

Generalizations

In conclusion, we can summarize the means of the property tax in Comparative Law in the following way.³⁷

Property Transfers	Proof
Verbal agreement	Witnesses
Private sale-purchase	Non-registered deed
Deed inscription	Deed registration
Title registration	Title registry

Formal-substantive link in the registry-cadastral system

The European tendency is toward multiple objectives, automation, geocodes and digitized information. The integration of information has been very difficult when it has been maintained in manuscript form. That is, the automation of information is the key to achieving the integration in a system. The geocodes allow the conversion of geographic information to spatial systems. If the unit of land has assigned coordinates in a national plan, it is possible to connect all the country's geographic information. The digitalization of information first occurred in the cities. Currently, this practice is extending to other areas. The creation of plans with different scales and with a combination of various information levels is possible. This process also allows for the integration of information of public services, a necessity in all of Europe.

Between 1986 and the year 2000, the United States will spend \$90 thousand millions in collecting and maintaining related geographic information. Each year in Canada, 0.50 cents per person is spent in mapping and land surveying.³⁸ Developed countries are about to start a new era of technology and information to achieve prosperity and economic development. Developing countries, however, are in danger of lagging behind.³⁹

With the inception of the Torrens and other cadastral systems, the property tax registry has played an important role with

the cadastral agency by possessing critical information for the formulation of the MPLIS/GIS.⁴⁰ However, in all parts of the world the most significant element to improve the existing systems is its appropriate administration.

Frequently the current systems are antiquated and inflexible in their operations and system operators are not aware of alternatives and actual expenses.⁴¹

A Methodology Of Registry-Cadastral Reforms: A System Of Multipurpose Land Information

Definition

As the name indicates, a Multipurpose Land Information System/Geographic Information system is a land information system designed to respond to generating a number of objectives including those of registries and cadastres.⁴² In its traditional form, a MPLIS/GIS contains a variety of land information including property, utilization, surface, soils, geology, zoning and other land use restrictions, swamp lands, and flood plains. In addition, it includes a geodesic base which generally proceeds from the general geodesic network, that has as an objective to integrate the

⁴⁰ J. David Stanfield, "Rural Land Market Implications of Titling and Registration Programs in the Latin America and Caribbean Region" (University of Wisconsin Land Tenure Center, 1991) page 5.

⁴¹ Peter F. Dale and John D. McLaughlin, *Land Information Management* (1990) Page 229.

⁴² Much of the information presented here is a summary of: Steven E. Hendrix y D. David Moyer, "Property Registries" 2 *LAC TECH Bulletin* (July, 1992); Steven E. Hendrix, "Estrategias para Acceso a la Vivienda con la Gente, Información y Tecnología (main presentation of the VIII Reunion, la Red Latinoamericana y del Caribe de Instituciones de Vivienda, Gestión y Medio Ambiente Urbano, Santo Domingo, Dominican Republic, August 19-20, 1993); Steven E. Hendrix, "Land Tenure in Guyana: A Rapid Appraisal Report with Recommendations on Policy Formulation and Registry Modernization for the A.I.D. P.L. 480 Program" (University of Wisconsin Land Tenure Center, June, 1993) pages 23 et seq.; Steven E. Hendrix, D. David Moyer y Ronald Strohlic, "La Reforma del Registro de la Propiedad en Guatemala: Informe de Situación con Recomendaciones" (June, 1992) pages 26-41; D. David Moyer, "Multi-Purpose Land Data Systems" (Natural Resource Economics Division, U.S. Department of Agriculture, October, 1979); D. David Moyer, "Property, Information and Economics: A Foundation for Land Information System Evaluation" *Geo-Processing* (1980) pages 275-295; D. David Moyer, "Land Title Records and Recording Procedures in the United States" (Center for Resource Policy Studies, University of Wisconsin, August, 1974).

³⁷ Gerhard Larsson, *Land Registration and Cadastral Systems* (1991) page 17.

