sections involved: 5
Description: Balmazújváros outskirts, cadastral map
Number of sections involved: 14

2.1.2 The software environment

I created and applied different sets of criteria regarding the system of GIS tools which play some role in data processing and those used to ensure the user interface.

The system of software used to support the data processing must meet the following requirements:

- fast and reliable management of data in great quantities,
- full-scale support provided to the geo-relational data model, as default function,
- handling of own and external databases (in addition to the basic function of spreadsheet processing),
- safe and reliable handling of both raster and vector data,
- possibility of similarity, polynomial, affinity-based and projective transformation,
- support provided to the preparations of network-related applications,
- possibility of development of specific applications,
- ability to integrate all work processes into a single and consistent system,
- possibility for recognizing the data format of each widely-known and prevailing GIS software
- fault-tolerant and highly reliable design.

After having deliberated the viability of several GIS software products, the data were processed (incl. data collection, database structuring and data integration) in an ESRI ArcInfo environment (the software is owned by HBMÖ.IK). The software integrates the cartographic and expressly GIS-related functions and supports the solution of every GIS-related problem previously defined among the "Objectives" (e.g. data integration and processing, topology structuring). This is a basic GIS system considered a "quasi-standard" in the relevant EU system. I chose the ArcInfo 7.1.1 system as an aid best suited to supporting my development efforts. The ArcInfo GRID module was used to analyze and process the raster data. The tasks related to data collection were carried out in ArcInfo's ArcScan module. The version number of the supplemental modules is always identical with the version number of the main module.

Since ESRI ArcView 3.1 combines the various functions of ArcInfo's inquiry and editing module (ArcEdit), display module (ArcPlot) and its most important database management module (INFO), it was chosen as the tool for designing the user interface (the software is owned by HBMÖ.IK). I used ESRI ArcView 3.1 also for data inquiry, for verifying the edited printing preview of the databases and for completing the printing jobs, as well. For the most part, adequacy of such choice was verified by the following aspects and factors:

- user-friendly UserInterface, already in case of the out-of-the-box software,
- availability of localization, also in the Hungarian language
- availability of integrated script-language, to support fast development of applications (Avenue)
- possibility to get connected to the MS basic software (Windows XP). (DLL - dynamic-link library, DDE - Dynamic Data Exchange).
- cost-efficiency,
- optional possibilities for network operation (limited),
- opportunities for concurrent utilization (limited file-locking),
- possibility for operation in ASP environment.

I applied the same software environment to unfold and explore each of the three themes.

2.1.3 Processing methodology

The developed and applied method was expected to meet the following requirements:

- reduction of the demand for manual (digitizing) work to the minimum,
- support provided to the development of a similar GIS system in case of either Hungarian settlement.

In contrast to the conventional method (generally started by manual digitizing of the input data using some of the CAD-based systems), I opted for the use of a different approach. I completed all the necessary processes within a single system, by integrating them in the same GIS environment, in order to reduce the number of the possible processing errors. Furthermore, I favored this choice to other options because I expected the integration of the processes to facilitate the subsequent correction of the errors and the updating of the process results.

The processing method was completed by pursuing the following steps:

- scanning
- vectorization (in semi-automatic mode, supervised by the user)
- collection of attribute data elements
- development of a geo-relational daabase
- data integration – processing of GIS data of downtown areas
- data integration – processing of GIS data of outskirts
- development of user interface.

2.2 ELECTION RELATED TASKS – SUPPORT TO SHAPING THE CONSTITUTENCY BOUNDARIE

2.2.1 Purpose and antecedents of data processing

I focused my development efforts to the development of a GIS tool capable of maximum utilization of the available scope of action, with due regard to the regulatory environment created to define the rules of the public election procedures.

As to achieve this objective, I surveyed the list of tasks related to registration of personal data and addresses of domicile and decided to examine the possibilities available for providing support to or creating a new foundation for the improved shaping of constituency boundaries.

2.2.2 Initial database

I chose the task of developing a GIS application which complies with the provisions of Act LXIV of 1990 (on the election of mayors and local government representatives) and is capable of providing GIS support to shaping the constituency boundaries prior to the election of mayors and municipality representatives, primarily in towns and other settlements of population exceeding 10,000 inhabitants. Debrecen, a town vested with rights due to an entire county, was chosen as target area, due its population, geographic location and the dominant role it has played in the society, economy and the political life of the region.

The sets of data and information available at the beginning of this project were classified as described below.

