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Hellenic cadastre: state of the art experience, proposals and future strategies

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Abstract

In 1994, the Hellenic government, with the support of the European Union, started a project for the establishment of the Hellenic Cadastre (HC), which will be a title registration information system in fully digital form. It is estimated, that this project will last 20 years and it will cover the whole country. So far, digital photogrammetric Cadastral Surveys (CSs), named Pilot Phase and Main Program, of a total area of 893,000 ha have been commissioned and executed in various areas of Greece; 250,000 ha more were commissioned within the year 2000. Through this work, a surprisingly high level of cooperation between the private and public sector has been achieved. This paper focuses on the research and the progress that has been made in all scientific fields, such as the definition of the content of this project, the implementation of the responsible institutions/agencies for the HC, their administrative structure, the proposed regional structure, the development of the National Legal Framework for the compilation of the CSs, the adjudication procedure and maintenance issues. An emphasis is given to the experience so far gained in the legal and technical aspects, and especially to the proposals for an improvement of the methods, and to the attempt to create a cost recovery business culture for maximizing the products and services, which can be supported by the HC. This project requires major international and local experience and a high level of research in all the above mentioned issues, which has to be applied successfully. © 2001 Elsevier Science Ltd. All rights reserved.

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1. Introduction

More than 5 years have passed since the institution of the project for a big reform in Greece, which is the establishment of the Hellenic Cadastre (HC). In the meantime immense challenges had to be faced in getting the project off the ground, including: obtaining and sustaining the necessary support, working out a strategic plan (HEMCO, 1994; Ktimatologio SA, 1999; McLaughlin, 1998), adopting the necessary legislation, managing the joint venture relationships and responsibilities, working out the technical aspects using modern methods and tools, continually striving for greater efficiency and providing constant attention to quality control. Significant challenges may still remain (McLaughlin, 1998). While there is much to be learned from international experience, ultimately the scope and direction of the HC will be dictated by the unique institutional landscape of Greece. So far a great deal of high level, multidiscipline research (in collaboration with local and international experts) in organizational, administrative, legislative, technical, and fiscal issues has taken place within the Hellenic Mapping and Cadastre Organization (HEMCO) and Ktimatologio SA, concerning its implementation. The result of all this joint effort is what we call today: 'Hellenic Cadastre'. This paper gives an overview of this multidiscipline approach, at all levels.

In Section 2, the most important historical information concerning all critical efforts to introduce a cadastral system, since the establishment of the Hellenic State, is given. The Mortgage Bureaux System, still in operation in Greece, is briefly mentioned, yet, its main weak points are clearly defined, proving the necessity for a reform, which will satisfy the modern needs of the land market and will provide the tools for sustainable development.

In Section 3, the target of the project, its content with its main legal and technical characteristics and some general information about its execution are given.

In Section 4, the administrative structure of the responsible state organization, Ktimatologio SA, for the compilation of the HC is given, together with a proposal for the further expansion and the regional structure of the HC. This proposal has not been applied yet, it is still under development.

In Section 5, the state of the art of the legal cadastral framework, such as the adjudication procedure and, to a certain extend, the maintenance of the cadastral data is given. More legal issues concerning the detailed specifications for the subdivision of the parcels, etc., are still under development.

In Section 6, main technical information concerning the accuracy of the Cadastral Surveys (CSs), the selected scales, the content of the maps, the cadastral code number, the quality control, etc., are mentioned. A statistical analysis of the acquired results and some comments are derived through that. New approaches to the execution of the project, based on the gained experience, are proposed. In addition, the state of the art of the research made for the development of the IT strategy for the HC is briefly given; this issue is still under development, the final results will be presented in a later paper.

In Section 7, the ideas for a cost recovery policy through the development of a marketing strategy are presented, and in Section 8, some general remarks are given.

2. The necessity of a modern cadastral system

Greece has tried several times to establish a cadastral system but unfortunately has not, until recently, managed to devise and operate a reliable system (Larson, 1991; Toerhoenen, 1995).

In the year 1825 the new Hellenic State was established. The first effort to introduce a cadastral system took place in 1836, after the publication of a Royal Decree by King Othon, in order to improve the land market and to enable the mortgage loans. In 1853, the *French Mortgage Bureaux System* was introduced, a deed registration system not connected with a map. This is the until today operating system.

In 1895 a proposal for a Law for the Cadastre was made and in 1910 a new Law (called ΓΧΝΖ/1910) for the HC was published. In 1917 a great fire destroyed Thessaloniki, the second largest city in Greece, so a big effort started after that to establish the Cadastre in Thessaloniki. In 1923 a Legislative Decree, concerning the codification of the cadastral surveys of *urban areas* was made. Between 1926 and 1929 a cadastral system was established on the islands of Rhodos and Kos in Southern Greece, known as the *Dodecanesean Cadastre*. The system continues to operate until today, according to a special Regulation. The operation of this cadastre today faces a lot of difficulties mainly due to the *very poor maintenance* of information, *both graphical and textual*, the *lack of personnel* and the *unwillingness of the public to register the changes of cadastral data, especially when it comes from inheritance, in order to avoid taxation*.

Another effort for the implementation of a cadastral system was made in the year 1932, which was focused on rural areas, the *rural cadastre*. Its aim was the registration for the *raisin producing areas*. In 1943 two *cadastral bureaux* were established in *two counties in the vicinity of Athens named Kallithea and Paleo Faliro* (total area: 1200 ha), which operate until now.

According to the Mortgage Bureaux system, the main system that still operates in Greece, all legal rights concerning land (surface, subsurface resources, buildings, etc.), such as land ownership, lease, mortgage, charge, easement, seizure, claiming etc., are registered and available to the public under special prerequisites. The 394 Mortgage Bureaux (the number of them changes from time to time due to amalgamation or splitting of some of them), operate throughout Greece, some of them since 1856. These offices are responsible for the *registration of deeds, but they do not guarantee the content of the deeds*. This is a system, that maintains *regional records and deeds* with the legal rights on the real estates that the persons have at the particular region. The registrations are based on the names of *persons*, this means, that the entry to the system can only be achieved by the name of the person, at each individual region separately. It is a deeds registration system, *not in digital form and with a description of the real estate totally inadequate for the identification of parcels*, usually referring only to the names of the bordering neighbors. The result of this is that in many cases the parcel cannot be located. The records are not associated with the general map and very frequently not even with a special individual plan. Some contracts are accompanied with topographic plans, prepared privately, but these plans are not in a unique reference system, nor do they follow any technical specifications.

The system ensures publicity, but it does not guarantee the real estate rights. Due to this fact, quite frequently it is necessary to search the archives in order to find out the history of a particular real estate till its first title, sometimes even till the middle of the previous century. All the above make the need of a title registration system, connected with an updated map, very clear. Many efforts have been done for the establishment of a *positive Cadastre*, but didn't have any real result.

From 1971 until 1974 the first phase of a new cadastre started. In that period a great percentage of Greece (25 Prefectures out of 54 in total) was covered, among them Crete, Peloponese, Central Greece, Thessaly and a part of Thrace. The adjudication process was made on copies of simple air photography, by a plain declaration made not obligatory by the owner, but by anyone who might know the area and the owner of the land parcel, as well. The land parcels were outlined directly on the photos and coded. It was a big effort, but it was stopped immediately after the political change in the year 1974. In 1976, there was another attempt concerning *the registration of forest land*. Also, some cadastral information has been collected indirectly, as part of the activities of Urban Planning according to the Law 1337/83, which introduced the *Urban Plan Implementation Act*.

Then, an essential step for the implementation of the Cadastre in Greece was the Law 1647/86. This Law established HEMCO, which belongs to the Ministry of Environment, Physical Planning and Public Works and is responsible for the mapping of the country, the implementation and the running of the Cadastre and the creation of Databases for the national resources and the environment.

In October 1993, the Minister of Environment, Physical Planning and Public Works of Greece asked the Technical Chamber of Greece and the National Union of Rural and Surveying Engineers to prepare a strategic proposal for the compilation of the HC. Four committees, legal, financial, technical and administrative were established and they presented their work on that to HEMCO, in April 1994. In July 1994, was the final proposal — actually the original strategic plan for the Hellenic Cadastre — ratified by the Ministry and the European Union (EU) together. According to this plan, the HC is designed to be a modern Information System, which will improve the efficiency of land transactions and guarantee land tenure. In addition it will provide all levels of information to both private and public sector, necessary for land management, urban and rural planning, agricultural policy, land administration and above all *environmental monitoring*. (Economic Commission of Europe, 1996; National Research Council, 1980).

