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Multisectoral Urban and Rural
Development Programmes

Land Information Systems for Urban Development

Experience in the Application of LIS in Development Cooperation

Deutsche Gesellschaft für
Technische Zusammenarbeit (GTZ) GmbH

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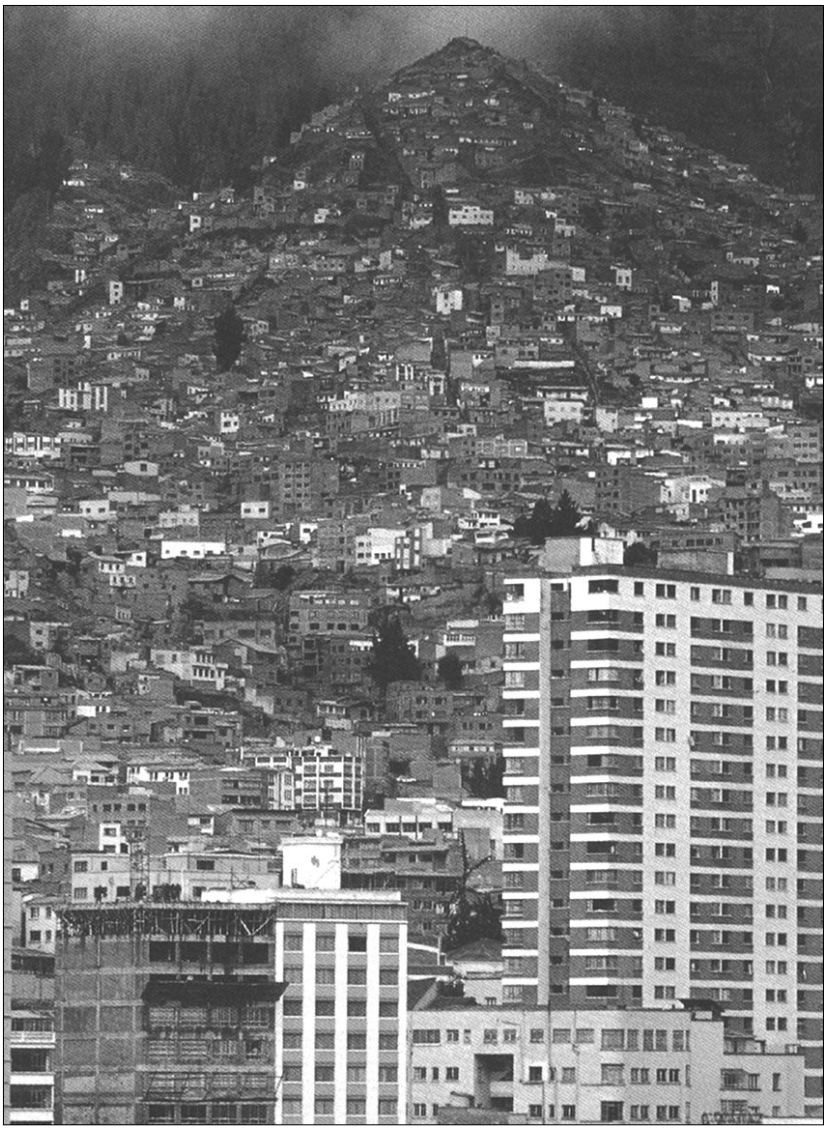
0. INTRODUCTION

0 INTRODUCTION

CONTEXT



The challenge of urbanisation

Over the past decades, developing countries have been experiencing a **dramatic and unprecedented process of urbanisation**, which has turned a world of villages into a world of towns and cities.

With this process of rapid urban expansion being set to continue, **the pressure on land and other resources is also expected to increase in the future**. **Informal settlements** with extremely unhealthy living conditions **house the majority of the urban poor**. They are found in almost all urban areas, and are one of the most obvious signs of this process. The other negative consequences are **deteriorating urban environments and overloaded infrastructure**.

But towns and cities are also focal points of economic activities. They produce an increasing share of GDP, which is generally much higher per capita in countries with a high rate of urbanisation than in those with a more rural economy.

The **urban economy** is undoubtedly **an important factor influencing overall economic development**.

To cope with the problems of urbanisation and to foster its potential is therefore a **major challenge for policy makers and municipal officers** in the Third World.

Land as basic resource for urban development

Land is one of the most important elements to be considered in the context of urban development. It is the **origin of almost all material wealth** and the main resource for human settlements. The shortage or inaccessibility of land can, therefore, have very negative effects on urban development, and can seriously hamper social and economic development.

One of the prerequisites of efficient land management is the **availability of information on land: its location, uses and tenure**. In most developing countries, this information is not only incomplete and inaccurate, but also difficult to obtain. In many countries, land tenure systems are characterised by an overlay of statutes and customary laws where ownership, tenure and user rights are often ambiguous, undocumented and difficult to transfer. Moreover, the cadastral systems used in most of the developing countries are based on models developed in nineteenth-century Europe, which are just too cumbersome for the dynamic urbanisation process of today. In short, **the collection, documentation and processing of land information have not been able to keep pace with the expansion of human settlements**.

OBJECTIVES

The search for the best land information system

Against the foregoing background, the upgrading of land information for the purposes of urban development has become an increasingly more important item on the agenda of international development, thereby accelerating the evolution of **land information systems** (LIS).

The LIS developed in the 1970s and early 1980s did no more than introduce or **improve on traditional cadastral systems and property registers**, largely following or adapting those systems used in the developed world. They usually required **considerable efforts in mapping, surveying and registration**. They were difficult to sustain because they were difficult to keep up to date under circumstances which did not favour their survival. **More ambitious and technologically sophisticated approaches** to establishing comprehensive planning or management information systems, to cover a wider range of data for multi-purpose uses, have generally resulted in **even greater failures** and waste of resources.

More recent attempts have been **more pragmatic**: they have been trying to focus on **key issues**, such as speedier procedures for the **registration and legalisation of property rights** and tenure, and the **improvement in the collection of land-related municipal revenues**; they have also tried to give more **emphasis to the institutional aspect** and the procedures and routines necessary to support these tasks.

The rapid development in computer technology in the 1980s raised **high expectations of being able to leapfrog obstacles** and overcome the shortcomings of **previous approaches** by the use of simpler but more efficient LIS with the help of personal computers, which are now widely available and affordable even in developing countries.

In addition to maintaining traditional cadastres and property registers, these **computerised systems are also able to embrace a wider range of urban management tasks** through their ability to cross-reference and to link different types of information together, thereby giving **an entirely new dimension to the information**.

However, in spite of the high expectations and ongoing discussion in professional circles, the **actual application** of these land information systems appears to be **still in the experimental and developmental stage**: examples of successful implementation in the cities of the developing world are rare.

