THE USE OF A GIS IN ORDER TO SOLVE THE PROBLEMS OF GENERAL LAND SURVEYING AND OF SPECIAL LAND SURVEYING FOR DEVELOPING THE SUISTAINABLE DEVELOPMENT OF THE TOWNS

UTILIZAREA UNUI GIS ÎN VEDEREA REZOLVĂRII PROBLEMELOR DE CADASTRU GENERAL ŞI DE SPECIALITATE PENTRU DEZVOLTAREA DURABILĂ A LOCALITĂȚILOR

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***Abstract**: Known as **GIS** (**G**eographical **I**nformatics **S**ystems), the instruments of visualizing and analyzing the geographical information constitute today a field with a spectaculars evolution. The special GIS operations over the spatial information make from these instruments not only some efficacy instruments for making maps, but especially, irreplaceable instruments for analyzing the information that refer to the terrestrial surfaces. Also, the existent information can be reused, due to the fact that one of the main purposes of introducing the GIS technology consists in creating – by conversion in digital form – some efficient possibilities of maintaining and updating the information. During the last quarter of century, the GIS applications have been extended quickly into the following fields: natural resources, energy, transports, business, and public safety.*

***Rezumat:** Cunoscute sub denumirea de **GIS** - Sisteme Informatice Geografice – reprezintă instrumentele de vizualizare şi analiză a informaţiilor geografice şi constituie azi un domeniu cu o evoluţie spectaculoasă. Operaţiile GIS asupra informaţiilor spaţiale fac din acestea nu doar instrumente eficiente pentru realizarea hărţilor, dar în special instrumente de neînlocuit în analiza informaţiilor care se referă la suprafeţele terestre. De asemenea, informaţiile existente pot fi refolosite, datorită faptului că unul din principalele scopuri ale tehnologiei GIS constă în crearea unor posibilităţi eficiente de menţinere şi actualizare a informaţiilor. În ultimul sfert de secol, aplicaţiile GIS s-au extins repede în următoarele domenii: resurse naturale, energie, transporturi, afaceri şi securitate publică.*

***Key words:** Geographical Informatics Systems, spatial information, maps*
***Cuvinte cheie:** Sisteme Informatice Geografice, informaţii spaţiale, hărţi*

INTRODUCTION

Definition: *An information geographic system (GIS) is an assemble of **persons, equipments, programs, methods and norms (rules)** having as purpose to **collect, stock, analyze and visualize the geographic data.*** (Fig. 1.)

The main purpose for introducing the GIS technology consists in increasing the efficient possibilities for maintaining and updating the data.

- Local public administration – Local Councils, County councils, Prefectures, City Halls;
- Municipal utilities – phone networks, water, gas networks, etc.;
- Constructions – placing, modelling, interacting material need;
- Cadastral need – creating, maintaining and exploiting the cadastral data bases at rural, urban and national level ;
- Cartography – making thematic maps, etc.

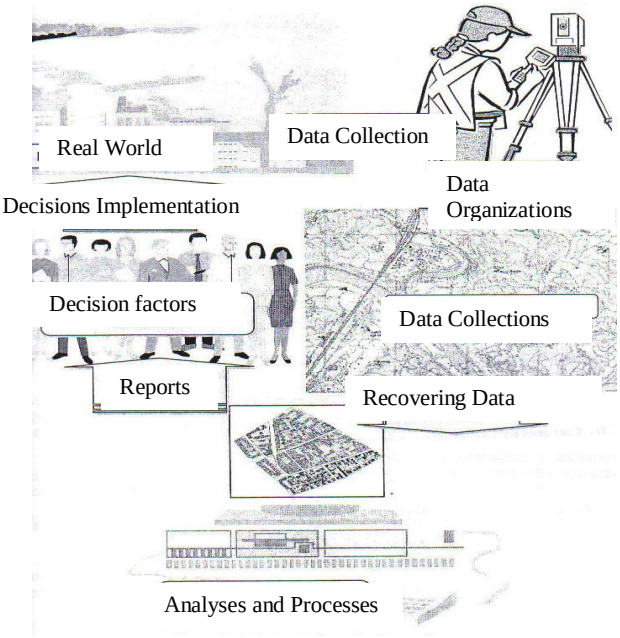

Fig. 1 Geographic Information System

A geographic information system is constituted mainly in five components (fig.2.):