³⁸ Peter F. Dale y John D. McLaughlin, *Land Information Management* (1990) page 2.

³⁹ Peter F. Dale y John D. McLaughlin, *Land Information Management* (1990) page 227.

system's data. The location coordinates function as an axis to connect all the data.

The data from a MPLIS/GIS consist of a series of levels. The characteristics of the plots are the basis for several of the levels. Other levels are built from the information collected from areas such as soils, surface, and geology. The common frame of reference (the general geodetic network) makes it possible to combine data from plots and polygons for a broad variety of uses. The main purpose of a MPLIS/GIS is to supply users with information about the property, value and land use.

Each level in an MPLIS/GIS has a person responsible for its operation. Consequently, the Property Registry Office will maintain the plot's ownership status, the office of appraisal and assessment maintains the tax data and a planning office compiles land and soil use data.

Given that an MPLIS/GIS is destined to serve a variety of users, its construction and maintenance should be done in such a way that the data are:

- Sufficiently accurate to meet the required uses.
- Sufficiently compatible to be used in combination with other data bases, part of the same system; and
- Sufficiently broad so that in any moment adequate and current information can be obtained.

However, an MPLIS/GIS consists of more than just data, computers and programs. Staff, personnel and institutional support are also necessary for its operation. A coordinated program that sets up and administers all aspects of an MPLIS/GIS is required for it to be successful.

Benefits

The operation of an MPLIS/GIS represents various types of benefits among those are the increase of efficiency, efficacy and equality.

The implementation of an MPLIS/GIS results in greater efficiency. Costs are decreased as a result of a reduction in the duplication of data gathering and in the maintenance of multiple

sets of similar maps. Other costs if not reduced are stabilized benefiting governmental operations.

A second benefit derived from the implementation of an MPLIS/GIS consists in improved data access. Titles can be transacted more rapidly with a complete and coordinated data base. To this data base one can easily and rapidly add new data and technology such as the location of data via Global Positioning Systems (GPS).

The third benefit that MPLIS/GIS offers is greater efficiency by the state. A better access to data and analysis stored in the system and the possibility of using these in additional tasks, improves the efficiency of the government and makes it more competitive, either at the department, national or international levels. With the implementation of an MPLIS/GIS considerable improvements can be expected in land transfers, thus supplying a rate base of properties for tax purposes and information for the administration of resources and environmental planning.

The MPLIS/GIS systems seem to be more exact and impartial than manual systems since the technology geared toward the administration of land information can incorporate detailed data without the biases, real or perceived, that on occasion are associated with manual systems. The use of this type of system tends to increase since its users consider it more objective.

The improvement in the flow of information eases governmental efforts to increase land and housing access. Frequently, free market economic strategies include a strategy of a land or housing bank, a mortgage bank, property taxes, titling projects, leasing with an option to purchase and sale-purchase programs. All the tools to activate a market depend on the access to a reliable flow of accurate information.

In summary, the benefits of using an MPLIS/GIS are great. Cost reductions are expected due to a reduction in collecting, storing and sharing of data. In the long term, the benefits will increase as the analysis and capabilities of the system become more complex.

Typically, an MPLIS/GIS model includes elements such as:

1. District boundaries

- Tax districts
- Political districts
- Other districts

2. Land survey information

- Corner points
- Geodetic points
- (Monumentation and remonumentation boundaries)
- Public access boundaries
- Roads
- Railroads

3. Plot information

- Plot boundaries
- Plot identifiers
- Plot location and address
- Legal description
- Mining rights
- Solar rights
- Infrastructure/edifices
- Tax appraisal and assessment
- Tax amount
- Tax rate
- Specific zoning
- (Restricted limits)

4. Hydrology

- Wetland information
- Rivers and streams
- Water currents, rivers banks
- Flood plain areas
- Water well location
- Underground water quality and location

5. Land/Terrain/Soil

- Outline
- Grade

6. Infrastructure

- Location
- Cable, electricity and gas mains
- Sidewalk location
- Water pipes
- Sewage drainage
- Location of manholes