3. The content of the HC project

The “Hellenic Cadastre Project” is considered to be the most significant infrastructure project under construction in Greece, in recent years, and one of the most important projects of that kind all over the world (McLaughlin, 1998). *Its purpose is the systematic collection, registration, organization and multipurpose management of the spatial information in relation with its legal/ownership status all over the jurisdiction*. Some of its main features are:

1. guarantee the land tenure and improve the land market;
2. safety of publicly owned land, which is estimated at a minimum value of a trillion Greek Drachmas (about US\$ 4 billion);
3. creation of about 2000 new employment positions per year of its establishment;
4. elimination of costly and time-consuming paper-work and bureaucratic procedures;
5. assistance of the management of land and monitoring of land use (for planning, efficient land policy and other administrative purposes); and
6. facilitation of the sustainable development and environmental protection (detection of fires, illegal building, etc.).

All the above are matters of vital importance for Greece (Dale, 1998; MacLaughlin, 1998).

Its critical characteristics are:

1. that the HC is *one* unique organization, like the Kadaster in the Netherlands, the Cadastral Office in Belgium, Czech Republic, etc., responsible for both the collection of all necessary spatial information concerning land parcels and the registration of all legal rights on them; this decision was a very important administrative step (Badekas, 1999);
2. the HC is a *title registration* system, so it is a *positive* Cadastre (Williamson & Ting, 1999);
3. during the cadastral surveys a special *adjudication* procedure is been followed;
4. the stretch of the HC refers to the total of 131,600 km² country's surface, which is divided as follows:

urban-suburban areas	8000 km ²
rural areas	36,000 km ²
forest land (as the valid legislation defines) divided as:	84,100 km ²
forest	29,800 km ²
forest areas	32,400 km ²
pasture, barren land	21,900 km ²
lakes-rivers	3500 km ²

5. the basic maps for the cadastral surveys are carried out by *photogrammetric* methods, to take advantage of the facilities of modern technology (FIG Publications, 1995);
6. the main *scales*: most cadastral maps need to have scales varying between 1:500 up to 1:10,000, depending on the size of the land parcels, the detail demands, the compilation method used, the land value, the desired cost and compilation time, etc. In the case of the HC it was decided that the possible scales for the cadastral maps would be for urban areas from 1:500 up to 1:2000 and for rural areas from 1:2000 up to 1:20,000. Taking into consideration the above mentioned factors, and the need to use photogrammetric methods, the scale of *1:1000 in urban areas was considered to be the most appropriate* and in some

sub-urban areas the scale of 1:2000, while *in rural areas* the use of the scale 1:5000, already used for the topographic maps series for common use that cover the whole Greece, was decided, and *in forest or mountainous areas* the scale of 1:10,000, due to the reduced accuracy and detail demands;

7. all cartographic and textual information are in *digital* form;
8. it contains additional information such as land uses, land cover and administrative;
9. the digital information is on a network which allows real-time access;
10. the estimated time for its completion is 20 years and the expected cost according to the estimate made by the responsible state organization (Ktimatologio SA, 1997) is US\$1.25 billion for the rate of 1994, with a deviation of $\pm 20\%$, which for the year 2000 corresponds to US\$1.8 billion;
11. the project is financed partially by the EU (75%) and partially through governmental funding (25%). The total available funds for the years 1995 up to the year 2000 is US\$200 million, which is equivalent to 50 billion Greek Drachmas; and
12. the execution of the project:

the compilation of the HC is carried out by the private companies, so it is a shared public and private responsibility (FIG Publications, 1995);

the project of the HC is under the political supervision of the Ministry of Environment, Physical Planning and Public Works. It is executed through two institutions, which belong to the government, that is HEMCO, and the Ktimatologio SA;

the state responsibility for the compilation has the 'Ktimatologio SA', a private sector company, established by the government, in 1995. All shares of this company belong to the Ministry of Environment, Physical Planning and Public Works; and

to facilitate the implementation of the HC a Project Manager has been appointed for the period 1997–2000. The selected consortium consists of three companies: SAGRIC from Australia, CARL BRO from Denmark and EURODYNAMICS from Greece.

4. Administrative aspects — regional structure

Ktimatologio SA is managed by the Board of Directors, the President of the Board, the Managing Director and the General Manager. The present structure of the company is divided into two branches and eight departments with 243 approved employee positions, out of which the 117 are already occupied. Its structure consists of:

1. the Directors' Department (19 employees),
2. the Legal and Finance Branch (72 employees) and
3. the Technical Branch (152 employees).

The hierarchy at the Directors' Department is: the President, the Managing Director, and the General Manager.

The Legal and Finance Branch consists of four Departments and their Divisions:

1. the Legal Department, responsible for Public Law and Property Law issues and for internal legal support
2. the Administration Department,
3. the Finance Department, and
4. the Commercial Department, responsible for marketing, advertising and sales.

The Technical Branch also consists of four Departments and their Divisions:

1. the Planning and Quality Department, responsible for the Technical Specifications, Tenders, Planning, Research, Development and Quality Control,
2. the Cadastral Surveys Supervision Department, responsible for the cadastral surveys, contract management and forest mapping,
3. the IT Department, responsible for the planning and management of digital data, the Data Base and the internal support,
4. the Regional Structure Department, responsible for the supervision of the Regional Offices, the planning and establishment of new Regional Offices and Regional Centers, like the one already in operation, in Thessaloniki.

At the moment, the IT and the Regional Structure Departments are under development.

4.1. Recent research proposal for the regional structure expansion of the HC

Detailed administrative operations may be centralized or decentralized depending on the size of the country and the nature of communications. Usually decentralization offers advantages, especially in a country where distances are great or travel is inconvenient. Yet, from a political perspective, bringing government closer to the people through decentralization has considerable appeal. From a practical point of view, placing cadastral offices at the district or local government level tends to ensure greater accuracy and effectiveness. The landowners should feel that the land office is there to serve them rather than to serve government bureaucrats in distant offices. On the other hand, the greater the degree of decentralization may be, the greater is the need for good communications between the local offices and the headquarters (Economic Commission for Europe, 1996).

Up until now, as it is mentioned above, the only Regional Center of the HC in operation is the one in Thessaloniki. This period, the company is working on developing the regional expansion strategy, a brief presentation of this work is given below. In developing a strategy for a functional, efficient, flexible and sustainable Regional Development Plan for the HC many factors have been taken into account. The four most important ones are:

1. the political impact;
2. the existing administrative and Mortgage Bureaux structure;
3. the efficiency of the local office; and
4. the distance of the users/clients to the office.

The installation and keeping of the HC at a regional and local level is of great importance, not only from a purely technocratic point of view, but mainly because it brings the individual citizen closer to the project, helps the citizen to become aware of its usefulness and its final targets, strengthens the citizen's interest and confidence to the institution, and in general it is considered that it will help the *public acceptance*, a very critical issue for the project's success (Potsiou, 1997).

The HC, due to its character as the most important infrastructure tool for proper planning and management at national, regional and local level, has undertaken a very significant role. So its successful establishment, and its future sustainability, directly depend on its *social* and *development* character.

The research for the best possible solution referring to the regional structure, the organization/operation and the personnel employment at a decentralized level is of great interest. Definitely, the international experience in such a field is of great value but as it is clearly understood no available model is applicable for Greece. The Hellenic solution has to evolve by taking into consideration all the specific and very particular local situations (Welter, 1999).

The basic principle of the master plan proposal for the Regional Development is the conception and application of a model, which, by making good use of modern communication technology and IT systems, will assure the efficient, easy and unique operation of the HC at a national, regional and local level.

The fundamental elements of the master plan proposal for the regional development consists of:

1. *administrative* and *organizational* issues: the general planning of the system and its administrative structure, such as the basic responsibilities of various departments/branches/offices etc., the necessary forms and manuals for the implementation and operation of the work, the human resources and necessary personnel, etc.;
2. *technical* issues: the definition of the technical infrastructure (hardware, software, network), that should support the various applications, the products of the HC, and the databases of the digital data derived from the cadastral surveys or other sources at all levels;
3. *financial* issues: cost-analysis concerning the investment cost (expenses for the purchase and installment of the hardware/software for the regional structure) and the operational cost of the regional structure; and
4. *coordination plan* for its application.