Thus, the search continues for the best land information system.

This report, the product of a research project funded by the German Ministry for Economic Cooperation (BMZ) and executed by the Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ - German Technical Cooperation), aims to provide **an overview on appropriate and practical applications** of LIS in the developing world.

While there are a number of publications available on conceptual and technical approaches to LIS, based mostly on academic research or policy discussions of development agencies, very **little has been published with regard to practical experience with LIS**, since what experience there is has hardly been evaluated. It is the intention of this report to try to close this gap.

To this end, examples of appropriate LIS, which have been successfully implemented in a few developing countries in recent years, are presented and discussed. These systems were developed either in bilateral or multilateral development co-operation projects, or by local governments or other institutions.

One aim of using these case studies is to provide **references and orientation for assessing the conditions and suitability for establishing LIS** in other cities or regions. The other aim is to derive some guidelines and tools for use in future planning and implementation of LIS. For these reasons, therefore, more emphasis is given to the conceptual and institutional aspects, their underlying objectives and their uses, than to detailed technical issues.

Hence, the target readership is **practitioners** in the field of urban development and management rather than technicians or specialists in information technology; in particular:

0 INTRODUCTION

- **professionals** in the field of urban development and management, who work **in bilateral and multilateral development cooperation**
- **staff of national and regional institutions**, who train and advise municipal staff and local government officials in urban development
- to a lesser extent, **municipal officials and staff** who wish to improve their administrative capacity and broaden their information base.

By making the experience of different LIS experiments available to a wide audience, it is hoped that this report will make a worthwhile **contribution to the ongoing discussion and further development of LIS as a tool for urban development planning and management**.

The aims of this report:

- **To give a general overview on practical experience with LIS in the developing world.**
- **To describe recent approaches to LIS in international development cooperation.**
- **To provide orientation for assessing the conditions for the development and implementation of LIS.**
- **To derive general conclusions for the use of LIS in development cooperation.**
- **To provide basic guidelines and tools for the development of LIS, as well as sources of more detailed information on successful LIS.**

SUMMARY OF CONTENTS

To facilitate its use by different target groups, this report is presented in two parts.

PART I: LIS - AN OVERVIEW

This part provides a general overview on the subject for readers not interested in too much detail. It is divided into three sections:

1. **Concept, past experience and future trends**
   which gives a brief introduction to the concept of LIS and the conditions for its introduction both in industrialised countries and in the developing world.
2. **Overview of recent experience**
   which provides brief summary descriptions of five selected land information systems recently developed and implemented in Latin America and Africa.
3. **Conclusions and recommendations**
   derived from the case studies.

PART II: CASE STUDIES

This part presents the five selected simple land information systems in detail.

An **ANNEX**, containing a short **glossary** of important technical terms used in this report and a short **bibliography**, is attached to the end of the report.

PART I: LIS - AN OVERVIEW

1. CONCEPT, PAST EXPERIENCE AND CURRENT TRENDS

1 CONCEPT, PAST EXPERIENCE AND CURRENT TRENDS

DEFINITION

Since **land information systems are still evolving rapidly**, there is as yet no final definition for LIS which embraces all its different aspects as discussed by the profession. The definition below (see box), as adopted by the *Federation Internationale des Geomètres* in 1981, is still widely used and offers a glimpse of the concept of a land information system. However, it is rather general in terms of the practical uses of LIS, and remains ambiguous with regard to the relation of LIS to other spatial information systems.

For the purposes of the present discussion, which reflects current discussion in international development cooperation, LIS is understood in a much narrower sense, focusing on the management of land information in the context of urban development. **It is an information system which provides strategic and operational tools for the management of land in urban areas.**

In contrast to **Geographic Information Systems (GIS)**, which generally provide land-related information on much larger areas, such as water catchment areas and soil zones, **land information systems** are usually **applied to smaller areas**, such as cities; **and use individual parcels of land as their basic units**.

To be able to support urban management tasks efficiently, an LIS cannot be confined to the collection and processing of data. All aspects of an LIS - the data; the way the data are collected, evaluated, processed and analysed; and the institutional and organisational procedures for the exchange of data - are equally important parts of the system. **The organisational and institutional framework of an LIS must therefore be considered as important as its technical design and the accuracy of its data**. A further important feature of LIS is their ability to link and integrate different types of information, and to communicate between different institutions or departments responsible for different aspects of urban management.

The LIS discussed in this report are intended for the collection, storage, maintenance, processing, analyses, update and dissemination of land-related information to assist decision making in all aspects of development planning, be it legal, administrative or economic. They can potentially fulfil a wide range of functions, such as:

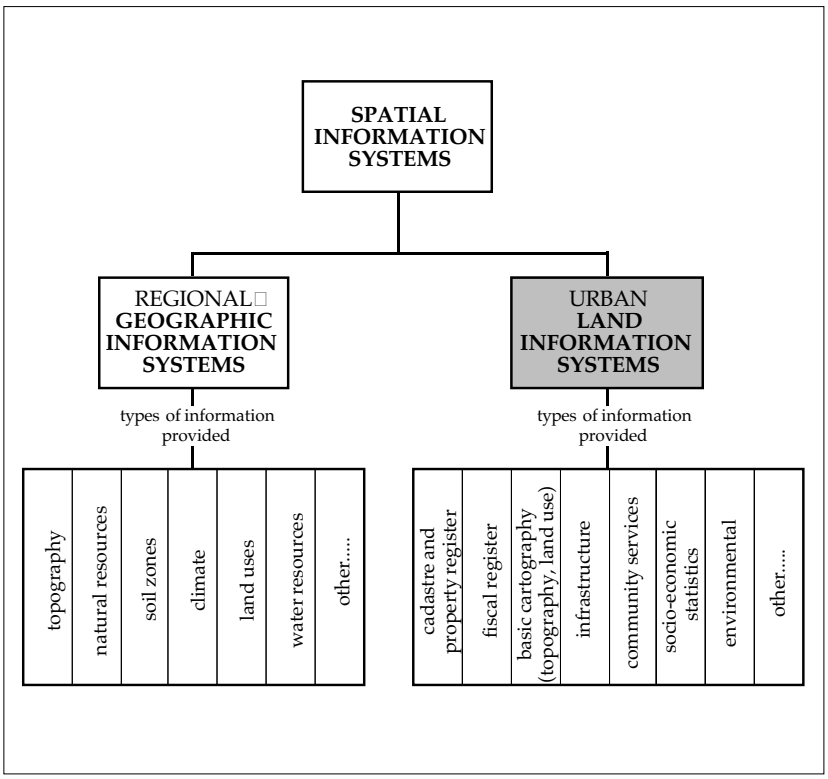
- **cadastres and property registers** for the registration of tenure and as a basis for land taxation
- production of **topographic and thematic maps** as a basis for urban planning and site development

A Land Information System is a tool for legal, administrative and economic decision making and an aid for planning and development which consists on one hand of a database containing spatially referenced land-related data for a defined area, and on the other hand, of procedures and techniques for the systematic collection, up-dating, processing and distribution of data.