Geometric data used as basis for data processing:

Description: digital base map of the town of Debrecen
Volume: database designed to cover 100 % of the area involved in the task
Description: town of Debrecen, set of data made to illustrate the axis of the roads/streets
Volume: database designed to cover 100 % of the area involved in the task

Attributive data used as basis of data processing:

Description: structured cutout chosen from the register of personal data and address of domicile
Volume: database designed to cover 100 % of the area involved in the task

2.2.3 Method of data processing

2.2.3.1 Initial facts and data that influence the method of GIS-based data processing and model structuring

My objective was to develop a GIS application which complies with the provisions of Act LXIV of 1990 (on the election of mayors and local government representatives) and is capable of providing GIS support to shaping the boundaries of the territorial individual constituencies and polling districts.

- The process of dividing the area into districts should be supported by providing appropriate GIS methods while maintaining the advantages of the present method of districtizing based on the use of characters and intervals.
- The addresses relevant for the shaping the polling district boundaries must be broken down by details like individual staircases in the apartment buildings. In principle,it can happen that two staircases in a ten-storey apartment house belong to two different polling districts.
- The boundary of a territorial individual constituency marks, in every case, the boundary of a polling district.
- The boundary of the territorial individual constituencies is adjusted to the natural boundaries, like a street axle, the boundary of a downtown area, the public administration boundary of a settlement.
- Failing a natural boundary or a boundary of a block of houses or a suburban district, the boundary of the respective constituency or polling district can not be identified objectively.

- The polygons that mark the area of the territorial individual constituencies completely fill the settlement's public administration area, leaving no gap.
- The polygons that mark the area of the polling districts completely fill the settlement's public administration area, leaving no gap.
- Each polling district is located within the boundaries of an individual constituency. The boundary of an individual constituency marks, in every case, the boundary of a polling district.
- Any modification of the boundary of the territorial individual constituency entails modification of the boundary of the polling districts within that constituency.
- The modification of a polling district necessarily entails modification of the individual constituency that comprises the polling district concerned.
- The database containing the citizens' personal data and address of domicile (SZL) must be considered the root database.
- The functions to be developed make no effect on personal data.

2.3 REGIONAL DEVELOPEMENT – SPATIAL PATTERN OF COUNTY LEVEL

The scope of tasks, responsibility and institutions of the counties (basic public administration entities in Hungary) has considerably changed during the past few decades. The intensity of such changes gained an additional impetus after 2000 and none of the 19 counties can avoid being exposed to the consequences. Also the decision-makers of Hajdú-Bihar County had to undergo substantial alteration of their views and approaches, in order to support sustainable development of the county. In addition to other miscellaneous tasks, the concept of operating a "service provider" county comprises the task of coordination of the territorial/regional development concepts and local plans and expectations adopted by the individual settlements.

The success of such coordination can result in the implementation of many tender and development objectives which reflect the real constraints faced by the settlements and the problems the citizens encounter and try to tackle in their everyday life.

It was crucial that the tender documents published to invite the county and its individual settlements and the development concepts and ideas submitted to react to such invitations be structured as priority lists and development models that are proportionate with the available resources and ensure their optimum utilization.

It was similarly important that the IT application intended to meet objectives of prioritization, displaying, inquiring and classification of key issues and notification of the senior executives be capable of collecting development ideas built on the local needs sensed and indicated by the individual settlements.

The spatial position of the relevant data and their thematic displaying in connection with the various groups of settlements was indicated using a proper GIS application.

The database and application were expected to meet the following functions:

- facilitation of identification of development priorities, concepts and directions,
- reconciliation of the local, subregional and county-level development directions with the regional and national concepts,
- collection of regionally identified problems and priority lists,
- displaying of the data's spatial distribution patterns, broken down to settlements, special-purpose regions and the county as a whole,
- Submittal of proposals, preparation of analyses, reports needed to support optimum allocation of resources,
- Comparison of the indicated problems with statistical data arranged in time series, using comprehensive reference databases.

Geometric data used as basis for data processing:

Description: boundary lines of settlements of Hajdú-Bihar County

Processed attributive data:

Description: data of perceived problems/deficiencies
Description: Statistical data of the county and the region
Description: Unemployment data
Description: Personal Income Tax data
Description: System of regional statistical data
Description: Selected corporate tax revenue returns
Description: General Agricultural Census (ÁMÖ 2000)
Description: Selected data from municipality statistics
Description: Key ratios/indices representing projects financed by the Municipality
Description: Key ratios taken from Municipality Balance Sheets

2.3.1 Method of data processing

The work phases were arranged according to the following order: accurate specification of the data collection method, modeling of the related processes, database structuring and development of application (**see Table 1).** The most important part of development consisted of the mapping of the necessary data and information and their conversion and integration into a single and consistent system. The regulatory background assigned to the task was significantly more flexible than the rules applicable to the urban rehabilitation plans or the shaping of constituency boundaries. The real challenge was imposed by the need to identify and present in a user-friendly way both the actual set of data required by expectations conceived only in general terms (e.g. presentation of the spatial patterns of the priorities) and the sources and method of organization of the data.