In brief, the basic factors that influenced the decision for the regional structure proposal were the:

1. general international experience. The most important issues are:
 - private and public sector are closely cooperating by introducing more privatization for the keeping of the Cadastre under the supervision of the state;
 - the decentralized operational model is encourage;
 - cost-recovery strategies are developed; and
 - digitization and modern information technology is introduced.
2. administrative structure of Greece:
 - the existing administrative structure of regions, prefectures, municipalities and communities, constitutes a sustainable and operational structure for efficient public administration; and
 - the efficiency of local authority, which nowadays has significant responsibilities has been proved sufficient and necessary for the local development.
3. regional structure of the existing Mortgage Bureaux System. A very important point is that according to the Law 2664/98 the Mortgage Bureaux, that belong to the areas that join the HC project each time, will work as cadastral offices for the transitional period;
4. the easy access to the cadastral offices:
 - during the compilation period the citizen should be in continuous contact with the cadastral office; and
 - during the operation of the HC every citizen should not only enjoy better service but easy access, too.
5. the efficiency of the Cadastre in all levels:
 - the aim is to achieve the expediting of all necessary operations within a tolerable cost and time length.
6. the management and availability of the products. One of the most important activities for the achievement of cost-recoverability for the HC and especially for the Ktimatologio SA will be the marketing of the products. After the compilation period there will be a series of byproducts that should be available, such as topographic maps, DTM, ortho-photo maps, database in GIS structure, statistical data, etc., that may constitute the infrastructure for the development policy. The main users of the byproducts will be the public services, the local authorities, the utility services, private companies, individuals that their activity is focused on regional level.

The *proposed plan* of application for the Regional Development of the National Cadastre refers to the following function levels (*at the moment, this is only a proposal under development*).

The whole project will be under the supervision of HEMCO and Ktimatologio SA, the existing headquarters in Athens, at national level. The regional system will consist of three levels:

1. *Regional centers*: there will be five regional centers, which will be regional branches of the Ktimatologio SA and will be under the responsibility of the Regional Structure Department.
2. *Cadastral offices*: according to the proposal, there will be 55 cadastral offices (one at each of the 54 prefectures of Greece, however, at the prefecture of Attica, which is the largest and most active, there will be two offices in operation). Taken into consideration the particular circumstances at the islands, the isolated mountainous areas, the areas close to the frontiers etc, it is estimated that finally the number of the cadastral offices in full development will be about 70.
3. *Service offices*: for the benefit of the individual citizen, for his/her better service and access, a series of service offices for the public is proposed to be established at a local level (municipalities and communities) all over the jurisdiction. These offices may be operated either by the local authority or by individuals (private sector) and may be established either within the Greek State or at the Greek Embassies abroad.

The present proposal consists of only a *draft plan*, which will be further investigated, developed, documented, discussed, improved and finally ratified by the headquarters office procedures (Fig. 1).

5. Legal aspects — national legal framework

5.1. The adjudication procedure

The Law 2308/1995 (Government Gazette, 1995) rules the cadastral surveys for the establishment of the HC, describes the adjudication procedure preceding the first registration in the cadastral records and establishes the Ktimatologio SA.

In brief the procedure is as follows.

1. The area (of one or more municipalities) is declared to be under cadastral survey. The boundaries of this area are defined by a Ministerial Decision, that follows at HEMCO proposal. The decision should be published worldwide.
2. All who have real or other rights to be registered in the cadastral records on real estate in the area under cadastral survey are called to *submit declarations* with descriptions of their rights and references as to the manner of their acquisition. The declarations are to be submitted within a 3-month term. The declaration submission is obligatory. For each change in the rights, which occurs after the day following that of the submission of the initial declaration the owners are obliged to submit additional declarations.
3. In the event of the submission of a false declaration, the provisions of an existing Law (1599/1986) come into effect. In the event of omission of a declaration submission, any real deed on the real estate referred to is

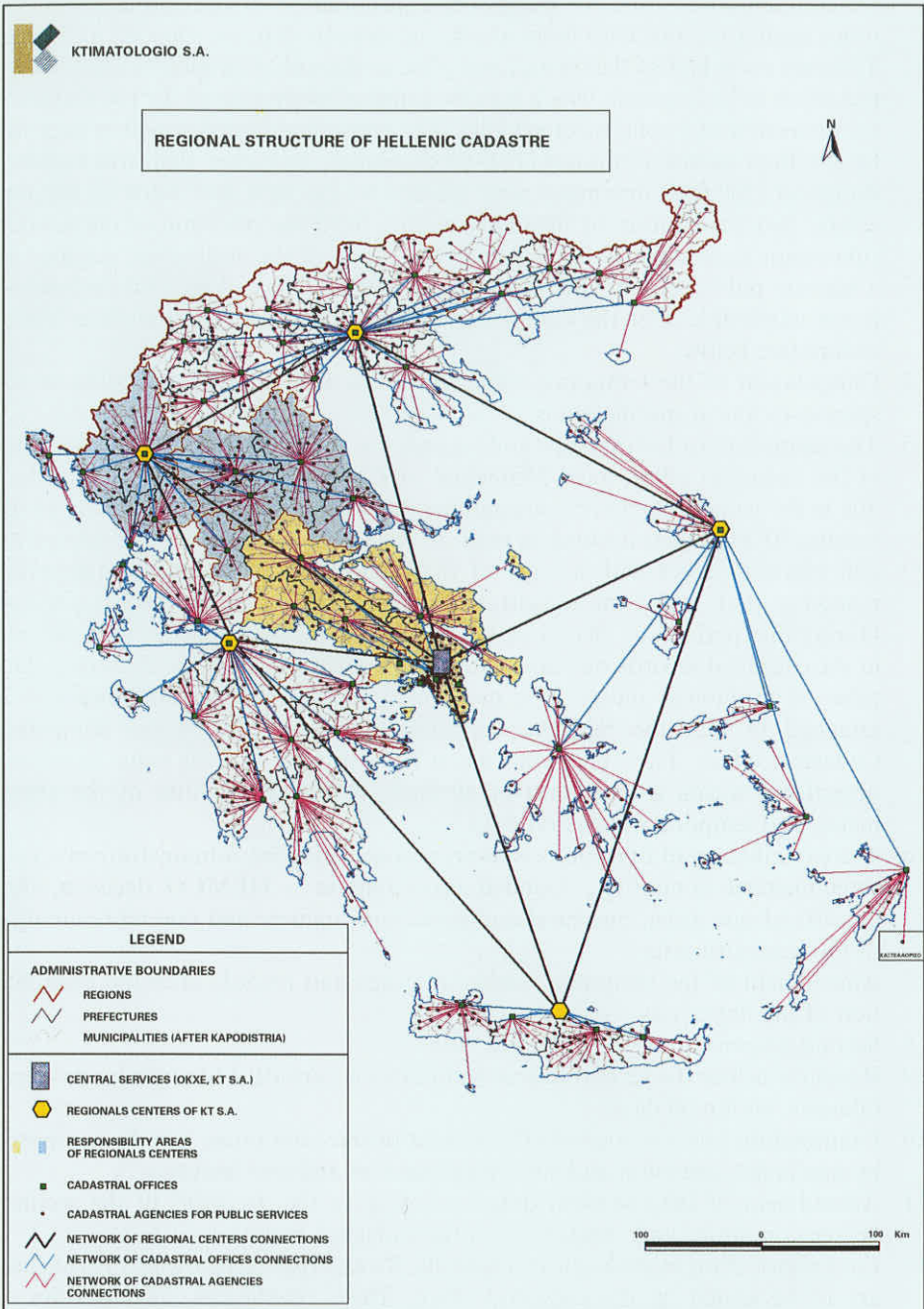


Fig. 1. Proposed regional structure of the Hellenic Cadastre.

prohibited, as is also the granting of a building license, the collection of possible compensation owed for obligatory expropriation of the real estate or for other similar reasons is to be blocked, and deposited in the Deposit and Loan Treasury on behalf of the owner, and after a relevant assurance by HEMCO, a penalty is to be imposed, which is to be collected according to the provisions of the collection of Public Income Code. The above mentioned penalties may not be less than twenty thousand (20,000) drachmas, or higher than five hundred thousand (500,000) drachmas proportional to the type and value of the real estate. Any prohibition or invalidity arising from the omission of declaration submission is removed by the belated submission of the declaration certified by a relevant publication by the competent Cadastral Office. A belated declaration is not admissible after the completion of the second-degree Committee's procedure (see below).