The base of a land information system is a uniform spatial referencing system for the data in the system, which also facilitates the linking of data within the system with other land-related data.

Resolution 301 of the XVI. Congress of the *Federation Internationale des Geomètres* (FIG), 1981, Montreux, Switzerland

Types of Spatial Informations Systems: LIS and GIS



DEVELOPMENT BACKGROUND

- **mapping and documentation of technical infrastructure** to support investment decisions, utility management and maintenance, and collection of user fees
- **mapping and documentation of community facilities** and social services to support planning and investment decisions
- **provision of socio-economic information** as a basis for the promotion of industrial or commercial development, or social development projects
- **data bases on natural resources** and environmental conditions to support environmental planning, monitoring and auditing
- **other data bases**, e.g. for housing market studies and analysis of land markets.

The evolution of LIS has been running largely parallel to the rapid progress of computer technology in the past few decades. Before the advent of computers, **land-related information** had been collected, **documented and processed manually** in the forms of registers, maps, plans or books, by specialised agencies or institutions. These had usually processed information according to their own priorities and procedures, and had hardly considered the need for interinstitutional communication. Because of this, **links between different** types and **sources of information** were **difficult** to establish and the uses of the information collected had generally been limited to the tasks of the institution that had collected it.

In recent years, **computer technology**, especially the fast-developing area of graphic data and image processing, **has brought cross-referencing of geographic and alphanumeric data onto a new plain**, and given land-related information a completely new dimension through their **multipurpose uses**.

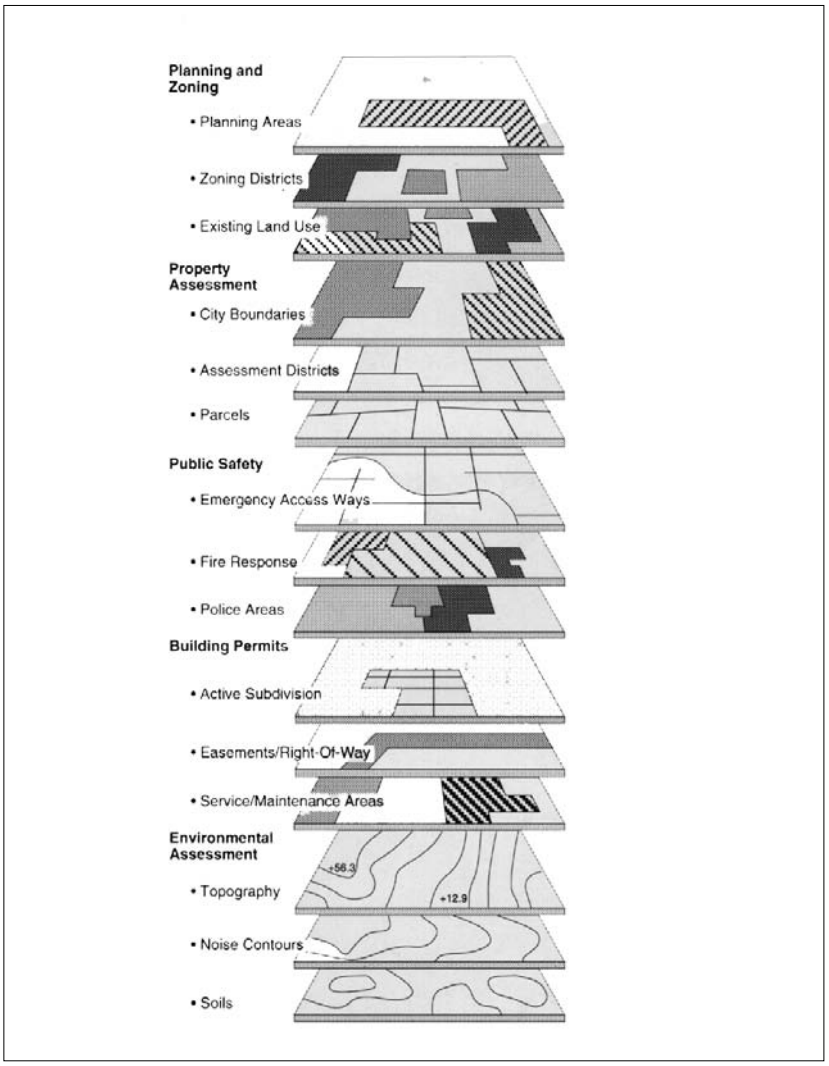
It has also opened up the prospect of **linking up the data sets of different agencies to build comprehensive and more efficient information systems over time**. This idea of easy access and the potential of computer technology have been continuously fascinating technicians, planners and politicians. It has also raised high expectations of finding an all-powerful tool for development planning.

Early approaches to LIS, hence, had a strong **technical orientation** towards full computerisation and automation of land information. The **new technology**, with its ability to process huge amounts of data, was **often perceived as an end in itself**, with little regard to the real demand for such information, the institutional and managerial capacities to digest and use it in a sensible way, and the cost-benefit ratios of such systems.

LAND INFORMATION SYSTEMS IN INDUSTRIALISED COUNTRIES

The evolution of LIS as a tool for land management in the developing world has largely been dependent on the concepts and technologies developed in the industrialised countries. A short summary of the experience with LIS in the industrialised countries might therefore provide some insights to the current state and perspective of LIS in the developing world.

In the past 15 years, the computerisation of land information has received great attention from central government agencies, local authorities and private companies in all industrialised countries. **Considerable investments** have been made - and are still being made - to transfer records, previously kept manually, to digital data; and to integrate different sets of data to build comprehensive information systems. These **information systems are used in many areas**, including cadastres and property registers, urban planning, mapping, documentation and management of infrastructure, demography, social statistics, and environmental management - to mention but a few.



Potential uses of LIS as promoted by the software industry
Source: Environmental Systems Research Institute (ESRI): Arc/Info - An Integrated Answer for Local Government

Favourable conditions

In general, the design and implementation of land information systems in most industrialised countries have benefitted from a number of favourable conditions.

- The **data** needed for municipal administration, land management and other public tasks are usually **collected, processed and updated systematically by agencies with clear-cut functions and responsibilitie**s.
- The **data bases** themselves are usually **reliable**, having been **compiled in accordance with well defined standards, rules and regulations**.
- The data can be **used for various tasks** by different authorities (e.g. levy of fees and taxes, statistics, city planning), and by private individuals (e.g. examination of land registers, purchase of maps or plans).
- **Qualified and experienced personnel** are available for the collection, processing and evaluation of data.
- The **availability of cartographic and cadastral data**, as well as other land information (e.g. statistics), is **generally considered an integral part of public services**.
- **The costs for the collection and update of information** can normally be **recovered**, to a large extent at least, through fees or rates (e.g. costs of cadastres and land registers through surveying and registration fees; costs of mapping and registration of infrastructure through user charges).