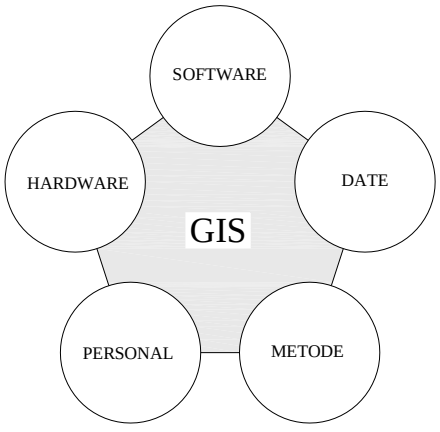

Fig. 2. Components of a GIS

Functions of a GIS

- Capturing and introducing the data (input)
- Manipulation (elaboration)
- Administration
- Interrogation and analyze

➢ Visualization

MATERIALS AND METHODS

Mainly, the implementation and exploiting a GIS is developed in the following stages:

Defining the requests. It involves a detailed study of the user's requirements. After this study there are established the quantitative and qualitative features of the final products (precision, structure, representing scale) and it is estimated the data volume;

Establishing the system functions. Being known the requirements, it is necessary to be specified the functions which must be accomplished by the system for fulfilling its objectives.

Projecting the data base. Into the GIS the data are stocked in thematic layers. It is necessary to be defined these layers and features (attributes) of the data stocked in each of them.

Choosing and procuring the equipments and programs. Among different possibilities for implementing a GIS must be chosen the variant that assures the totality or majority of the functions established as being necessary in conditions of maximum efficiency.

The personalization of the programs at the application requirements.

Loading the data base. It consists in making the digital map by completing the layer data.

Exploiting the GIS. This is developed in three main directions: **updating, analyze, reports**.

Structure of a GIS application

The GIS technology is used in all fields for which the spatial information is relevant, that means in all fields that use the geographical map for stocking, analyzing and representing the data which are processed.

No matter what is the field, any GIS application includes a spatial data base (a digital map) and a soft which exploit these data bases.

The digital map must contain the spatial data specific to any field whose it is designated to this application. In order to furnish some useful information, this data base must be up-to-date, which means it must represent correctly the terrain (geographic space) that is always under changing.

This exploitation soft is made from many functions of analyzing the spatial data contained into the digital map and of visualizing the resulted information, specific to the application field.

Accomplishing the digital map

The digital map must be made by vaporizing all the existent resources based on a good analyze of these content and the involved costs, following to assure the necessary quality, in conditions of maxim efficiency. Into the fig. 3.1 it is presented a general scheme of principle of sources that can be taken into consideration for making the digital map.

Acquisitioning the data is the process of conversion of the data for the shape in which it is exists in one that can be used by a GIS.

In order that the spatial data can be obtained from a great variety of sources, it must be done the difference between acquisitioning new data and of the existent one.

Each data source presumes the existence of some special programs that are used for transforming the data into a shape of the digital map.

Models of data from the digital map

In a digital map, all four components of a geographic data are expressed digital through values organized in a specific structure, forming a geo-database. This contains data

that define the position and shape of the represented entities (graphical data) and also data that are expressed the features of these entities (attributive or textual data).

