

UP-TO-DATE ASPECTS CONCERNING THE IMPLEMENTING OF THE GIS TECHNOLOGIES IN THE MANAGEMENT OF THE AGRICULTURAL TERRITORIES IN THE REPUBLIC OF MOLDAVIA

O. C. Horjan¹

ABSTRACT

The subject of this paper is to present information about GIS education in the Republic of Moldova and discuss related problems. Among more than 40 Moldavian universities, only 3 answered the inquiry that they teach GIS or subjects with GIS contents. They are the State Agrarian University of Moldova, the Technical University of Moldova and the State University from Tiraspol. In all departments courses of GIS or with GIS content are a part of undergraduate study. The students in these courses are introduced to data acquisition, data storage and management as well as data analysis and visualization. GIS teaching at the postgraduate level is not organized. The most important problems in teaching GIS at Moldavian universities are: the lack of appropriate academic and scientific staff; the absence of GIS literature in the Romanian language; the acquisition costs for geodetic equipment (especially GPS receivers) and for some graphical and attribute data; the shortage of teaching time and lack of understanding methods of spatial analysis. There need to implement and to promote GIS and LIS teaching and training to other specialties and postgraduate study programs.

*

1. GENERAL ISSUES

During the 90's, while implementing the reform of the agriculture in the Republic of Moldova, about 2 million hectares of land had become private, which means about 60% of the country's territory. The average size of a farm, divided in 2-7 plots situated at a considerable distance between them and on which fitotechnical production (horticulture and wine growing) takes place does not overpass 1.5 ha. Besides, 1.245.000 families had received in property plots belonging to houses and gardens. All the project working, including subsequent plotting, preparing and release of Titles for autoidentification of the land owners' rights, have been effectuated by engineers-specialists in the field of cadastre and territory organization, based on GIS Lcad and MapInfo software.

The Republic of Moldova prepares at present the introduction of a new geodesic network, five geodesical points being already measured and connected to EUREF; there were effectuated geodezical elevations in order to re-establish the geodesical network of 1st category. Works to create a new levelment network and new cadastral maps are being held;

¹ *State Agrarian University of Moldova, Cadastre and Law Faculty, 20049 Chisinau, Republic of Moldova*

there are also some steps in the field of editing new thematic maps of the cities, of the whole country. Many geodesists, topographers, fotogrammetrists, cartographers and other specialists are involved and trained in this activity, using traditional methodes as well as the most modern equipement, including GIS software.

This aim can not be reached without the support of a lot of well trained specialists, keen users of GIS techniques, capable to provide rapidly the nececery information to the decision factors.

As a conclusion to the exposed data:

1. The present problems of the management of the agricultural lands can be solved only by qualified specialists from different fields of the national economy.
2. All these specialists should be able to fulfield the tasks at the level of modern requirements, only by applying the adequate technologies, methodes and performant equipements, including those in the field of GIS.
3. Reaching the enumerated aims, implies the endowment of the specific teams of executors with the proper GIS hardware and software.

2. THE PRESENT SITUATION OF THE TRAINING IN GIS FOR APPLICATIONS IN THE MANAGEMENT OF THE AGRICULTURAL FIELDS

Only in three Universities (*State Agrarian University of Moldova, Technical University of Moldavia and Pedagogical University of Tiraspol*) among the 40 in the Republic of Moldavia, GIS discipline is taught, along wih other disciplines containing GIS elements in the curricula. All these studies are held only at the diplomate university level, where students learn the general theory of GIS, the methodes for acquisition, hoarding and management of data, their validation and processing, elements of modelising and spatial analysis. No University has curricula elaborated and implemented at the level of Master.

The Faculty of Cadastre and Law – State Agrarian University of Moldova has three specialties : Cadastre and territory organization, Evaluation of Buildings and Environment Engineering – where students can get familiar with the GIS basis, at the level of simple user. GIS disciplines have the greatest weight in the first specialty. Here, besides GIS discipline (6 credits), other disciplines in connection with GIS technique are taught: Automation of cadastre works (4.5 credits), Project and organization of territory (5.5 credits), Remote electronic measurements (2.5 credits), Geodesy (8 credits), Topography (8 credits), Cartography (7 credits), Photogrammetry and remote sensing (6 credits), Spatial geodesic technologies (2 credits). These disciplines deal with well-known software as Idrisi, MapInfo, Arc/Info, Arc/View, InventGrad, AotoCad, AotoDesk as well as the with the smaller LCad and LegalCad.