Table 1: Presentation and satisfaction of demand

Demand	Reactions
The information needed to complete the task is not available and must be collected piecemeal from each settlement.	Data collecting distributing questionnaires of properly developed, structured and easily comprehensible format, complete with filling guidelines.
In order to increase the respondents' willingness and to improve accuracy of the answers, the questionnaire should be enriched by integrating novel challenging elements.	There is no place for textual answers. Numeric classification and application of alphanumeric classification constraint, interpreted on a diverse scale
Additional data suitable for being used as "benchmarks" must be integrated, in order to double-check and further refine the conclusions drawn from the collected data.	Integration of the available statistical data linked up with the questions worded in the questionnaire (preferably structured in time series)
The users' questions should be responded using both spatial and attributive approach.	GIS application, using special user interface.

Facts accepted and principles adopted for the purpose of structuring the questionnaire:

The data was collected during two subsequent intervals separated by a month, keeping the necessary processing time and the complexity of the issues in mind.

I examined the same range of issues in both cases, breaking down the questions related to the various areas to different depths of detail.

In each case, the respondents were requested to build a list, showing the priority order of the local problems and local needs for development, using a numeric scale to grant scores between 1 and 20 (most important: 1; least important: – 20).

The respondents were requested to classify every numerically interpreted element shown in the list also to one of the A, B or C Category. (A: vital importance; B – medium importace; –C – can be suspended)

A more precise definition and cross-checking of the conclusions drawn from the data "distilled" from the questionnaire required integration of further data suitable for making comparisons. The recording module reacted immediately to extreme situations, like the case when someone classified a demand for development into Category 1 of the numeric list and into Category "C" in the alphanumeric list or, reversely, when a demand was graded down along the numeric scale but granted the "vital importance" category in the alphanumeric group. The advantage of the self-controlling, twofold classification manifested itself in numerous cases.

Based on the above described method, I compiled a priority list of possible development projects to be implemented in Hajdú-Bihar county and developed an application to illustrate the problems perceived by the local citizens and a background database composed to match the relevant Geographic Information System environment.

3. PRACTICAL BENEFITS OF THE RESULTS

3.1 URBAN REHABILITATION – GIS SUPPORT TO THE COMPLETION OF URBAN REHABILITATION TASKS

3.1.1 General description of the results

I surveyed and documented the process model underlying the preparation of the urban rehabilitation plans. I developed a generic methodology applicable during the preparation and processing of urban rehabilitation plans and related to the building of a GIS database. In addition, the methodology comprises elements like semi-automatic vectorization process for building a map database underlying the subsequent planning work, designing of a geo-relational database meant to support the urban rehabilitation plan and a related error detection and correction methodology.

I used the ArcInfo environment for the development and presentation of the sequence and purpose of the actual and implementable steps and the method of their superpositioning. I specifically referred to the issues related to the implementation of correct topological relationships.

Following the phases of planning, data collection, database structuring, error detecting and correction, I developed a GIS-related user interface designed to facilitate implementation of the urban rehabilitation plan and the orientation, communication and presentation tasks related to the use of the plan. I developed many individual programs written in the Avenue script language and capable of accomplishing the above outlined functions.

Database of the digital planning map:

I developed the GIS database for a digital planning map that covers the entire public administration area of a selected settlement. I consulted an engineer specialized to urban rehabilitation projects to design the marks and symbols of the digital planning map. I replenished the GIS database by entering the entire range of input data that corresponded to my survey, the structural plan and the rehabilitation plan. Such replenishment comprised both the preliminary collection, categorization and entering of data that describe the selected settlements and the creation of many new mapping solutions and several hundred data layers which constitute the maps.The results of the entire processing work were recycled to the procedure by harnessing the above described methods.

3.1.2 Functions of the developed application

I converted the GIS database in order to provide the users with a simple, fast and unequivocally described tool. I developed an environment which enables even municipality employees having no special GIS-related expertise to make an efficient use of the information now available in a novel format, regarding their respective settlement.

With the use of the above described method, the settlement's geo-database and its "superstructure", i.e. the user interface were made suitable for providing support in the everyday use and application of the urban rehabilitation plan.

The results achieved using my method can be applied efficiently to the GIS-focused processing of data of any other similar settlement.

Each of the presented layer extracts was produced using the data sets created on the basis of the above described method. I developed the user interface in an ArcView 3.1 environment. I developed the individual modules and most of the communication with external programs integrated in an MS VisualStudio environment.