Problems and pitfalls

Given the favourable conditions, the development of LIS in the industrialised countries can **focus** principally **on establishing links between different types of data** hitherto managed by different institutions. However, in spite of this, the road to digitisation and integration of data bases has often been bumpy, with many pitfalls on the way.

- To establish links between different data sources, standards and interfaces have to be developed. Unfortunately, **conflicting interests and diverging technical priorities** of different institutions and agencies have frequently hampered agreements on standards, interfaces and reference systems.

- The **high levels of accuracy and security required**, especially for cadastral purposes and property registration, pose considerable difficulties in the design of the systems and their components.

- Many systems and their data bases, which were only established fairly recently, have already become obsolete owing to the **rapid changes in the technology**, followed by the need to update hardware and software constantly.

- Existing systems often have to be adapted **following changes in political circumstances and institutional priorities**.

Because of these problems, **much effort and investment have been wasted**, and high expectations dashed. Even now, traditional cadastres and registers, which usually serve as the basis for more complex LIS, are still being kept, in many industrialised countries, in parallel with computerised systems in the forms of maps, data sheets or microfilms. This is even more so with regard to other land-related information held by municipalities and sectoral institutions. They are being converted to digital data only slowly and incrementally. **Complex computer systems**, completely integrating cadastral data with other data, **are still an exception**, whilst the coexistence of traditional and digital data bases is more the norm.

In many cases, **pragmatic and less ambitious approaches**, focusing on only one or two priority uses, have **proved more successful** than comprehensive systems aiming at full integration of all available data right from the beginning.

Current trends

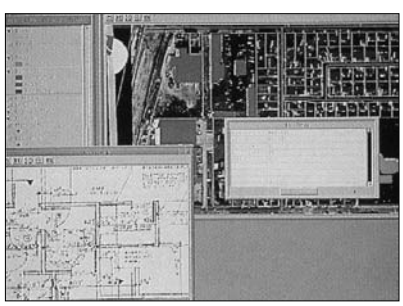
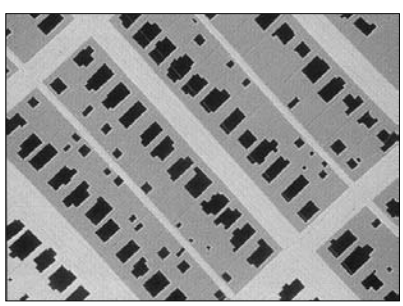
The efforts to automate the processing of land information and to make better use of available technologies are continuing. In some countries, considerable **progress** has been made **in automating cadastral systems**; and many municipalities have embarked on the computerisation of their internal information networks.

A driving force behind these efforts is the **need to cut personnel and administrative costs** in the face of enormous cuts in government spending, especially in local government expenditure. At the same time, the amounts of information to be processed keep growing, due to the emergence of new issues and new tasks, such as environmental impact assessment, environmental auditing, etc.

As a net result, efficient information management is much in demand. In addition to the public sector as traditional supplier of information, the **private sector** is fast emerging and **taking a fair share in the new market of land data documentation and processing services**.

However, with scarce public resources and rapidly growing information, **the fully integrated land information system is still a long way from reality**. The technical possibilities are there, but the practical applications of the technologies are still being investigated.

Computer screens of LIS software
Source: Environmental Systems Research Institute (ESRI): Arc/Info - An Integrated Answer for Local Government

1 CONCEPT, PAST EXPERIENCE AND CURRENT TRENDS

LIS IN DEVELOPING COUNTRIES

Lack of information

Although the technology for information systems is available and suitable for the developing countries, considerations relevant for their introduction are significantly different, and the conditions are much less favourable than in industrialised countries. These can be summarised as follows.

- There is a general **lack of up-to-date maps** to provide the required information on topography, urban boundaries and urban land uses.
- **Urban cadastres and property registers**, where they exist at all, are **not** kept **up to date**. In many countries, they are not managed by local government, but by central government agencies or institutions, often in a very inefficient manner.
- Information on **technical infrastructure** networks and their condition is **hardly documented**, let alone updated.

Decisions on future development are, therefore, usually based on incomplete information. Municipal administrations tend to consider only the formal parts of the cities, while the fast-growing informal settlements are largely ignored. Settlement projects or infrastructure installations are often carried out as individual projects on an ad hoc basis, without much coordination or consideration of their impacts on the entire structure of the city and the environment.

The unplanned expansion of informal settlements, as well as the uncoordinated development of industrial sites, are endangering and destroying important natural resources and, at the same time, incurring unnecessarily high costs.

The lack of good information also hampers the levy of municipal taxes and fees, which are urgently needed to strengthen local administrations, and to maintain and extend municipal infrastructure and services. Furthermore, the lack of information is often the root of inequity in the tax systems which, very often, favour the rich over the poor.

The lack of land information can also restrict economic development. Both individuals and commercial or industrial enterprises can be adversely affected by an inefficient land market in the following ways.

- Land transactions are costly and slow, as property boundaries and ownerships have to be investigated and established through complicated and time-consuming procedures.
- Unclear tenure often gives rise to litigation, incurring additional high costs.
- Access to formal finance for housing or house improvements is difficult, especially for the urban poor.
- Other private investments are also made difficult by the lack of secure tenure and collateral.

Institutional weaknesses

In addition to the lack of information and the ongoing challenges of urbanisation, the institutional and political frameworks in most developing countries often pose further limitations on the development of LIS. These can be summarised as follows.

- The **weakness and instability of** those **public institutions** in charge of land management.
- The **lack of political will** for the necessary reforms, e.g. towards more local autonomy, or taking more account of the interests of the poor.
- **Unclear** definitions of **responsibilities and functions**.
- **Ambiguous rules and regulations**, or a complete lack of them; or the lack of enforcement where rules and regulations do exist.
- A **lack of understanding of the importance of accurate land information**; or vested interests against openness on the part of local officials and politicians, and even local inhabitants.
- **Insufficiently qualified staff** due to the low salaries in the public sector and lack of motivation amongst the staff.
- A **lack of knowledge about the interest and needs of information users**, and insufficient consideration for their capability to work with information systems.
- **Divergent perceptions of land management and tenure** (customary tenure, traditional land laws, etc).

Experience with LIS: failures and "white elephants"

Given the problematic context, the experience hitherto with LIS in international development cooperation have been largely characterised by failures or "white elephants", wasting a lot of effort and investment.