4. Compilation of the temporary cadastral maps and records, according to the specific technical specifications.
5. The temporary cadastral maps and records *are to be displayed*, for two months, at the cadastral office, local Municipal or Communal office. Instead of that, due to the gained experience through the Pilot Phase, for better publicity of the results, HEMCO has decided to mail, to each owner, a copy of the map of his real estate together with a copy of the record with the textual information related to that, called the cadastral sheet. This stage is called *first suspension*. During that period any change of the real rights or other rights to be registered in the cadastral records on real estates of the area, to which the displayed data refer, is prohibited unless it is mentioned in the contract and unless it is attached to that the relevant cadastral sheet supplied by the competent Cadastral Office. Each one, who has a legal interest has the right to submit objections, within a time limit of 60 days, to the registration of the above mentioned temporary cadastral data.
6. The examination of objections is done, within 2 months, administratively, by a three-member committee, founded according to a HEMCO decision, that consists of one jurist, one rural and surveying engineer and one representative of the local authority.
7. Amendment of the temporary cadastral maps and records after the examination of the objections.
8. Second suspension of the cadastral data.
9. Recourse before the second-degree committee is permitted to any who has legal interests, within 60 days.
10. Examination of the recourses. The second-degree committee is to be composed by one judge, one rural and surveying engineer and one lawyer.
11. Amendment of the cadastral data according to the decisions of the second-degree committee and completion of the cadastral survey.
12. First registration in the cadastral records. To the registered owners certificates are to be issued by the cadastral office. These certificates are not titles of registered rights and do not create a proof of them, but certify, with reference to the real estate, the first registration in the cadastral records, the date and the

rest of its basic data. For the issuing of this certificate a recovery fee is to be paid to HEMCO, whose amount may not be less than ten thousand (10,000) drachmas nor in excess of three hundred thousand (300,000) drachmas and is to be published to the Government Gazette. The income from the collection of this recovery fee is to be registered in HEMCO's budget, and is to be available for the attainment of its goals.

5.2. *Maintenance of the HC*

The Law 2664/1998 (Government Gazette, 1998) describes the fundamental principles for the operation of the Cadastre, describes the regulations under which the first registrations lie, defines the content of the cadastral record, and the responsibility for the operation/maintenance of the cadastral data.

The first registrations will constitute the cadastral base, on which any posterior registration is based. The time limit for dispute of the correctness of the first registrations, before the competent ordinal courts by any who has a legal interest, is five years (the relevant period for people living abroad is seven years). The first registrations, whose correctness have not been in dispute within this limit, are to be validated by the expiration of this time limit. Then, a permanent proof is to be created for those inscribed at the first registrations as owners of the rights; this is the title to the land. Any change to the content of the first registrations is then prohibited. In the case of inaccurate first registration, the real owner, who has sustained a loss by the permanent proof, has a financial claim only against the inaccurately registered owner for the return of enrichment caused by the creation of the permanent proof. Real estates that are shown in the cadastral records as "of unknown ownership", come into the public domain after the validation of the first registration.

In brief, the transfer from the existing System of Transfers and Mortgages to the new cadastral system will be achieved gradually, region by region. According to the above law (article 23) this transfer has as follows:

1. Since the beginning of the Cadastral validation, at a particular region, the registration to the registers kept until that time at the locally competent Mortgage Bureaux are to be ceased. From that period on, the responsibility for the registration of the transactions now belongs to the Cadastral Office only. Consequently, the Mortgage Bureaux abolished continues to operate as a Cadastral Office. In the case that part only of the region, which belongs to the responsibility of the Mortgage Bureaux is incorporated to the Cadastral System, then both systems will be functioning for each part of the particular region, respectively.
2. Responsible for the keeping of the cadastral data are the cadastral offices, which are the basic administrative units of the Cadastre, and which are incorporated administratively in to HEMCO. With a Presidential Decree, after a proposal by the Ministers of the Presidency of the Government, Interior, Justice and the Environment, Physical Planning and Public Works, the

responsibilities for the operation of the cadastral offices and the keeping of the cadastral data can be transferred from HEMCO to organizations of local authority.

3. The data kept at the cadastral office are the following:
 - the cadastral maps for the whole area of the cadastral survey, which is under the jurisdiction of the relevant cadastral office;
 - the cadastral tables for the real estates, which are included in the cadastral maps;
 - file of the real estates and the buildings based on the Hellenic Cadastre Code Number (KAEK), in correlation with the cadastral maps and the cadastral tables;
 - the cadastral book, which consists of cadastral sheets for each real estate, the full content of the cadastral sheets is mentioned below;
 - the calendar, in which all applications for registration in the cadastral book are inserted according to their submission order, so that the fundamental principle of time priority is secured;
 - the alphabetical index of the owners of the rights registered in the cadastral book;
 - the file of titles and other justifications, which are submitted with the applications for registration in the cadastral book.
4. The cadastral book is to be composed of the *cadastral sheets*, which have continuous numbering and in which the cadastral registrations are to be registered both electronically and printed, according to those defined in details at the specifications, of HEMCO.
5. Each real estate has a corresponding cadastral sheet. *The minimum data that must be registered on the cadastral sheet*, are the following:
 - The data, which *define* the real estate and particularly the Hellenic Cadastre Code Number, to which the real estate is also related with its representation on the cadastral maps, *the location* of the real estate, by mentioning the address for urban real estates and the area and location, in which it lies for non-urban real estates, etc.;
 - The information, which define the *legal substance* of the real estate, as an object of ownership, which belongs to two categories; to that which refers to the ownership of the real estate [in which, also the co-ownership and the horizontal (floor)-ownership and vertical ownership are to be included] and to that, which refers to the other kind of rights, i.e. lease, mortgage, the pre-note of mortgage, the right of mine-ownership, the long duration renting of real estates (for a period longer than nine years), the time sharing hiring, lawsuits, seizures obligatory or conservatory. In the last case, besides the identity card data of the lender, the title on which a seizure of the real estate was based, and the registration date, the demand whose the satisfaction or insurance is pursued is also to be noted on the cadastral sheet. The same is also valid for a mortgage.

6. The deeds to be registered in the cadastral sheets are:

All deeds that are registered to the up till now valid Mortgage Bureaux system. Since both systems follow the principle of publicity of the real estates rights and they will have a parallel validity for a pretty long period (in *different* regions, of course), this correlation is obligatory. It is worth mentioning that besides expropriation, which actually constitutes title of acquiring ownership and has to be registered on the cadastral sheets, also the declaration of a future expropriation has to be registered in the part of the cadastral sheet, which refers to the leaseholds and to enchainments of the ownership. A note of the deed, by which the obligatory expropriation was declared and the fact that it includes (partially or wholly) the real estate, to which the cadastral sheet corresponds, is needed. The same is valid also for the ratified road planning or the urban planning plans and for any other operationally relevant deed. The aim of this is to protect any purchaser from possible future alterations of the legal rights.

7. The procedure of the cadastral registrations is as follows:

- submission of application and of all the documents, in which the deed whose registration on the cadastral sheets is requested, is to be written;
- for the submission of the application any person whose legal issues are influenced directly by the content of the deed is to be legalized. This submission may also be done by an attorney, whose power was offered notarially, or by the notary, who has compiled the deed, or if it is a court document of a judicial decision by the lawyer;
- the applications are registered immediately after their submission, on the same day, on the calendar (date and time), with a continuous, serial numbering, so that the principle of time priority is to be kept;
- a legal examination of the submitted data follows. In the case that the submitted papers are insufficient, the Head of the Cadastral Office has the authority to decide whether the registration will be temporary, until the applicant brings the missing documents etc., or definite, or whether he will reject it;
- against a negative decision the applicant has the right to raise objections by submitting a relevant application before of the locally competent Cadastral Judge;
- a correction of the cadastral registrations, due to dispute of those rights noted in the cadastral sheets, is possible only with a permanent judicial decision. The Head of the Cadastral Office has the right to forward a correction of obvious error of the cadastral registration. The Head of the Cadastral Office has the right for the correction of the geometric information of the cadastral registrations in the case of a posterior more accurate cadastral survey; and
- the registration of subdivided parcels and the procedure of necessary measurements during the transaction is not described in this Law. The details of the procedure to be followed are still under development.