In the frames of the First Project of Cadastre, UASM – State Agrarian University of Moldova and UTM – Technical University of Moldavia had received generous donations of hardware and software modern equipement up to hundreds of thousands of dollars, for topo-geodesic measurements. UTM managed to obtain and implement a Project TEMPUS-TACIS “Graduate education in the field of GIS”

There is to notice also the acute lack of teachers; of didactic-methodic literature in Romanian; the huge cost of topo-geodesic equipment (especially GPS) and of the tool needed in the acquisition and management of the data of the type attribute and spatial; the

small number of lectures in spatial analysis. The majority of the specialists, scientists, teachers and decisional factors from other fields in the country does not hold a clear vision on the necessity and importance of the study and implementation in their activity of GIS technologies. The majority of the specialists in economy does not have basic knowledge in the field of GIS, in contradiction with the Decision of the Government of the Republic of Moldavia concerning the Geographical Informational National System, adopted in 2003.

Thus, an important issue arises: that of preparing teachers in the field of projecting GIS technologies and applying them in different fields of the social-economical life, among which, of great importance is the field of the management of the agricultural lands.

In order to achieve this Program, teachers and specialists from different fields are needed; their preparation could be organized at the level of master and post-graduate studies, at the level of user or specialist in implementing GIS in the following specialties:

- Geo-informational technologies applied in agriculture (for agricultural and biology specialties graduates)
- Geo-informational technologies applied in the environment engineering (for monitoring and improving the environment specialties graduates)
- Geo-informational technologies applied in cadastre and territory organization
- Geo-informational technologies applied in the management of natural resources
- Geo-informational technologies applied in the evaluation of buildings etc.

Scientific research in the view of applying GIS technologies along with organising the educational process will be held in the following directions:

- creating the support for spatial data at national and international level;
- applying GIS at the level of State Administration;
- applying GIS in agriculture;
- applying GIS in the field of cadastre and territory organisation;
- applying GIS in the field of building evaluation;
- applying GIS in the field of environment protection, the use and management of natural resources;
- applying GIS in ecological monitoring;
- applying GIS for editing maps with different purposes, automatisisation of cartographic works;
- applying GIS in remote electronical measurement in different GIS projects;
- applying GIS in physical and human Geography
- creating and distributing data obtained with the help of GIS technologies, with free access for public

3. THE CONCEPT OF TRAINING

During its short history, GIS followed an evolution from the beginning of the 70ies in some Universities and Scientific Institutions to the first applications in the military and public administration fields in the 80ies and continuing to business and others fields of the social-economical life in the 90ies. In the contemporary informational society, GIS technologies along with energy and telecommunication became the main developing force of business. Related to the above mentioned fact and in concordance with the existing tendencies in the university education, a education strategy in the field of GIS should be established. Developing university curricula and methodes of training will be prior to practical applications of the programme and implementation in different real projects. At

present, the majority of the Universities use in the educational process, predominantly standard packages of some known software and less their own. We evaluate that the following forms of education would be possible:

- graduate studies (classical education on different specialties either at diploma level or master; many universities in the world give priority to the last one in the field of applied science);
- politechnical university studies (with more practical than theoretical studies in the field of Geomatics of Informatics with GIS application)
- life-long studies (different forms of self-training, especially in the fields of technics, calculating and elaborating of advanced programmes)
- perfecting in the frame of international projects;
- post-university studies (stage courses, professional „recycling”, an efficient and quite cheap solution);
- low frequency studies (less expensive educational form practiced in many countries);
- remote studies (developped especially in the last few years, but requires an attentive preparing)

After answering at the question: „How should education be?” – another one rises – „What should be studied?”

The last definitions of GIS treat it as a complex and technic informational system (networks, hardware, software, data, people, technological processes) and bring us close to the questions above. In modern science and practice, two directions appeared in science and education: elaborating and implementing GIS systems on one side and applying them in the view of modeling spatial data on the other side. These two directions are presented by two categories of specialists: a) GIS elaborators, represented by engineers, information engineers, geodesists and b) GIS users – geographers, cadastre-engineers, land architects, geologists and many others who apply GIS technologies as a tool for analysis and spatial modelations.

Engineers who deal with elaborating and implementing GIS systems create the specialized informational system for the processing of geographical data. Besides analytical geometry, structure and typology of spatial data, management of geographical data, these specialists need advanced knowledge in the field of elaborating software, compatibility and inter-operability of the the distributive data processing systems, of the architecture of modern softs and proceedings for their elaboration. The management and control of the huge volume of spatial data requires the application of new techniques and methodes for implementation of spatial modelling, based on the knowledge of selecting and storing methodes, and simultaneous processing of data and spatial information

Besides specific professional knowledge, geographers and other specialists in GIS, need to know the GIS techniques, the graphic analysis functions, the operations of GIS analysis, spatial statistics, mathematical and statistical modellations, methodes for integrating the existing models with the available data sources and means of visualisation.