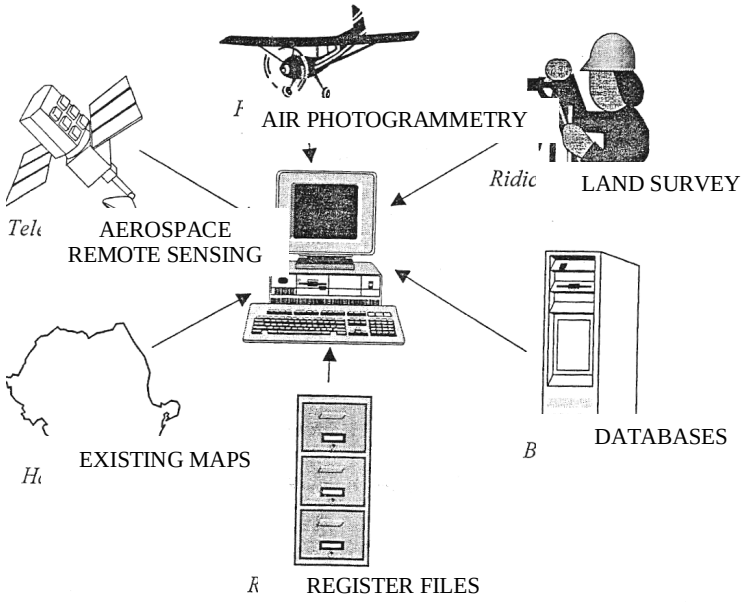

Fig. 3.

There are used two main models for organizing the digital maps:

Into ***raster model*** the represented territory is divided in many cells, which are especially squares, having all the same dimension.

Into the ***vector model*** it is considered that any geographic entity can be represented as a *point*, or a *line* (or arch), or as an *area* (or polygon). With a point it is represented punctual phenomena (for example altitudes). The lines are formed from many points linked between them and they represent for example administrative limits or any other limits. An area is delimited by lines and it is used to be represented entities or phenomena for which the area is significant (administrative territories, lakes, types of vegetation, etc.)

For the digital map of the information system for administrating the towns it will be used the vector model.

There are represented with the lines also the objects that are too tight for being considered surfaces (a railway on a map a shot scale). A surface (or a polygon) is delimited by lines and it is used for representing entities and phenomena for which the area is representative (administrative territories, lakes, polluted areas, types of vegetation etc.).

The justification of this approach results from the specific of the urban territory where there are many point-like and line –like entities.

In both models the geographic data of a certain territory are organized on many *layer*s or thematic *coverage* (fig. 4.).

The digital map is a special territory is represented by the sum of all layers that have been defines. A derived map will be constituted from a layer or a certain combination of layers from the existent ones.

One of the main problems that should be solved inside the project of informatics system will be to define the layers that form the digital map and to establish the entities that

belong to each layer.

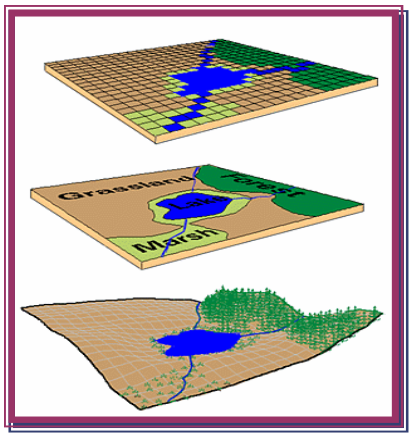

Fig. 4. Layers in a Digital Map

RESULTS AND DISCUTIONS

Informatics' systems in surveying

In whole world there is an increasing of the needs of information regarding the territory as a base for planning, developing and controlling the territory resources. This requests detailed information regarding the basic element: the terrain owner or how it is used this territory. On the other hand there are needed the instruments necessary for the above mentioned application.

The cadastral maps contain major information regarding the lots and buildings and they are in general sheets of map having the scale between 1:500 and 1:5000.

The cadastral registers contain information regarding the dimensions and categories of use of the lots, their juridical situation, owners, restrictions, mortgages, evaluations and taxes etc.

A **cadastral informatics' system** (CIS) presumes to accomplish automatically these products. A CIS is a part of SIT where the territory unit is used for the lot. CIS have the same stages of any SIT project only that its objectives are for the surveying.