- Given the political and institutional predicament, **many LIS projects focused** almost exclusively **on technical issues**. The **need for institutional and legal reform** was usually **ignored**, or only superficially investigated.

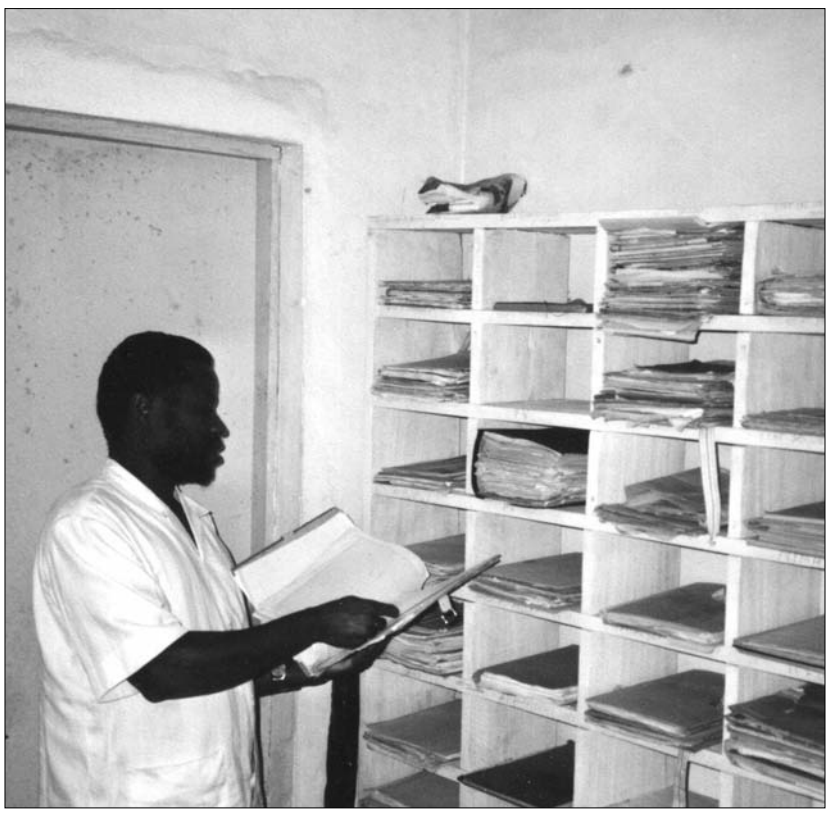
- **Sophisticated computer systems** were installed in **weak institutions**, which **did not have the capacity to operate and maintain these systems**.

- Fascinated by the technical potential, **large amounts of data** were collected which, in the event, could **not** be **processed or used**.

- The **costs of updating and maintaining** the information were rarely given due consideration when introducing the system.

Consequently, **many ambitious projects failed right from the beginning**, or were not able to continue when external support ceased. Even where they have survived, usually after considerable technical and financial inputs, they have usually ended up using isolated parts of the system for a few essential tasks, and not utilising the full capacity of the system in information exchange and integration.

Still prevailing: traditional manual cadastres



Prerequisites for introducing LIS in the developing world

In contrast to the industrialised countries, where LIS generally have a reliable data base and firm institutional structure to build on, the challenge for LIS application in the developing world is more complex. While, in many industrialised countries, there is a move to limit the responsibilities of both national and local governments to core functions, in most developing countries, the institutional capacity for these functions has yet to be built up. In brief, when introducing an LIS in a developing country, there are two major tasks which have to be undertaken simultaneously:

- **to establish an adequate and reliable data base**

- **to build an appropriate institutional structure and to define procedures for the processing and the use of these data.**

It should be noted that, in this context, the **institutional and legal framework** is always **more important** for the functioning of an LIS **than the technical issues**, which can usually be solved relatively easily. Furthermore, special attention has to be paid to the procedures and methods used for data processing and utilisation, and for system maintenance.

1 CONCEPT, PAST EXPERIENCE AND CURRENT TRENDS

LIS IN DEVELOPMENT COOPERATION

Despite the difficult environment, the increase in the **demand for land information is inevitable**, given the current rates of urbanisation.

In many metropolitan regions characterised by unprecedented and hardly controllable development dynamics, considerable efforts are being made to establish good data bases on land, infrastructure and services, in order to manage the cities more efficiently.

In the newly emerging industrial countries, like those in the Asia Pacific region, it is increasingly recognised that land information is important for both the extension of municipal services and the protection of the environment and natural resources.

In many other countries, notably in Latin America, municipalities and other local authorities are forced to find more indigenous revenue sources as a result of decentralisation and a growing reluctance of central governments to transfer funds to local governments. Land information systems are especially in demand, in these circumstances, for establishing or updating fiscal cadastres as a basis for the levy of municipal taxes and charges.

Given these potential applications, it would seem worthwhile to investigate further the **major priority tasks in urban management** in which LIS may be most useful.

Levy of land taxes and other charges

One of the most important prerequisites for the efficient provision of urban services is a reliable source of income. Unfortunately, in most developing countries, sound and stable finances in local government are the exception rather than the rule.

The share of local government in national revenues is often very small and dependent on political preferences. Some national governments are trying to further reduce transfers to local authorities and urging them to mobilise local resources following the adoption of a strategy of decentralisation.

Land-related taxes and charges would provide a stable income for local government. Unfortunately, most municipalities in the developing world are too weak to levy local taxes and charges efficiently. Obsolete or incomplete registers and cadastres, clientelism and a shortage of qualified staff all render the collection of local revenues extremely difficult.

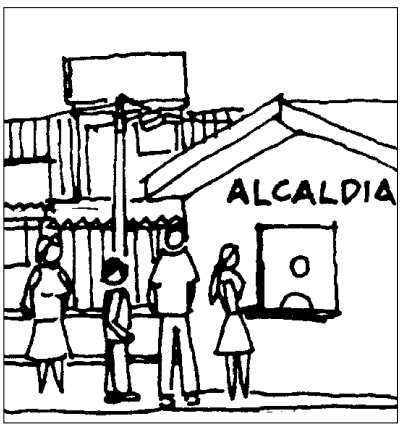
Appropriate land information systems can facilitate the **update of fiscal registers and cadastres** considerably, automate the issuing of tax demands, monitor payments, and **improve transparency and accountability** of municipal revenues.

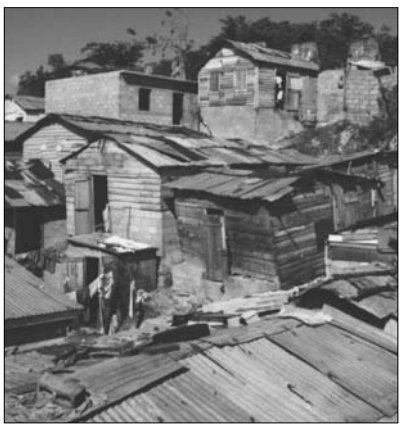
Legalisation of tenure

In most developing countries, an increasing number of people are settling informally or illegally on the edges of cities, with hardly any services or utilities. While squatters have always existed in larger towns and metropolises, today, even medium and small municipalities are increasingly confronted with a rapid expansion of such settlements.