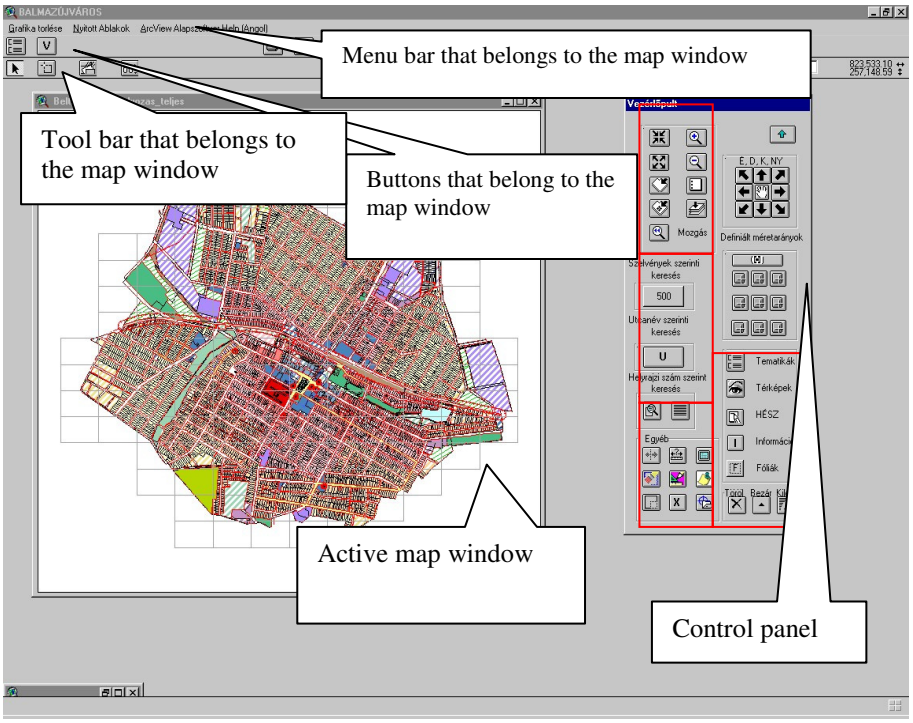
The developed application communicates with the users in the Hungarian language.

Classification of the tools developed by me and featuring functionalities beyond the basic range of GIS funcionalities:

- Organization of the urban rehabilitation plan's chapters, identification and displaying of the design sheets. The user interface sensitively reacts to any change experienced in the scale of every map and its parameters can be controlled via the program. The user interface always displays the significant elements that belong to the given displaying scale of the map attached to the given task. Also the displayed map marks and symbols are modified in function of the actual scale and data content.
- Summary query of descriptive data that belong to a specific piece of land or group of such pieces.
- Displaying of information that belong to a specific piece of land or group of such pieces and specified in the relevant construction regulations. In this part of the program, the user can decide whether the entire collection of the local construction regulations is displayed or only the specific instructions/regulations applicable to the given object should appear.
- Search based on the number of section, name of street, address or topographic lot number.

- Automatic compilation of summary map views, arranged according to the preferred order of the available descriptive data. The default template of the map view displays also the location of the queried/displayed lot of land within the territory of the settlement. If the selected lot of land benefits from protection of some sort and also the respective digital photo is available, this latter is inserted in the layout. The preferred sequencing order or the order of displaying can be set by means of parameters.
- I provided a built-in option for connecting additional textual descriptive data which had not been collected during the preparation of the urban rehabilitation plan but acquired importance of some sort during the use of the plans.
- I provided a built-in option for connecting additional pictorial descriptive data which had not been collected during the preparation of the urban rehabilitation plan but acquired importance of some sort during the use of the plans.
- Option of integrating and displaying standard signal codes.
- Use of the Hungarian language in the user interface.

I paid particular attention during the development of the user interface **(see Figure 1)** to the proper classification of the functions that belong logically together. As a special advantage, either information potentially needed by the user can be accessed by max. three clicks. I attached much importance to ensuring that each button, tool, menu and dialog window needed to manage with the urban rehabilitation plan is easily available and I hided from the user's sight all menu bars not belonging directly to the process or unnecessary or disturbing.



User interface for the urban regulation system

As a result of the development efforts, the user can retrieve the urban regulation plan and the related information simply, quickly and, in general, by three clicks. The users need not to be proficient in handling either the GIS system or the related database. The complete set of the ArcView tools is available to the experienced users.