7. Demography

- Plots, blocks, sections
- Census estimates
- Votes and election results

8. Other

- Geology
- Soils
- Environmental corridors
- Parks
- Hazardous/contaminated waste sites
- Historical use of land
- Current use of land
- Proposed use of land
- Classification of zoning boundaries
- Location of landfills
- Municipal boundaries
- Current location of buildings
- Proposed location of buildings

In other places, the MPLIS/GIS can incorporate spatial information, such as breakwaters, irrigation systems and ecology among other information as required. Usually, proposed users are members of the private sector (including private citizens and businesses), the municipal governments and other segments of the government. Other members include, public and private utilities, regional or state government, universities and organizations. Statistically, the most used information is land data (as described above).

In the United States, users normally request a hard copy of the data due to the lack of computerized systems. When systems become computerized, the interested users request digital information. The latest computerized system is called ARC/INFO. The second most used system is called DXF. Others such as DLG, Intergraph DGW, Intergraph SIF, MOSS Export are also used. Even with computerized systems, a great number of users request hard copy information. Nevertheless, the tendency is computerized information.

Design and implementation of a MPLIS/GIS

The design and implementation of a MPLIS/GIS is a complex process. MPLIS/GIS, as aforementioned, is not only made up of computers and programs. Consequently its implementation implies more than just the purchase of equipment and programs needed for its operation. Such equipment, programs and other components of a MPLIS/GIS are to be carefully adapted to meet the requirements and characteristics of the general structure that supports it.

The following seven essential phases are to be followed in order to ensure the development and implementation of a MPLIS/GIS adapted to the appropriate requirements of its users:

1. **Determine the system's scope**
2. **Introduce the MPLIS/GIS technology to the community which will develop and use it.**
3. **Estimate the users' needs**
4. **Analyze the system's requirements**
5. **Design the system**
6. **Design the implementation process**
7. **Design pilot projects, demonstrations and operative evaluations**

1. Determination of the project's scope

The first and essential phase for the design and implementation of a MPLIS/GIS is to determine the scope of the project and to determine the functions and agencies which the MPLIS/GIS will serve. The key is to include a sufficient number of participants to justify the principal benefits that the MPLIS/GIS

will supply. At the same time, the project's magnitude must be limited so that governments will be able to administer and finance its construction and operation. Even in the earliest stage, it is important to consider not only what data sets to include but also how to store and update them. A data base without adequate maintenance will rapidly deteriorate and will doom the MPLIS/GIS to failure.

2. The introduction of MPLIS/GIS technology

The introduction of technology has two purposes. First, it presents to a determined organization the new concepts, methods and equipment that constitutes a MPLIS/GIS. This phase is destined to tackle questions about a MPLIS/GIS. For example, what new equipment, techniques and methods will be used? How will services and products change? What are the proposed costs, benefits and other implications involved in the use of MPLIS/GIS technology? Second, the introduction to technology propels potential participants in the implementation process of an MPLIS/GIS. In which way will the organization achieve the transition? How and why will users participate in the estimates of the requirements. What are the long term goals? What is the role of the users in the use and maintenance of an MPLIS/GIS.

By definition, an MPLIS/GIS involves a certain number of agencies and many people. Due to varying points of view in such groups, it is necessary to select a leader that will ease this process. Consequently, if a leader has not been designated during the previous phase, one should be selected during this phase. This person should be capable of convincing the system's users and policy makers about the system's potential achievements to guarantee its support. For a successful implementation, it is essential that cost estimates, benefits and necessary institutional changes be realistic.

3. User needs assessment

The first step in the user needs assessment is to identify the potential users of a MPLIS/GIS. Subsequently, what each user accomplishes, how it is accomplished, what data and techniques are used and how the user employs the technology of a MPLIS/GIS

need to be determined. Among questions to answer in the needs assessment phase are:

- Who uses the registry in this organization?
- What type of data is managed in this organization?
- How are the data utilized (analysis, decision making processes and generated information)?
- How frequently are the different types of registrations obtained and updated?
- Who is responsible of the maintenance of data?
- What improvements will automation achieve (e.g. what transactions will be conducted efficiently, and which new transactions will be possible?)