Although the informal sector is the most efficient provider of basic shelter, the improvement of the living conditions of the poor is often inhibited by insecure tenure. Even where governments have embarked on programmes of upgrading informal settlements, the legalisation of tenure, which is a very important condition for access to formal housing finance, is usually obstructed by outdated property registers, as well as by drawn-out and costly registration procedures.

Outputs of land information systems can be used to facilitate the legalisation of informal settlers and **speed up the process of registration and tenure**, thereby creating a secure environment for investments in infrastructure and house improvements.





Physical planning

Confronted with the rapid growth of urban population, the planning, management and control of urban development are some of the most challenging tasks for municipal authorities. Unfortunately, in most developing countries, urban planning hardly ever works. Urban development plans and master plans are no sooner produced than they are outgrown by an accelerating process of informal settlement and urban sprawl. Moreover, maps and other information required for planning purposes are difficult to update. Many municipal administrations do not even have information on the present status and extent of informal settlements.

Spatial information provided by a simple LIS can considerably improve urban planning capacities. Since most of the required information could be obtained from other LIS data bases, such as fiscal registers or cadastres, the urban planning component of an LIS would only have to focus on some **urgently needed information for planning**. An efficient LIS can also bring such planning tools as **maps and statistics** up to date easily.

Infrastructure management

The provision, operation and maintenance of infrastructure are another priority task in urban management.

In most developing countries, the responsibility for the provision and maintenance of utilities is shared by a wide range of government departments, with local government playing only a small role. Powerful sector ministries or line agencies in central government usually play a much bigger role than the municipalities. Municipal infrastructure projects are usually implemented when funds are available, without much planning or coordination. The decisions on these projects are often taken without sufficient knowledge of local demands because the information on utility networks and their condition is not available, or it is only kept centrally and inaccessible to local authorities.

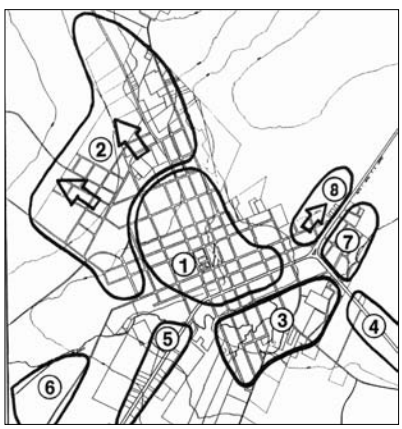
With its standardised and easy procedures for the documentation and update of information, a land information system can provide a much **better basis for investment decisions and interdepartmental cooperation**, and for **facilitating operations and management**.

Environmental management

Rapid urbanisation has lead to massive environmental problems, ranging from water depletion to air pollution from factories and car fumes. Urban environmental issues have become a new priority area in urban management in recent years.

In most developing countries, administrations at central and local government levels have little experience in addressing the growing environmental problems, which are characterised by complex relationships between different factors and causes. One major obstacle to more efficient intervention is the lack of information on environmental conditions, since such data have not been recorded in the past in any systematic way.

To address these environmental problems, information on the environment will have to be collected to support such tasks as **urban environmental planning** and **environmental auditing**. Land information systems can be used to document and process this information, for instance, in the form of an **environmental data base**.



2. OVERVIEW OF CASE STUDIES

2 OVERVIEW OF CASE STUDIES

REGIONAL DISTRIBUTION AND SELECTION CRITERIA OF CASE STUDIES

The presentation of case studies in this report is intended to provide an **overview of recent experiences** in LIS in development cooperation. In no way does it pretend to give a comprehensive picture of the applications of LIS in the developing world. It is, nevertheless, hoped that these case studies will give a fair **impression of the current state of development of simple and appropriate LIS** in developing countries.

The cases have been selected from a review of bilaterally and multilaterally aided projects, as well as from the GTZ experience in this field. Four of the five cases are from **Latin America**, reflecting the high level of urbanisation in that region and the relatively high level of local autonomy - hence the demand for land information at municipal level.

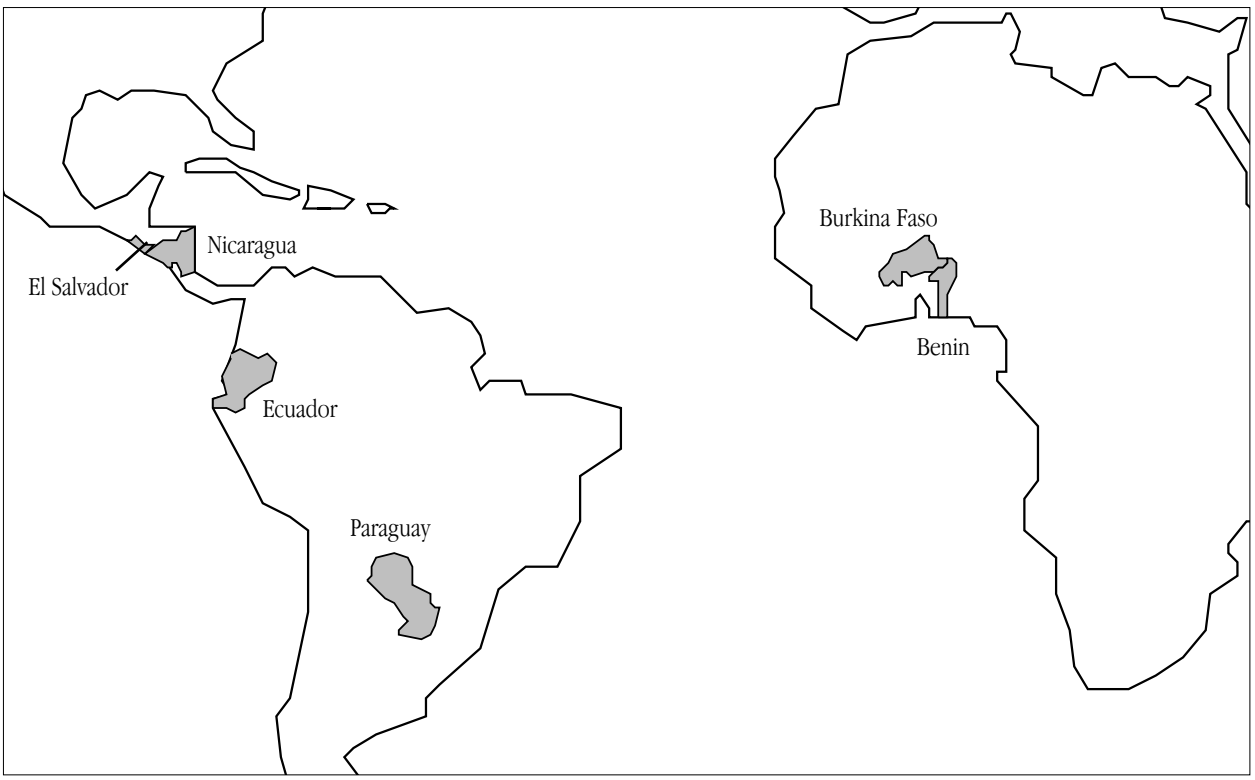
The remaining example is from **West Africa**, a region which has experienced extremely high rates of urbanisation in the recent past, necessitating an urgent update of land information to improve the urban services and revenues of rapidly growing municipalities. While similar projects have been carried out in almost all francophone West African countries, mainly with assistance from the World Bank, UNDP and French development cooperation, the Benin example was selected as it is here that LIS has had the most tangible impact. This example is complemented by a summary description of a similar system in Burkina Faso, which exemplifies the general approach followed in most West African countries.