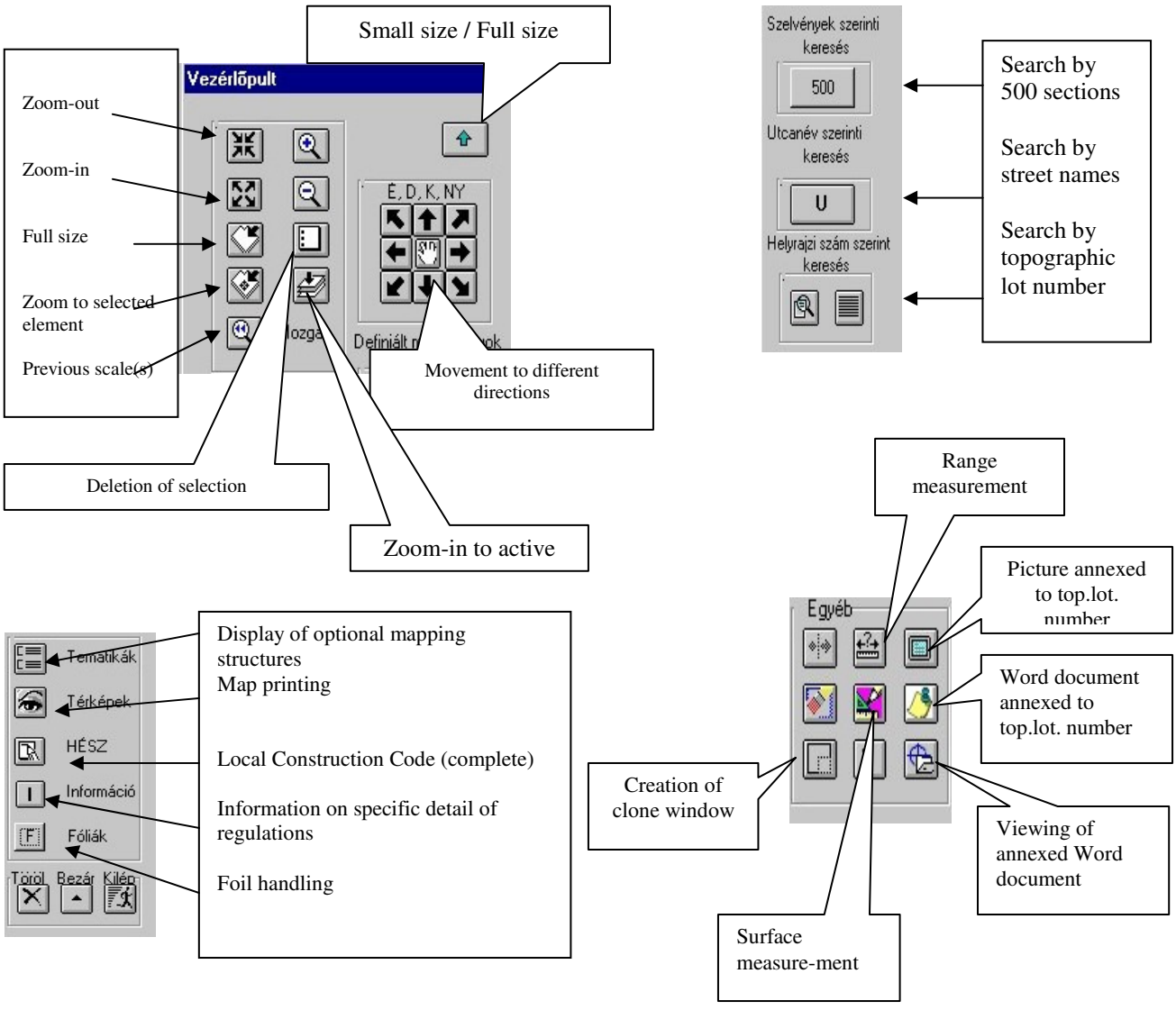


Figure 1: User Interface and elements of the central control panel

3.2 PUBLIC ELECTION TASKS – SUPPORT TO SHAPING THE CONSTITUTENCIES

3.2.1 General description of the results

I developed a methodology for the compilation of a database suitable for providing GIS support to shaping the boundaries of the territorial individual constituencies (TICOs) and the polling districts (PODs) defined in the provisions of Act LXIV of 1990 (on the election of mayors and local government representatives). regional development

I determined (in respect to other settlements, as well) the variety of databases needed and sufficient for performing the task. By means of examining the substantial and format charcateristics of the necessary input databases, I developed a series of steps whose consequent completion facilitates the creation of a geo-database considered the basis for performing the task.

I integrated the information of the polling districts' addresses stored as alphanumeric IT information managed on the basis of conventional database organization principles and considered the local etalon of any register of personal data and domicile addresses. I integrated also the database derived from the classical GIS data model as to represent the address elements as point objects.

I defined the GIS processes and the sequence of the steps of their implementation carried out starting from the map-based approach and, thus, parting with the purely character-based approach.