6. Technical issues of the HC

6.1. Technical specifications

In November 1994, HEMCO published the ratified issue for the Technical Specifications (TS; HEMCO, 1997), which govern the execution of cadastral work for the HC. The basic principle in the philosophy of the TS is the clear description and the objective control of the final product, not the description of the methods to be used in its production. It is the emphasis on product rather than method, which contrasts with the official TS for pure topographic surveying works obtaining in Greece at that time. HEMCO selected the accuracy demands and the content of the final maps, entrusting to the private surveying companies the responsibility for the choice of methods and the instrumentation that they will use to reach the desired result. Having as criterion the achievement, in the cheapest possible manner, of the unified character, the consistent updating and the reliability of the cadastral information, HEMCO has elaborated and defined these Specifications. In the composition of the texts the extant material (presidential decrees, ministerial decisions, decisions of the Board of Directors of HEMCO or interior decisions of its services) was used. The first issue of the TS has of course been revised, enriched, completed and in some cases reconstructed to result in greater effectiveness, cost efficiency and prescription of the obligations of both sides with more clarity for a fruitful and harmonious cooperation between the private professional sector and HEMCO.

In brief, the TS prescribe and/or define:

1. That the geodetic reference system of the HC is the 'Hellenic Geodetic Reference System of 1987' with reference ellipsoid the GRS'80 and fundamental point with conventional coordinates $\varphi = 38^{\circ}04'33''.8107$ B, $\lambda = 23^{\circ}55'51''.009$ A and height of geoid $N = 7.00$ m. The projection reference system is the transverse mercator projection. The trigonometric and level national network can be *densified* according to the needs, using unique signification of these points to facilitate the easy recognition and use.
2. The planning, signification, measuring methods, calculation and accuracy demands, documentation, data to be delivered, supervision, quality control and procedure of the reception of *urban topographic network of high accuracy* (of a density of 1 point every 500–100 m), for the necessary horizontal and vertical control of the cadastral surveys. This network will constitute the basis, on which the objections concerning the geometric information of the cadastre will be based, and it will be used, in future, for the updating of the cadastre.
3. The organization of work, planimetry, leveling, topographic control network, content of topographic basic maps, construction of the cadastral maps, geometric accuracy, cadastral number, parcel characteristics, land uses, data to be delivered, etc. in *urban-suburban, rural and other areas* for the compilation of *cadastral surveys*:

urban-suburban areas: digital photogrammetric or field surveying maps, on a scale of 1:1000 or existing reliable topographic or cadastral maps;

rural areas: digital ortho-photo maps on a scale 1:5000 or existing reliable topographic or cadastral maps; and

other areas: digital ortho-photo maps or existing reliable topographic or cadastral maps or rectified aerial photos on a scale of 1:10,000.

The maximum value of the mean square error in the distance between two successive control points, of the control network in urban-suburban areas, should be less than 10 mm + 100 ppm; the maximum mean square error in direction between two successive control points should be less than 20 cc and in the azimuth less than 50 cc. In rural and other areas should be 10 mm + 200 ppm, 50 cc respectively, and in the heights less than 0.20 m.

The *content of the topographic* (photogrammetric or field surveying) *basic maps* is all topographic details that can be shown at the map scale: planimetric details (survey control points, buildings, boundaries, roads, squares, railway lines, pylons, pipes, rivers, streams, hydraulic installations, lakes, coast line, parks, antiquities, etc.), leveling details (contour lines — every 4 m for 1:5000, every 2 m for 1:2000 according to the terrain, elevation points).

4. The technical characteristics of the photogrammetric cameras to be used for the acquisition of the aerial photographs, the camera calibration, the scale of aerial photography (according to the map scale), the flight lines and photo overlap, the documentation of the procedure and material produced and delivered, the proportion between the scale of aerial photography and the scale of ortho-photo map (between 1:3 and 1:6), the ortho-photo map production procedure, etc.
5. The material to be delivered concerning the *photogrammetric plotting (maps)* using analytical instruments or digital photogrammetric systems: digitized aerial photos, control points-coordinates/errors, data of aerial triangulation (solution-residuals), comments, coordinate files of planimetry and leveling, the data base of the digital maps, plotting of the maps.
6. The material to be delivered concerning the *ortho-photo maps*: digital terrain model, coordinates of control and detail points, the digital data of aerial photos of photo mosaic and vector data of ortho-photo map, the negatives and diapositives used, the mapsheets of the ortho-photo map and the films.
7. Necessary material for the compilation of the cadastral maps apart from the basic topographic map also is the *declarations of the rights*, the *certificates* of transactions, seizures or claiming that is requested from the Mortgage Bureaux, the information taken from other services, the additional credible information about the boundaries of the land parcels indicated by the owners or given by an informant or collected by other means during the field survey.
8. Each land parcel is characterized by the *administrative code number (KAEK)*, which is based on the administrative division of the country and consists of 12 digits. The first two refer to the prefecture, the following three to the municipality or the community, the following two to the sector, the following

two to the cadastral unity (residential block) and the last three to the parcel serial number.

9. The topographic maps and the final cadastral maps are checked. *Quality controls* are concerned with the absolute and relative positioning of detail points. The control is carried out by *sampling* and is based on the comparison of computed data (distances and height differences) from the digital file on the one hand and from field survey measurements on the other. Differences between computed and directly measured values should follow the normal distribution. The maximal values of deviations (tolerable U_o) have been defined according to the map category (mapping scale) and are shown in the following table:

Map scale	Tolerance U_o in planimetry (cm)	Tolerance U_o in heights (cm)
1:1000	40	50
1:5000	200	250
1:10,000	400	500

10. The various types of land uses for the land parcel in urban areas (14 types), the building in urban (20) and rural areas (4) and the type of cultivated (7) or other areas (3).
11. All the details about the symbols and the map sheet format of the cadastral maps.
12. Due to the special valid legislation concerning the public rights in forest areas, there is a need for special *forest maps*. These maps are being compiled, during *every cadastral survey*, photogrammetrically using both the aerial photo series of the year 1945, which cover the whole country, and the *ortho-photo maps* produced during the CSs, in order to achieve the necessary monitoring of the environmental changes.
13. The material to be delivered in general, which is:

- lists of calculations;
- topographic control network documentation;
- prototype final cadastral maps;
- topographic basic maps;
- magnetic tapes or CDs with the files of digital maps and cadastral tables accompanied by full documentation of their content (in two copies); and
- forest maps.

6.2. Statistical analysis of information and progress of the CSs

The CSs are to be carried out by the private sector. The CSs under compilation are:

1. The CSs of the Pilot Program, developed in two phases (Phase A' and Phase B');

2. The CSs of the first main program; and
3. The CSs of the second main program.

The commissioning of the A' Pilot Phase was done in December 1995 and January 1996. This phase refers to 30 CSs, including 66 municipalities with in total 525,000 inhabitants (5.1% of the total population in Greece), of a total area of 226,000 ha (1.7% of the total area of the jurisdiction): 16,000 hectares of urban area, 74,000 hectares of rural area and 136,000 hectares of rest area. The pre-estimated cost for this phase is US\$25.5 million. The compilation work is completed and the stage of first suspension has been reached.

The commissioning of the B' Pilot Phase was done in the Autumn of 1997. This phase refers to 27 CSs of a total area of 155,300 ha (out of which the 9600 ha refer to urban land), including 54 municipalities with in total a population of 295,000 inhabitants. The pre-estimated cost for this phase is US\$12.5 million, which refers to:

1. US\$0.18 million for topographic network;
2. US\$1.82 million for the compilation of the topographic basic map;
3. US\$2.84 million for the declaration collection;
4. US\$7.28 million for the compilation of the cadastral maps; and
5. US\$0.47 million for the operation of the cadastral office during the CS.

or a mean average of US\$81 per hectare.

The areas included in the Pilot Program are scattered over most of Greece (in 34 out of 50 prefectures), as it is shown on Fig. 2., so that most representative results will be achieved, taking into consideration the particular characteristics of any type of the various areas.

The A' and B' Phases were commissioned based on *fixed prices*, pre-decided by the responsible Ministry of Environment, Physical Planning and Public Works, based on a proposal made by a special HEMCO committee. This system, tested during the Pilot Program, has been substituted by a competition, based on *technical and financial tenders*.