Asia, although also a highly urbanised region, had no case suitable for detailed evaluation and presentation. Although comprehensive and technically ambitious LIS have been introduced in some large Asian cites (e.g. in Indonesia and China), they are not included here because they were still at the development and testing stage at the time the review was carried out.

The selected examples show that **successful applications** of LIS in the cities of the developing world have **generally focused on only one or two important tasks**; and priority has generally been given to the compilation and processing of the most urgently required data, rather than to the more complex task of administrative reform.

In some areas of urban management, such as municipal financial management, large-scale efforts have been made to introduce and use LIS, and some positive results have already been achieved. In other areas, such as urban planning and urban upgrading, the use of LIS has been much more limited, or is still in its initial phase.

Regional distribution of case studies



In yet other areas, such as infrastructure planning and operation or urban environmental management, LIS is barely known.

In order to learn from these experiences, the assessment of the case studies has been used to derive some general conclusions and recommendations for the development and introduction of LIS in developing countries. These are presented in the next section of this report.

The short overview of LIS in this section is complemented by a more detailed description of each case study in Part II of this report, which includes:

- the **background of system development**, the main areas of application and the improvements achieved by the system so far
- **technical and operational details**, such as the main system components and the stages of system introduction
- the **circumstances under which the system was introduced** (historical background, legal framework, institutional structure)
- **staffing and training requirements**, and costs
- the **adaptability of the system** to other regions, or areas of application
- **sources of further information** and technical assistance.

Each of the case studies was undertaken by consultants specialising in urban development or urban cadastres, on short-term assignments but with direct access to all aspects of the respective systems.

Criteria used for the selection of case studies:

- The system is actually supporting important **urban management tasks.**
- The establishment of the system has resulted in **tangible improvements** in the management of municipal revenues.
- The system as a whole, or its individual components, **may be replicated or adapted** to other circumstances.
- **Valuable lessons** have been learned from the establishment and operation of the system.
- The development and experience of the system have been **systematically documented** and are accessible to interested parties.

SIMPLE CADASTRE FOR SMALL MUNICIPALITIES - PARAGUAY

The new system introduced in Paraquay is a property and fiscal cadastre focusing on the levy of land-related fees and taxes in small and medium municipalities. The system was developed in a bilateral technical cooperation project, jointly executed by the *Instituto de Desarrollo Municipal* (IDM, a Paraguayan governmental agency which provides general and technical assistance to local government) and the GTZ, following a reform of local government and the transfer of responsibility for property tax collection from the central government to local government in 1992.

Since the little cadastral information that existed prior to the project was largely out of date, the new system began by setting simple procedures to complete and update this information to provide a better basis for the assessment and collection of municipal taxes. For these purposes, a set of basic tools (standardised data sheets, base maps and a computerised data base) was developed which could easily be used by municipal staff.

Although the legal status of the new cadastre remains ambiguous, it has so far been introduced in about 20 municipalities, and is currently being extended to support other tasks of urban management, such as urban planning and general budgeting and accounting. In the municipalities where the system is now operational, it has contributed to a considerable increase in municipal revenues from real estate taxes and other land-related fees. Because of this positive experience, many other municipalities have become interested in the system.

Brief system description
The system focuses on setting simple and efficient procedures for establishing geographic reference and a cadastre for revenue collection. The information base consists of maps, which have been produced manually, and a computerised alphanumeric data base of land parcels in the municipality.

Major applications
- automatic land valuation, tax assessment and tax collection
- support of general urban management tasks
- physical planning.

Area coverage
The system had been introduced in 20 small municipalities by the summer of 1994, mostly covering only the urban cores.

Improvements brought about by the system
- an average 300% increase of municipal revenues in the user municipalities
- a more transparent tax assessment method
- improved accountability of municipal finances.

System components
- municipal survey maps (produced manually)
- plans of individual building blocks (produced manually)
- standardised data sheets on properties and their uses based on information obtained from the survey maps and building block plans
- a computerised cadastre, the *Sistema Integral de Gestíon Municipal Automatizado* (SIGMA).

Technology and equipment
The system combines manual data recording with a simple computerised data base. The minimum equipment required for a small municipality is:
- 1 personal computer, 486dx processor, 4 MB RAM, minimum 120 MB hard disk, operating system MS DOS/Windows
- 1 dot matrix printer
- customised dBase data base software.

Staffing requirements
A core team of 2-3 persons per municipality for data documentation and processing, plus 2-3 temporary staff for field surveys.

Institutional structure
The system is based at the municipality and the core team of the work unit is normally selected from existing municipal staff. Owing to the fact that Paraguayan municipal administrations are not particularly well developed, the work unit may be located in different sections of municipal administration (finance, infrastructure or general administration).

Legal status
The system does not have a clearly defined legal status of its own, but comes under general legal provisions for cadastres and property registers within the existing law.

Time requirements
- up to 6 months per municipality for preparatory work, including system design and the assembling of existing data
- time required for field surveys and data processing depends on the size and the characteristics of the municipality, usually between 6 months and 2 years.

AUTOMATED MUNICIPAL INFORMATION SYSTEM - ECUADOR

Like the Paraguayan example, this system focuses initially on the improvement of land-related municipal revenues, but has a longer-term perspective of supporting other urban management tasks. It was developed in the framework of a large-scale multilateral cooperation project to strengthen the capabilities of local government in Ecuador, and to enable Ecuadorian local authorities to invest in urban infrastructure and services. The project has been running since 1990, and is funded by the Ecuadorian National Development Bank (*Banco del Estado*), with assistance from the Interamerican Development Bank, the World Bank and the GTZ .