Generally, the needs assessment is conducted by means of surveys and interviews with potential users of a MPLIS/GIS. The legislation, previous studies and pertinent documents must be examined. The needs assessment is useful to identify a project's goals and objectives as well as to refine the range of a projects such as MPLIS/GIS.

The needs assessment should be key to facilitating the design of an MPLIS/GIS. To ensure the maximum applicability of an MPLIS/GIS, its users should understand it well and should be able to explain how an automated system of this type will affect their work and responsibilities. Consequently, the results from a needs assessment depend on the users' understanding of MPLIS/GIS technology. Users must understand an MPLIS/GIS is more than just automation of usual procedures.

The challenge in the decision to include any category of information in a MPLIS/GIS, lies on the willingness of the user to pay for the collection, management and updating of data.⁴³

4. *Analysis of the system's requirements*

User needs assessment results are used in this phase to detail the technical requirements of an MPLIS/GIS. These include the configuration of equipment and programs, data sources, management of procedures and verification of the data's accuracy,

and the type of products expected from the system. It is important to conduct assessments to verify that the expectations are reasonable in relation to the existing technology. Among other factors to consider are the selection and training of personnel, the space needed for such personnel and equipment, safety costs in public areas as well as duplicating data bases in cases of emergency and the manner in which improvements in efficiency will be evaluated.

The software's functionality (if the computer programs do what is required of them) is important when considering the analysis of the requirements. A good way to start would be to examine several commercial computer packages. However, the final criteria for its selection should be the system's needs and future expectations. These points should be clearly known in order to define the requirements when requesting proposals.

Although computer equipment is expensive, they constitute a relatively small proportion of the total costs of an MPLIS/GIS. The equipment should be selected in relation to the software's needs (the selection of programs should be done first) and to the volumes of data that are expected to be managed. Since the volume of data and the system's use will tend to grow, it is recommended that the largest possible computer base be acquired.

5. *System Design*

System designs vary ranging from relatively simple designs to very complex ones. The design may include a model in which the system will be organized in institutional terms. It may also include data models and equipment and program configurations. In addition, the data model may be comprised of various components, including data flows, user interface methods and data indexing and cataloging.

In this phase, many of the decisions taken will require compromises. Decisions regarding the speed, flexibility and level of detail that the MPLIS/GIS will offer need to be considered. Once again, the possibilities of success in this phase will increase if decisions about the system's design are based on the results of

⁴³ Peter F. Dale and John D. McLaughlin, *Land Information Management* (1990) page 67.

the user needs assessment and on the analysis of the requirements conducted beforehand.

6. Implementation Plan

Once the MPLIS/GIS has been designed, an implementation plan is needed. An important factor to consider at this time is the way in which the manual system will be changed to an automated one. In the majority of cases, a gradual implementation and formulation of work plans are recommended. Work plans may include details regarding what should be done to accomplish a particular task, who is responsible for that task, when will such task be started and finished, and a description of the existing resources in terms of data, personnel and funding. For an additional discussion about gradual implementation, see section 4, in which financial requirements and benefits are included.

7. Pilot Projects

The purpose of pilot projects, demonstrations and operative evaluations is to test the operation, design and development of the system on a small scale. A new property registration system, for example, may be tested in one or two departments (states or counties, i.e. at the local level) before implementing it at a national level. Pilot projects allow the opportunity to refine the system, acquire experience in the use of equipment and programs and the trial of different alternatives for the resolution of specific problems. At this time, policy makers are shown results that reveal the system accomplishes what its designers attest.

Financial requirements and benefit flows

The financing of an MPLIS/GIS presents some problems. For example, the costs of MPLIS/GIS systems tend to accumulate in the first phases. The costs of equipment, programs and data (that frequently reach 75% or more of the total cost of the system) should be amortized before the system begins to operate.