A principle scheme of a SIC is presented below. (Fig. 5.).

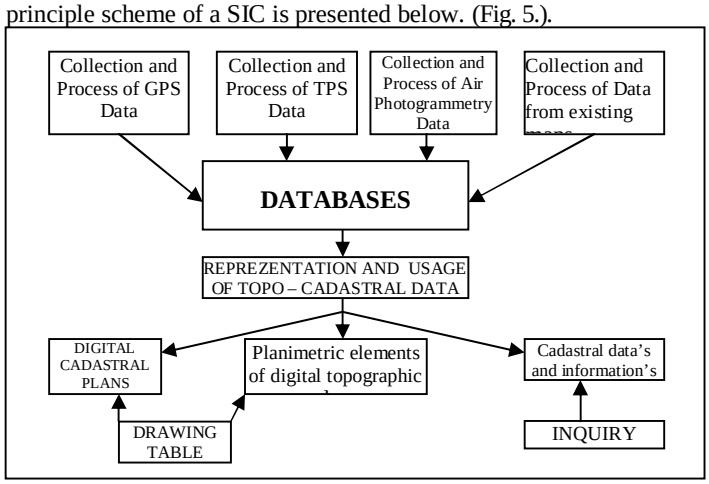

Fig. 5 Cadastral Informatics system

The need of data in all fields leads to the idea that within the Cadastral Informatics System there must be a "gate" to other systems from what the data can be released or collected in real time.

If this gate is efficient then the period between the request and answer will be no more than 10 second. This gate will make from CIS an opened one; not only for the taking over and releasing of information but also for the implementation of some new procedure made by different user.

A principle scheme of a Cadastral Informatics System for administrating and systematization of the urban areas is presented below (Fig. 6.):

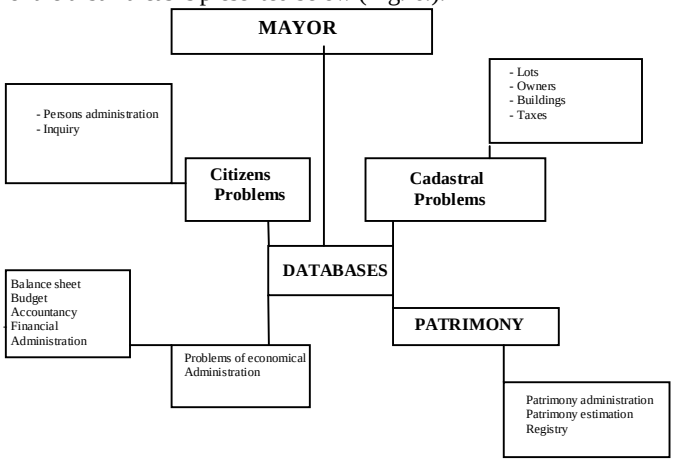

Fig. 6 a Cadastral Informatics System for administrating and systematization of the urban areas

Informatics System in mining survey

The mining survey assures the evidence of the graphical and analytical documents regarding to a certain perimeter of exploitation.

The base of the cadastral evidence constitutes the topographical documents regarding the delimiting and marking the lots with proper use and the documents for obtaining owner title over the terrains and the document from which it is awarded this title. Into the mining cadastral register it is kept the evidence for the areas that come in or come out from the use of the mine.

It will be kept the evidence of the cadastral works, surveying works and mapping ones made until present and in which there are described totally and partially the constructions and other works made by other economical agents at the unit order. All these are described into the **MINING BOOK** of each mining unit.

After been made the inventory it results the following structure:

- Mining Unit;
- The complex of works from the surface or underground;
- The building, its residence and destination;
- Its approximate area;
- The document or juridical facts of attribution: issuant, number, date, form (original/copy); the area from the documents.
- The categories of use for the areas where there are underground mining works from the safety and protection spaces;
- The information offered by A.N.C.P.I. and D.U.A.T regarding the technical elements of the building and recorded into the technical evidence of the survey;
- The information offered by the Land Book regarding the juridical situation of the building;
- The information over the existent cadastral plans of the building.