One of the most important results is that the versions related to the shaping and amalgamation of the territorial individual constituencies and polling districts or to modifications of their boundaries can be handled efficiently, in contrast to the currently used method which consisted, in most cases, of entering analog data in tourist maps.

I determined the GIS functions which support also the unexperienced user in harnessing the process designed to facilitate the shaping of polling districts.

I implemented the following functions and integrated them into the environment of the ESRI ArcView basic software:

Creation and termination of a territorial individual constituency.

Creation and termination of a polling district.

Modification of the boundary of a territorial individual constituency and the related polling district, starting from the maps' data content.

Modification of the boundary of a polling district and the related territorial individual constituency, starting from the maps' data content.

Polling district statistics – displaying of (1..n) data that belongs to the selected polling district and highlighting any diversion from the limit value.

Territorial individual constituency statistics – displaying of (1..n) data that belongs to the selected territorial individual constituency and highlighting any diversion from the limit value.

Does the classification used for the purpose of drawing the district boundaries complies with the applicable statuory provisions?

Transfer of district/zone data to the polling district sysem. Listing and export of the converted data of (1..n) polling districts (PODs) or territorial individual constituencies (TICOs).

Thematic map representation of the PODs and TICOs.

Time machine – handling of versions of arbitrarily great number.

As a result of the process, one can carry out both the complete (re)classification of each POD and TICO of the entire settlement and the redrafting of the respective boundary lines and, in the meantime, one can make sure (in each step) of compliance with the conditions set among regulations. **(see Figure 2)** Once the district boundaries are determined, the program supports both the printing of the map layer extracts and the textual listing of all addresses that belong to individual constituencies or polling districts of arbitrarily big number

The "Time Machine" function:

The final version containing the boundary parameters of the individual constituencies and polling districts is filed together with the version number and the date of creation. Thus, versions of arbitrarily great number can be handled and displayed simultaneously, together with the related statistical tables. In contrast to the previous practice, displaying of the versions' date of creation and the possibility of handling, comparing and restoring the versions are crucial elements among the results.

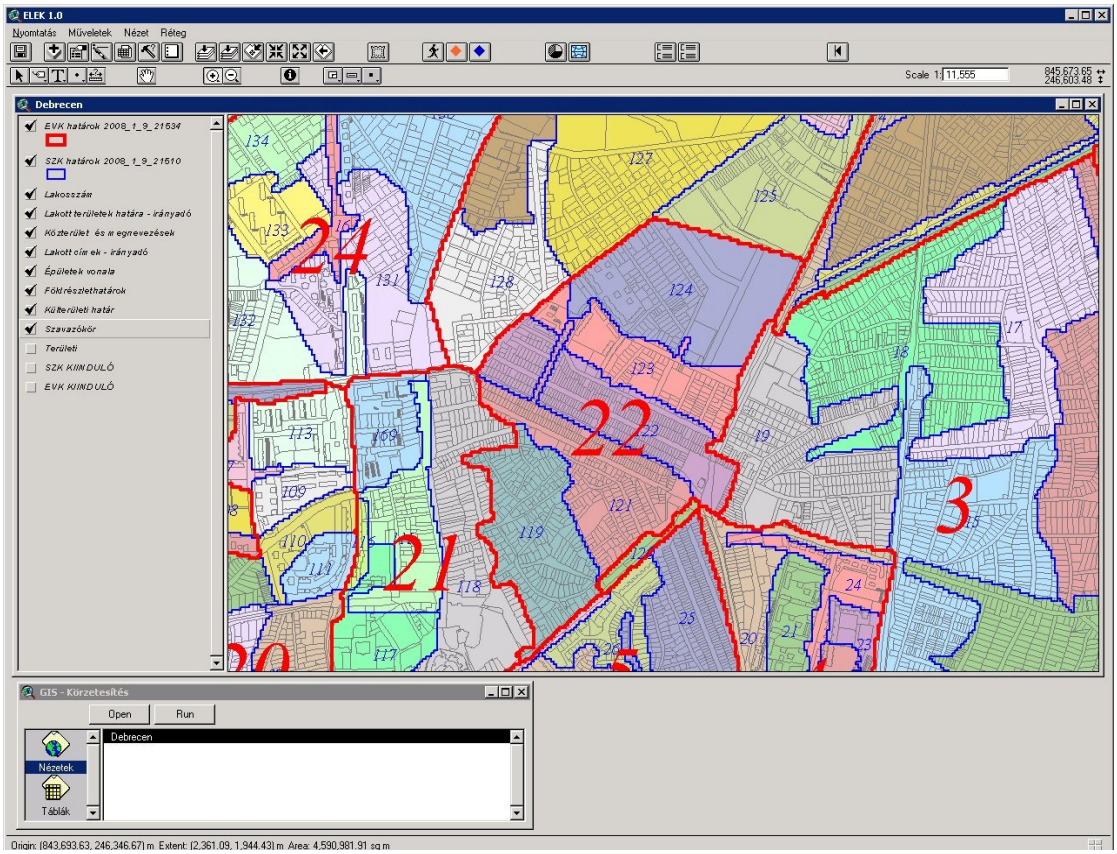


Figure 2: Creation and termination of a polling district

Function of transferring output elements to other systems:

The application produces a districtized list of addresses on the basis of the actual circumstances, in other words, it saves all addresses that belong to either individual constituency or polling district (identified in a GIS environment) into a character-based set of data.