Benefits become evident, on the other hand, on a long term basis. This implies that the total benefits will not correspond to the total cost until the system has been in operation for five to ten

years, and some might argue for longer terms of say 20 or 30 years. Furthermore, the benefits are frequently intangible - such as the faster acquisition of more accurate data and the production of new information which were previously impossible to obtain. Not only will some benefits be intangible, they will also be unexpected. All of these factors combined, make an accurate, economic evaluation of a MPLIS/GIS before it begins operation more difficult.

A budget detailing the costs and benefits expected from the system must be developed in order to guarantee the continuous financial support for an MPLIS/GIS from policy makers. The implementation plan should consider ways to phase in all integral parts of an MPLIS/GIS. In addition, the possibilities of establishing phases for the disbursement of information with respect to the immediate needs of government and the private sector should be explored. In other words, the specific need to improve the property registration system, evaluate the tax system on properties or resolve an environmental or land specific problem, could require the creation of a list of priorities and unexpected issues during a rigorous costs analysis.

One way to prepare a list of priorities for funding an MPLIS/GIS is to carefully consider the components of the system itself. For example, the geodetic base is frequently one of its principal components, since it constitutes the base (spatial coordinates) where all the strata of data will be referenced and analyzed. Frequently as a first step, a base map is established as a foundation for other strata of spatial data. Consequently, high quality graphic computer programs and equipment are required to support the system. Finally, personnel and operation procedures are required to operate and maintain the system.

These considerations suggest that establishing a strata of specific data is the foremost area to focus on to achieve a gradual implementation of a MPLIS/GIS. Once again, attention to the most urgent needs and the availability of resources to finance specific applications can be useful to make these decisions. More strata of data will be added as additional funds and needs arise. For this to happen it is imperative that a comprehensive plan be in existence before implementing any part of the system. This plan will assure

that parts that will later be added to the system will fall into place and be able to generate the desired results.

An evaluation of the benefits should be included in the implementation plan. The expected benefits should be characterized as such and be documented as soon as possible. At the same time, procedures to identify and quantify unexpected benefits, which occur when the project is in operation, should be determined. The importance of these unexpected benefits is great. Experience with prototypes of MPLIS/GIS systems, which are in operation in Wisconsin, indicate that the unexpected benefits constitute the majority of the benefits. Even though we know they will occur we still refer to them as unexpected benefits since we cannot accurately pinpoint them.

Once an analysis of the cost and potential benefits is conducted, a list of measurable objectives can be established which will serve to contrast with the actual operation of the system. Even though these objectives may not be completely met, they provide a general reference about the operation of an MPLIS/GIS and may suggest necessary modifications in the implementation plan.

Supervision and Evaluation of a MPLIS/GIS

As previously indicated, it is advisable to include in the MPLIS/GIS plan, a mechanism for its supervision and evaluation. Supervision, which includes the measurable objectives and the priorities used by designers and users of the system, will guide the operators and the policy makers to continue funding the system.

Many of these aspects relate to each other; at least in terms of the type of data needed to search for solutions. Because of this a design of a broad based MPLIS/GIS, which has the capacity to satisfy the needs of an extensive variety users seeking land information is often recommended.

This article is not intended to suggest that an MPLIS/GIS system should be implemented in its entirety at this moment in any given locale. However, it is suggested that its implementation occur in various phases over a period of several years. Consequently, in the design of any project, two issues should be considered: (1) how to include the primary archives about land and

decision making processes, and (2) how to develop a system that is in phases, logical and coherent over a specific number of years.

It is also suggested that the strata or module which incorporates improvements to the registration of land titles be one of the first goals of the revised system. This article as well as previous ones clearly document the need to immediately reform the land titling system in much of the developing world. In addition, the rectification of the existing inscriptions before entering any data into the system will be a task of considerable magnitude.