For recognizing and delimiting there are made as follows:

1. The minute of recognizing the area, closed between the representatives of the mining unit and the ones of the executants, where it is described the place.

2. The draft of the place.

For each neighbour there will be established as follows:

1. The name of the neighbour.

2. The draft of neighbourhood.

3. The topographical description and draft of each point of crossing between the neighbours.

The geodesic support network will constitute in field measurements starting with the state geodesic network depending on the needs there will be measured other points. The support points will have the following conditions:

1. To assure a minimum density of the point from the network that means a point at 5 ha.

2. The average error of determining the plan coordinates will be of ± 5cm.

3. The coordinates X, Y are determined in projection and reference STEREOGRAFIC 1970;

4. The points of the levelling network will be common with the ones of the plan metric network. The points' high is determined into the level system of Black Sea 1975.

5. It will be assured a precision of level determination of ±10cm.

6. The network points are materialized using marks according to the standards, which will be reported on the draft.

7. If the installations from the precinct of the objective are under surveying of their displacement in time by using the geodesic methods, the points of the surveying network will be integrated into the cadastral network.

Regarding the quarries it will follow the rule of introducing the special mining survey together with the special water, wood, environment survey.

For the preparations there will be introduced also the elements of the real survey and the town survey.

The digital topographic plan will be structured on layers, administrated by a platform type **Geographic Information System (GIS**), being exploited with products ESRI (ARC /INFO and ARCVIEW). The topographic plan will have the following layers:

a) layer 1 - old triangulation points;
b) layer 2 - banking points;
c) layer 3 -list of juridical documents that proves the ownership or the right for administrating the building;
d) layer 4 -symbol of the radiated point;
e) layer 5 - number of radiated point;
f) layer 6 - high of radiated point;
g) layer 7 -limit of precinct;
h) layer 8 -vegetation;
i) layer 9 -hydrography,
j) layer 10 - road communication ways;
k) layer 11 - technological platforms;
l) layer 12 -constructions: - at surface; - underground;
m) layer 13 - underground conducts, galleries, tunnels ;
n) layer 14 - fittings out;
o) layer 15 - ground networks;
p) layer 16 - underground networks;

q) layer 17 - ground deposits;
r) layer 18 - primary circuit into the electrical energy supply stations;
s) layer 19 - railways;
t) layer 20 - cadastral numbers;
u) layer 21 - terrain lots (enthralled fond) near the objective and bondage area;
v) layer 22 - delimitation from the lots in the neighbourhood indicating their owners.

For each type of network it will be made a layer of arcs and loops that describe each range of network. From the general survey there will be taken as basic information the numbers of cadastral sectors and of the ownership corps. The rivers have their own cadastral number along their length.

The cadastral plan is derived from topographic plan and it will be divided in the following areas:

a) Free area (Sl);
b) Road ways area (Str.);
c) Railway area (St);
d) Underground networks area (Sr);
e) Building area (Sc);
f) Air deposits area (Sd);
g) Technological platforms area (Sp);
h) Hydrographic elements area (Sh);
i) Transforming stations area (Sp);
j) Bondage area (Ss);
k) Delimiting the abutters.

The digital cadastral plan will be structured on layers. The drawings will follow the draft and map sheets at the designing scale.

The registers of mining survey are as follows**:**

1. Cadastral register of mining units.
2. Cadastral register of ownership corps.
3. Cadastral register of administrative units where there are the mining units.

CONCLUSIONS

To make the digital maps and to introduce the GIS systems into local community sectors will increase the level and quality of their decisional process.

Being very used in different fields, and starting from the information necessary to any citizen and till environment protection, from the marketing strategies to resources administration, the GIS marked a revolution in solving the problems.

The quality information means quality decisions. And GIS offers this possibility, transforming some simple information in real information and offering the interactive access to them.

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