The commissioning of the first main program was made in October 1997. This phase refers to 38 CSs of a total area of 571,730 ha or the 4% of the total area of Greece, including 221 municipalities with 1,554,000 inhabitants and the pre-estimated cost is US\$85 million.

In detail, the compilation cost distributed on to the deliverables, according to the offered by the tender mean average unit value, will be:

1. US\$6.8 million for the cadastral maps on a scale of 1:1000 (area coverage: 61,450 ha, which refers to urban areas);
2. US\$6.2 million for the cadastral maps on a scale of 1:5000 (area coverage: 571,730 ha, which covers the total area);
3. US\$0.6 million for the cadastral maps on a scale of 1:10,000 (area coverage: 198,250 ha, which refers mostly to mountainous areas);



Fig. 2. Cadastral survey areas.

4. US\$4.6 million for the compilation of the forest maps (area coverage: 205,340 ha — forest maps are produced as separate series from the air photos of the year 1945); and
5. US\$66.8 million for the compilation of the database of the rights, which also includes all relative costs such as the non-spatial data collection, the correlation of the data written on the declarations with those of the deeds, the operating cost for the services provided by the private surveyors to the public during the declaration collection period, the input of the data, etc. This cost is estimated and paid to the private surveyors per registered right (2,731,340 registrations of rights in total).

The procedure for the selection of Cadastral Surveying Companies for the second main program has started. This program refers to 106 municipalities of a total area of 225,200 ha and its pre-estimated cost is US\$14 million. Within the year 2000, the third main program will also be forwarded, whose pre-estimated cost is approximately US\$140 million, considerably greater than the others.

6.3. Comments and proposals

According to the analysis of the available statistical data and of the experience gained up to now through the execution of the Pilot Phase and the first main program, some useful comments and proposals can be derived:

1. The *compilation of a draft* cadastral map (that means a preliminary version of a cadastral map, or an existing map, or an orthophoto) is considered to be essential during the adjudication phase for the indication of the land parcel boundaries by the owners on the draft map, whenever this is necessary. That will facilitate the localization of real estates during the declarations collection phase, the people will obtain better service, and the percentage of boundary disputes and consequently the cost, during the following phase of objections submission, will decrease considerably.
2. The possibility of the *existing* maps (produced in the past for land consolidation, planning or other purposes) utilization, in most cases, has proved to be very restricted due to the lack of digital reliable updated data. Yet, this material may well be used as the basis for the draft cadastral maps during the declarations collection phase for the localization of the parcels and the registration of the owners (Avyerinos, Clonary & Tsakanika, 2000).
3. During the execution of the first main program, in some areas, where a land consolidation was made in the past and which of course has created titles of ownership, a deviation between the real situation today in the field and what is written on the existing documents (titles and maps) of the land consolidation, or urban planning studies, etc., was noticed. In these cases, for experimental purposes, HEMCO allowed the possibility, to the private companies responsible for the cadastral surveys in the area, of either taking into consideration the information of the existing maps and titles in order to produce the new

cadastral maps or simply to compile the new cadastral maps according to what appears to be the real situation materialized in the field. In the cases of applying the second choice an increased percentage of objections was noticed during the first suspension. On the contrary, whenever an effort was made to combine the information of the existing maps and titles with the real situation in the field, especially by maintaining the area size, that is mentioned on the existing title, of each parcel, comparatively few objections were submitted.

4. The decision of having *common deadline time for the collection of declarations* in all areas under cadastral survey proved to be correct. This allowed the broad advertisement for the information of the public. In future this *advertisement should be extended* during the whole period of declaration collection.
5. Very critical factor for the success of the program is *the achievement of a better cooperation with the local authorities*, so that they will contribute to the activities of the project.
6. HEMCO should publish a more detailed issue with *guidelines* for filling in the declaration form and the necessary additional documents. This issue will be distributed to the public during the declaration collection period.
7. The delayed submission of declarations, long after the deadline expiration, is to be *continued until the finish of work of the second degree committee*. In the following the rate of declaration submission during the A' Pilot Phase is given:

declarations within the fixed time term: 67.66%;

delayed declarations and additional declarations submitted before the first suspension: 15.90%;

delayed declarations and additional declarations submitted after the first suspension: 16.44%.

From the experience gained through the A' Pilot Phase, which is the only so far that has reached the stage of first suspension and objections submission, some comments and proposals can be derived:

1. As mentioned above, common dates have been selected also for the first suspension in the various areas of the A' Pilot Phase. *To avoid crowding*, HEMCO decided to *mail* abstracts of the cadastral data to the owners. This measure is considered to be very successful and it should be continued in future.
2. The submitted objections refer to the following:
 - identification data of the owner, at a percentage of 18%;
 - land parcel data, at a percentage of 76.5% (mainly *disputes on the area size of the land parcels* at a percentage of 39% and on localization problems at a percentage of 11.5%);
 - charge data, only at a percentage of 1.2%; and
 - other reasons at a percentage of 4.3%.
3. The largest percentage of submitted objections is the objections referring to the registered *area size of the land parcel*. In most cases this happens due to the differences between the accuracy demands for the HC and the accuracy of

methods used for previous estimations of the area size of the land parcel (private or governmental) or those estimations mentioned in the contracts. As far as these differences lie between the accuracy tolerance prescribed in the TS, *the registered value is considered to be correct* and no error is detected. If these differences are larger, the responsible surveying company is obliged to make additional field control.

4. The update of the cadastral database is continued after the end of the first suspension by the Cadastral Offices, which function under the responsibility of the Private company responsible for the cadastral survey.

The input data for the updating of the database are:

- the new declarations (delayed or additional), the declarations should be accompanied by the *proof documents*;
- the data included in the deeds, which are sent by the Registrars of Mortgages to the Cadastral Offices;
- the urban Planning Implementation Acts and the Land Consolidation Projects;
- the delayed objections data;
- the data of the Mortgage Bureaux, if asked by HEMCO; and
- the decisions of the first degree committee for the examination of the objections.

6.4. Proposal for the IT strategy of the HC

6.4.1. Systems architecture and operation environment

When contemporary IT applications are designed it is necessary, among other factors, to choose mature, flexible and expansive (broad) architectures able to cover the current and future processing needs, especially when it refers to such a large scale project as the one of the HC. The current client/server architecture is the de facto standard in the development of modern applications. This architecture, at optimum use, ensures a secure and productive on-line transaction processing environment. Similarly, the Web technology represents the most popular environment for utilization of applications to users, through the Internet/Intranet. This technology offers an efficient and friendly work environment, independent from the hardware and software infrastructure.

Web technology is in position to:

1. Facilitate the flow of information
2. Reflect business processes
3. Improve productivity.

In this way it offers an inexpensive platform for viewing different types of files and a friendly graphic environment that facilitates user training. By analyzing the technological trend, our proposal on the applications development environment for the support of cadastral operations focuses on the improvement and operation in an Internet/Intranet setting.

6.4.2. Regional operations overview

Fig. 3 depicts the suggested locations of HCs regional centers (RCs). Each RC will be responsible for the storage of the cadastral data that fall under its jurisdiction. The Central System at Ktimatologio SA headquarters will function both as the repository of the data stored in the RCs and as an RC itself for the region of Attika. The area covered for each RC is depicted on the map in Fig. 3 with different colors. Each area includes several prefectures. For every prefecture there will be at least one cadastral office, preferably located at the prefecture's capital, and three cadastral branches for public services.

Fig. 4 serves as an example, by zooming into RC(02) region, where we have four prefectures with the corresponding cadastral offices (02-01 to 02-04) and the corresponding Cadastral Branches (02-01-01 to 02-04-03).