The output format satisfies also the data demand of other districtizing systems because the list can be placed, using conventional methods, to the clipboard and can be inserted efficiently into external applications, as well (e.g. Office, Word, Excel).

3.3 REGIONAL DEVELOPMENT – SPATIAL DISTRIBUTION PATTERN OF DEVELOPMENT PRIORITIES SET AT THE COUNTY LEVEL

3.3.1 General description of the results

In the present period, characterized by the shortage of funds, efforts should be made to ensure optimum utilization of the available funds and to seek for new sources of financing. The system created as a “map of problems” operates as a complex combination of a GIS database and a user software and enables the user examine the lists of development priorities set by the

municipalities, according to arbitrary grouping (e.g. county, special-purpose regiont or any group of settlements that share common interests). I developed a database for being used at the level of a county or region. It contains the development concepts and objectives proposed by the municipalities of the county or region, arranged according to their order of importance and provided with scores needed for the ultimate weighing. The application enables comparing of the individual development objectives according to their relevance or superfluity. The primary function of the application is to determine the order of the problems and priorities and to display them in a simple visual format.

The database contains all data and factors related to the local infrastructure, the available human resources and the quality of life, broken down to the level of settlements, special-purpose regions and the county. Its control module contains retrospectively the key statistical indices and ratios of the settlements (e.g. rate of employment, educational background of the citizens, ratio of households connected to the sewer network). The "map of problems" comprehensively illustrates the development needs and ideas of the settlements and contributes to the implementation of large-scale projects. When combined with the regional rehabilitation plan, the database provides a firm background needed to justify the utilization of the EU funds.

I identified the scope of data needed to build the database suitable for mapping the real problems or deficiencies perceived by the local citizens. I specified the structure of a self-controlling questionnaire needed to collect the data. During the period of designing the GIS database and the superposed application, I paid particular attention to ensuring controllable reliability of the findings and proposals and, therefore, I developed a series of database organization steps linked to the possible methodology of data control and verification. I established a treasury of the available databases needed to ensure viability of the controlling functions. I developed a series of steps suitable for the integration, in a single GIS system, of data supplied in different formats, collected by different organizations and needed to support objective verification of the findings. Now, one can assess both the feasibility of the development ideas submitted by the municipalities when such ideas are compared to historic statistical data of the (group of) settlements and the viability of matching such ideas to the reality of competing for funds associated to the tender invitations published by the county, regional, national or EU authorities. The GIS application developed by me firmly supports discharging of the above outlined functions.

Application possibilities, key areas of utilization:

- Visual interpretation of problems perceived in a specific area, for the decision-makers.
- Automatic analysis of spatial distributon patterns of the demand for development.
- Spatial assessment of priorities of regional development. Submittal of proposals.
- Evaluation of the feasibility of the development ideas and possibilities in comparison with historic statistical data or other relevant reports/documents.
- Allocation of funds awarded to the best bidder(s) to the best development ideas.
- Optimization of the objectives and possibilities of the county/bidding settlements.

User program and functions of the map of priorities

I developed a customized GIS application written in the Hungarian language and integrated in the flow of processes, for the benefit of potential users untrained in this field. The application's structure matches to that of the generally used types of software. The proper elements of the user interface are displayed on the screen **(see Figure 3)**:

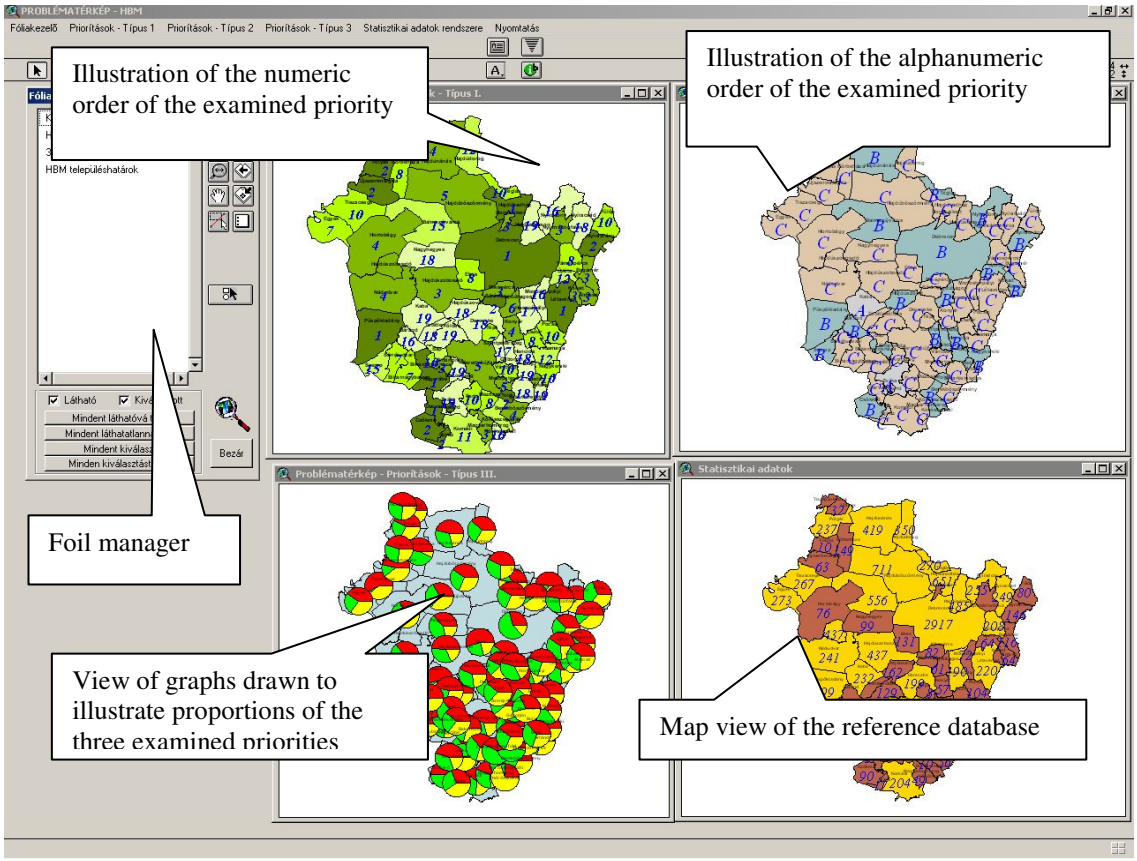


Figure 3: Thematic maps based on the known priorities

In addition to displaying the priorities and subjecting them to comparative analyses, the GIS application handles also the system of statistical data, including the following ones:

- unemployment data,
- Personal Income Tax data,
- system of regional statistical data,
- corporate tax return data supplied by key tax payers,
- General Agricultural Census (ÁMÖ),
- municipality data,
- investments completed by municipalities,
- financial ratios from the municipalities' Financial Statements (e.g. Balance Sheet).

4. NOVEL SCIENTIFIC ACHIEVEMENTS

1. I developed a generally valid methodology which can be used to create a geo-relational database underlying the urban rehabilitation plan of either settlement of Hungary. I presented the possibilities offered and results achieved through the practical application of this innovative methodology designed to collect and convert the relevant data.

2. I developed a separate user software component in order to facilitate the use of the urban regulation plan of the processed settlement. The functions of the GIS software component developed by me can be applied, without any alteration or adjustment, in the course of the GIS-based processing or putting to active use of either settlement's urban rehabilitation plan.

3. I developed a process and methodology for the integration into the GIS environment of alphanumeric information of personal data and domicile addresses recorded in the National Population Register. I embedded the process of shaping the polling districts relevant to the public elections tasks into an advanced GIS-based environment, substituting for the currently used system predominantly based on analog data processing. The use of the system developed by me can be extended to both urban/regional and functional applications, in case of settlements and districts of different type, respectively.

4. I developed a GIS-based data collecting and integrating process in order to support the process of detecting local problems and deficiencies, the identification of development priorities and the making of decisions by senior executives, ensuring that this process can equally be applied to specific settlements and various groups of settlements. I put the process to practical use as to develop a specific GIS-based application suitable for highlighting the crucial development priorities and providing support to high-level decision-making.

5. RELEVANT LITERATURE

Proof read articles and chapters:

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Fazekas, I., Pázmányi, S.: 2001. Sensitivity study for the emplacement of solid refuse of settlements on territories aggraded with river-water sediment; in Acta Geographica Debrecina 1999/2000; Tomus XXXV. pp. 67-82.

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Pázmányi, S.: 2008. Visual Public Services - Geographic Information System and e-government. A university handbook for administration organizers. 12. pp 149-161.

Proceedings:

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