4. THE DEVELOPEMENT OF THE CURRICULA

The key-problem in the development of curricula is education. As mentioned above, four categories of specialists who require adequate training in GIS field could be identified:

- GIS users who apply GIS techniques in their day-to-day professional activity, even for simple purposes, without problematical situations and who do not require the knowledge of the informational system in detail;
- specialists in GIS development who have basic knowledge about GIS as a informational system as well as about modeling, projecting and implementing processes of GIS applications, GIS analysis, general principles for different solutions. They should be able to activate as project manager, as members of the teams for spatial modulation, but they do not know good enough all the technical solutions;
- GIS engineers who project and implement GIS applications from the technical point of view, being specialized on data management, programming and spatial analysis, and visualization with the help of software. They have the obligation to know in detail the new technologies for elaborating GIS software;
- GIS analysts who are very familiar with spatial modeling as well as with the mathematical methods of solving the exposed problems.

After identifying these four professional profiles it becomes easier to establish the content of the curricula. Thus:

a) GIS user:

- **aptitudes:** to be able to use GIS as a procedure in his day-to-day activity;
- **abilities:** to have general knowledge in computer use, GIS architecture, digitization procedures and peripheral equipment, GPS, specific GIS software, SGBD, numerical modelations, theory basis, GIS concepts and terminology.

b) GIS development specialist

- **aptitudes:** to be able to apply GIS technologies and possibilities in new circumstances; activate as project manager in ellaborating or developping GIS;
- **abilities:** to know the principles of the GIS projecting process: fesability study, GIS definition, costs and benefits of GIS, the possibilities of data management, the knowledge of the principles of spatial modelling and of the solutions for the spatial problems; the knowledge of the support disciplines: geodesy, topography, cartography, fotogrammetry, remote electronical measurement etc.

c) GIS engineer

- **aptitudes:** to be able to develop and trade new GIS technologies and their appllications;
- **abilities:** to know the entire process of ellaborating the software, from conceptualization of the problem to its implementation: fesability study, technical solution, new product marketing, special problems in managing the database and inter-operability, testing; interface projecting, management, hardware and GIS networks, telecommunication.

d) GIS analyst

- **aptitudes:** to be able to effectuate analysis and spatial modelations;
- **abilities:** to know mathematical modelation, numerical and simulating methods; to accumulate knowledge from different applicative fields: physical processes, ecological, natural, socio-human etc.; processes decision making, technologies to elaborate GIS software; existing data sources and their quality.

CONCLUSIONS

We notice, in the development of the concept of education and of curricula in the field of GIS, their interdisciplinary and multidisciplinary nature, which does not allow, in our opinion, to concentrate the teaching to a separate, distinctive and only one speciality. GIS can not exist independently, without the theoretical foundation assured by some support disciplines as: applied mathematics, statistics, geography, geomatics, nature sciences and engineering, informatics, informational technologies etc. GIS university lectures should become a didactical discipline for the majority of the specialists involved in the management of the agricultural territory, it should have a central place in their curricula. Up-to-date, in the frame of the existing curricula, this course should be compulsory for some specialities (geography, cadastre and territory organisation, geomatic, environment engineering, building evaluation, ecology etc.) at the level of user, developer or GIS analyst, - maybe with some modifications -, and also for master post-university or other studies. At the level of GIS engineer, the facilities offered by existing specialities are useful – Informatics and Informational technologies.

REFERENCES

1. Artimo K. (currently Virrantaus) (1992), *Surveyor – A GIS Expert?*, *Proceedings of Landinpektorskongress*, Copenhagen, Denmark.
2. Donisa V., Donisa I. (1998), *Dicționar explicativ de teledetecție și sisteme informaționale geografice*, Edit. Junimea, Iași.
3. Longley P., Goodchild M., Maguire d., Rhind D., (2001), *Geographic Information Systems and Science*, Wiley.
4. Popovici N., Biali G., (2000), *Sisteme geoinformaționale*, Edit. “Gh. Asachi”, Iași.
5. Rütther H., (2001), *EIS Education in Africa – the Geomatics Perspectives*, *Proceedings of FIG International Conference on Spatial Information for Sustainable Development*, Nairobi, Kenya.
6. Virbantaus K. (2001), *From GIS to Geographic Information Science in University Education*, *Proceedings of FIG International Conference on Spatial Information for Sustainable Development*, Nairobi, Kenya.