6.4.3. Links and operations of the regional centers of Ktimatologio SA

In Fig. 5 the proposed decentralized structure of the information systems that will store the digital cadastral data is shown. Relating to the distribution and allocation

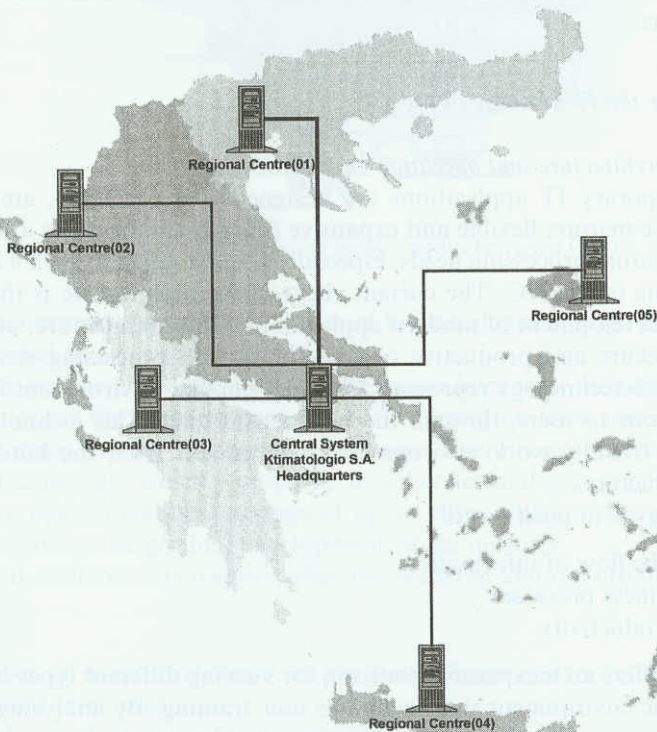


Fig. 3. Proposed regional centers for the Hellenic Cadastre.

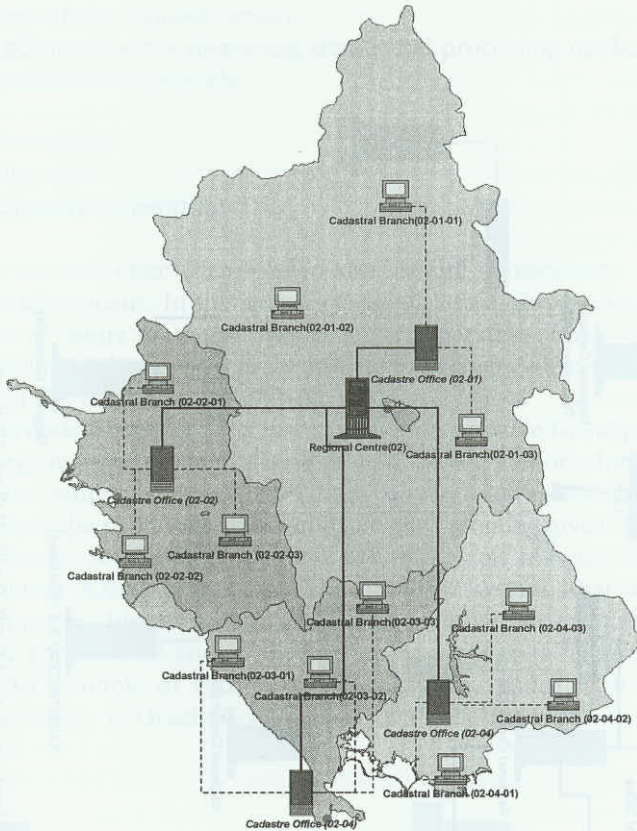


Fig. 4. Example of the IT structure inside a particular region (RC02).

of information between the regional centers of Ktimatologio SA it is necessary that they are connected to a wide area network.

This network will be accomplished through leased lines with the necessary bandwidth so as to allow the uninterrupted flow of information from one center to the other, using Virtual Private Networks technology. There is an international trend towards this technology, which, compared to other technologies, such as point to point, offers an operational cost savings of up to 60%, while, at the same time, it ensures and facilitates the gradual development of the network.

The proposed structure has resulted after the studying and quantifying of factors as:

1. the number of deeds performed by the Land Registry at a local, prefectural and regional level; and
2. the country's telecommunication infrastructure taking into account not only the available bandwidth, but also the points of presence of Internet Service Providers that grant access to the Internet.

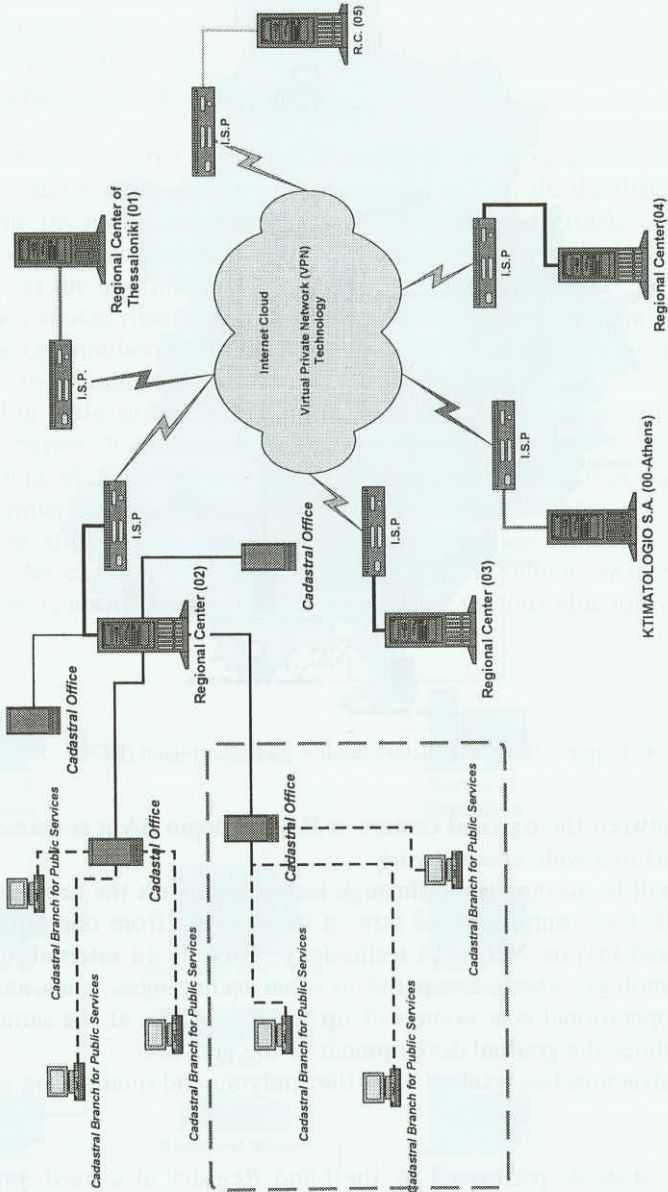


Fig. 5. Proposed decentralized structure of the IS for the Hellenic Cadastre.

6.4.4. Equipment of the regional centers

In order to efficiently serve increasing trends and processing needs, an up to date information system has to provide:

1. high performance;
2. modularity; and
3. low purchase and operating cost.

A three-tier or multi-tier client/server architecture is necessary for the implementation of such systems. In this architectural structure, the database itself is allocated to one or more database servers, the operation (task completion) of applications is allocated to one or more application servers while the clients perform the execution of the user interface.

With the above-described architecture, it becomes possible to support large databases and a large number of simultaneous users, while the efforts for administrating the systems are minimized and the overall operational costs are dramatically reduced. In Fig. 6 the proposed architecture of the system is given. In this *proposed architecture*, Server A (database server), will store and manage the spatial and descriptive data of Ktimatologio SA. The database system, that will handle the information must be able to manage geospatial data with a structure, that is independent of the applications and at the same time manage tabular, text and image information. An example of such a database system vendor, that has addressed many of these issues, is Oracle Corporation, with the introduction of the Spatial Cartridge.

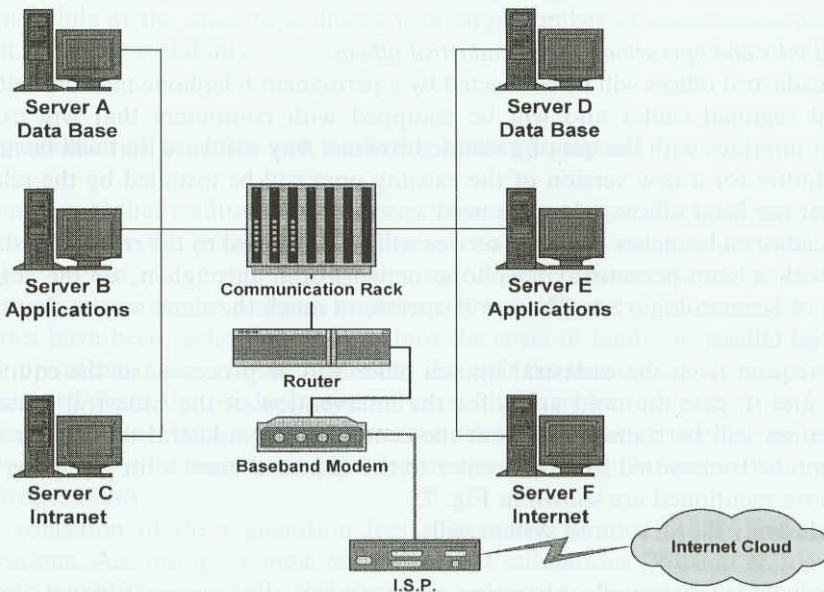


Fig. 6. Proposed architecture of the IT system.

The data requested by Server B (Application Server), are processed and then conveyed to Server C (Intranet Server), that forwards them to other regional centers, cadastral offices or regional branches for public services. Access to data of Server A is granted to cadastral offices that are under the jurisdiction of the relevant centers.

Access and security levels, will be utilized, so that each cadastral office will have the right of Inserting or Updating data, that refers only to the areas of its responsibility. All other regions have the right of a Read Only access.

In order to ensure data integrity on one hand, and to decongest the operation of Server A, on the other, a parallel array (Servers D, E, F) for servicing the Professional Groups is built, that will have the authority of accessing the data (attorneys, notaries, civil engineers, banks etc.). Server D, an online Read Only copy of the data is stored on Server A, that is automatically replicated. Server E, executes the IS Oracle applications according to authority level, while Server F ensures transmission and receipt of information, at the same time confirming that the request for access comes from a certified user.

The applications served by Server B are for the exclusive use of the cadastral offices and branches for handling and associating owners, properties, rights, deeds, issuing of certificates and also for the maintenance of spatial data. The applications served by Server E will handle review requests on the stored data like property location and status, map production, routing, land use, demographic information etc.

At the head offices of Ktimatologio SA it will be necessary to build a third array of servers, for supplying information to the public (the content and the type of this information falls under the legal aspects).

6.4.5. *Links and operations of the cadastral offices*

The cadastral offices will be connected by a permanent telephone network with the relevant regional center and will be equipped with computers that will execute the user interface with the use of a simple browser. Any software that will be needed in the future (or a new version of the existing one) will be installed by the relevant center or the head offices, when the need arises.

The cadastral branches of public service will be connected to the relevant cadastral office with a semi-permanent telephone network and through it, to the regional centers of Ktimatologio SA. These will operate in much the same way as that of the Cadastral Offices.

Any request from the cadastral branch office will be processed at the equivalent center, and in case the need arises for the intervention of the cadastral office, the information will be transmitted from the center to the cadastral office. The result will again be transmitted from the center to the cadastral branch for public services. The above mentioned are shown in Fig. 7.

Conclusively the structured system will:

1. provide, in a friendly operating environment, data access (textual, spatial, pictures etc):

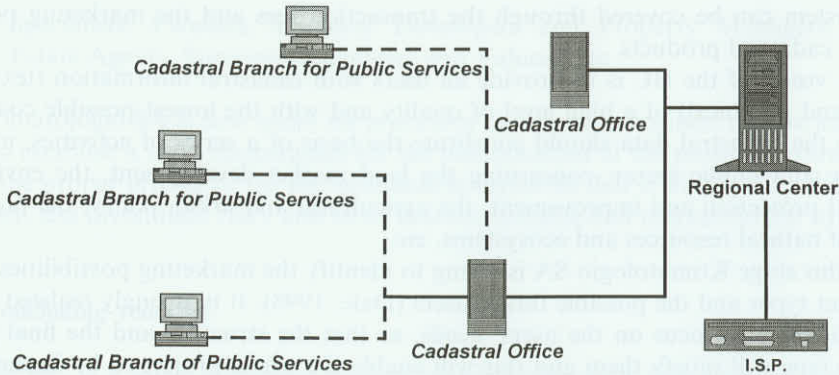


Fig. 7. Links between cadastral offices.

to the users who will be appointed by a common Ministerial Resolution from the Department of Internal Affairs and the Department of Justice; to users independently of their location (for example, through LAN connection, modem, wireless, mobile etc.); and at anytime (24 h per day).

2. handle complex data and applications with a specific number of powerful servers, that will be administered by a small number of specialized personnel. In this way the overall cost of the system will be reduced, while at the same time the quality of the service provided will be improved.

In the way described above, the utilization of the Web reduces the cost of the IT systems, while at the same time allows to a large number of users access to information, ensuring scalability.

7. Organization of products and marketing strategy proposal

It can be said that traditionally there has been a recognition, that the State has the responsibility for the provision of cadastral mapping. However, in recent years, there has been a major shift in the thinking of Governments about the costs and benefits of many of the services traditionally subsidized by the taxpayer. Many countries have been seeking ways to reduce the costs of land registration by introducing privatization or cost-recoverability through the increase of revenue, that can be generated from the products and services, that can be provided. It is broadly accepted that today, land registers store a wealth of information that can be used for many purposes other than to simply support conveyancing (Economic Commission for Europe, 1996).

The collection of the registration fees is expected to start by the time of first registrations. According to some early financial estimations (Potsiou & Ioannidis, 1998) the establishment of the HC system is expected to be supported by the State and the registration fees. On the contrary, the estimated maintenance expenses of

the system can be covered through the transaction fees and the marketing policy of the cadastral products.

The vision of the HC is to provide all users with cadastral information (textual/legal and graphical) of a high level of quality and with the lowest possible cost. In future the cadastral data should constitute the basis of a series of activities, in the private and public sector, concerning the land market development, the environmental protection and improvement, the agricultural and urban policy, the protection of natural resources and ecosystems, etc.

At this stage Ktimatologio SA is trying to identify the marketing possibilities, the product types and the possible future users (Dale, 1998). It is strongly realized how essential it is to focus on the users' needs, so that the structure and the final product's type will satisfy them and this will enable the whole project to be financially sustainable. In this manner, the whole company will be market driven and more particularly land market driven, according to the international models. The available cadastral products are either spatial or textual. The products that quite soon may be available to the users are:

3. ortho-photo maps;
4. photogrammetric and topographic maps;
5. cadastral maps;
6. air photos;
7. leveling data (contours, DTM);
8. forest maps;
9. coordinates of trigonometric or other control points;
10. administrative boundaries;
11. cadastral tables (owners, rights); and
12. certificates, etc.

The availability of these data will of course be possible each time only for the areas that have been declared under cadastral survey and after a considerable time necessary for their production. In the long term Cadastre will be gradually able to provide its users with more information about the land market, the buildings, thematic information or in general cartographic, geographic and statistical information at a national level.

The customers for such a land information system may include most government departments and many sectors of the community, for instance:

1. Agriculture and Forestry, Defense, Education, Environment, Finance/Economic Affairs, Health, Highways and Transportation, Housing, Internal Affairs/Police, Justice, Local Government, Natural Resources, Planning and Development, Power and Electricity, Public Works, Trade and Industry, etc.; and
2. Architects, Banks, Construction Companies, Economists, Engineers, Environmentalists, Farmers and Foresters, Financial and Insurance Advisors, Investors, Land and Property Owners, Lawyers and Notaries, Marketing

Specialists, Planners, Property Developers and Property Managers, Real Estate Agents, Surveying Engineers and Valuers, etc.

Ktimatologio SA is now *under the process of developing* a business culture and will try to establish a close cooperation for the identification of the possible future users and the proper pricing of the HC products in future so that it will develop the most proper, less investment risky and more cost-recoverable and market-driven strategy.

8. Concluding remarks

The HC is a huge, ambitious project, which addresses a vast array of political, management and technical challenges. During the 5 years of its execution many problems in various fields have been faced successfully; yet, equally many will arise in future.

The careful, multidiscipline, scientific, approach that is being taken towards the implementation of the HC within the Ktimatologio SA and the support provided to the project at political and governmental level guarantee the quality of the work done and the future of the HC. The public acceptance achieved and the cooperation established between all involved groups (lawyers, surveyors, IT experts, notaries, foresters, etc.) have influenced the implementation process positively.

The very interesting technical and legislative aspects, such as the establishment of the database, the IT strategy, the regional structure of the cadastral offices and the keeping/updating of the cadastral data are under continuous research and development and their final official version is expected to be available soon.

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