Based on the Local Government Law of 1966, the management of property registers and cadastres is a municipal responsibility in Ecuador. Although the Law has defined a basic framework for municipal cadastres, a wide range of local cadastres have been developed in the past. However, most municipalities have not been able to update their cadastres regularly to enable them to collect local taxes, and have been relying on governmental transfers for funding rather than on their own revenues.

Building on the Paraguayan experience, the technical cooperation project developed a new approach to make existing cadastral systems in Ecuadorian municipalities more efficient, by standardising procedures for the collection of municipal taxes and charges. The system combines a simple way of updating existing land information with a new cartographic base, both run on simple computer programs.

The new system, first conceived in 1993, has so far been installed in 14 municipalities, and is currently being introduced in 30 more. In all municipalities where the system is already operational, it has contributed to a considerable increase in local revenues.

Brief system description
The *Sistema de Informacíon Automatizado Municipal* (SIAM) is a computerised municipal information system, consisting of both alphanumeric and graphic data on land and properties. It is not a system to be built completely new, but is to be built on existing municipal cadastres.

Major applications
- identification of taxpayers, calculation of municipal taxes and other charges, and tax collection
- physical planning
- building control.

Area coverage
Around 44 small and medium municipalities (2,000-140,000 inhabitants) were using the system by the end of 1995. In the initial stage, the systems covered only core urban areas for which a cadastre had been established previously.

Improvements brought about by the system
- increases in municipal revenues from land and building taxes ranging from 100-450% per user municipality
- comprehensive update of previous cadastres and registers.

System components
- manually kept data sheets of individual plots and buildings
- a computer model for the valuation of urban land and buildings
- a computer program for managing and processing cadastral information
- a computer program for tax assessment, tax collection, and general administration of municipal fees and charges
- a set of maps as overall geographic reference for the cadastre system.

Technology and equipment
The system combines traditional information with computer data which are processed on personal computers. Cartographic information is processed both manually (at the municipality) and digitally (by the technical cooperation project). The minimum equipment is
- 1 personal computer, 286-486 processor, minimum 1 MB RAM, standard hard disk, operation system MS DOS 3.1, data base software Clipper 5.2
- 1 dot matrix printer.

Staffing requirements
At least 1 permanent member of municipal staff is needed to operate the system, but a basic work unit may comprise up to 5 staff members.

Institutional structure
The work unit is usually newly established and attached to the Department of Cadastre and Statistics in the municipality. Where this does not exist, the unit may be attached to other departments, e.g. finance, urban planning or public works.

Legal status
The establishment of the system is based on existing legal provisions which assign the responsibility for urban cadastres to the municipalities.

Time requirements
- preparation: 3 months
- data collection: 50 plots/person/day
- data processing: 250 sheets/day
- map digitisation: 5,000 plots/month.

DATA BASE FOR THE LEGALISATION OF TENURE - EL SALVADOR

In the context of institutional and legal reforms to support the peace process in El Salvador, a new property register, the *Registro Social de Inmuebles* (RSI), was developed to help legalise informal settlements and to promote low-cost housing projects nationwide. A new central government agency, the *Instituto Progreso y Libertad* was created; and new, more efficient procedures for the registration of land and real estate were introduced in 1991.

The registration documents issued by the RSI, though not equivalent to formal title deeds, do guarantee tenure and facilitate access to formal mortgages for those previously excluded from the formal housing market, thus encouraging investments in house improvements and urban infrastructure.

The RSI consists of a simple alphanumeric data base and a cartographic program which provides geographic reference for the system. Although initially focused on its main purpose of legalising tenure, the system can also support other tasks in urban planning and management.

Since the beginning of its operations in 1992, the RSI has processed almost 93,000 registrations of tenure. Of these, about 6,500 are tenure registrations of informal settlements; about 38,500 are subdivisions for new low-cost housing projects; and the remainder are registrations of mortgages and property transfers which had existed prior to the establishment of the RSI. Based on the positive experience so far, it is envisaged that other types of property registration will be integrated with the RSI system to form a unified system of land information at national level. Furthermore, in Central America, the RSI experience is lauded as a positive example of simple and speedy property registration.

Brief system description
The RSI is a new property register established to facilitate the legalisation of land tenure and to accelerate the process of property registration. It comprises a computerised property register and a cartographic program.

Major applications
- legalisation of land tenure in existing informal settlements
- registration of land subdivisions for new low-income housing projects
- monitoring of the legalisation of land tenure nationwide.

Area coverage
The system currently covers selected informal settlements and new development sites in urban and rural areas. Efforts are being made to extend the system nationwide.

Improvements brought about by the system
- legalisation and registration of properties in informal settlements (6,500 registrations between 1992 and 1995)
- registration of land divisions and property transfers for low-income housing projects (38,500 new registrations between 1992 and 1995)
- facilitation of access to formal finance for low-income groups.

System components
- an electronic data base for the management of property registers
- a cartographic computer program.

Technology and equipment
The system is completely computerised and requires the following equipment:
- 1 PC, 486 dx processor, minimum 50 MHz, 4 MB RAM, minimum 240 MB hard disk, VGA monitor
- 1 dot matrix or inkjet printer with graphic capacity
- 1 flat-bed scanner, tape back-up system
- operating system MS DOS/Windows, standard relational data base (dBase, Foxpro, etc)
- initially CAD software AutoCAD but subsequently replaced by MicroStation.

Staffing requirements
- 1-2 registrars (lawyer and assistant legal staff)
- 1-2 cartographers (civil engineers, architects, surveyors or topographers)
- 1 computer technician.

Institutional structure
To establish the system, a completely new executing agency was established with complete autonomy in management and operation. The system is currently operated from a central office and three regional offices.

Legal status
To establish the system and to facilitate property registration procedures, major changes in legislation were made. Special laws and decrees were issued by the President to provide a legal basis for the system. Minor reforms and amendments were issued subsequently to regulate and streamline administrative procedures.

Time requirements
A basic registration team can carry out an average of 1,000 registrations in a month.

PROPERTY TAX CADASTRE AT MUNICIPAL LEVEL - NICARAGUA

Unlike the other examples of municipal cadastres, which took a more incremental and piecemeal approach, the Nicaraguan system aims at a comprehensive reform of the legal and institutional framework as a precursor to the nationwide introduction of a new cadastral system at local government level. The design of the system - developed in the context of a technical cooperation project, financed by the Swedish government and UNDP, with technical assistance from UNCHS-Habitat, and jointly implemented by various Nicaraguan agencies - is based on a similar system developed by UNCHS-Habitat for the city of La Paz, Bolivia, and adapted to the conditions in Nicaragua.

At the initial stage, the technical cooperation project put forward a proposal for a real estate tax law to transfer the responsibility for property tax assessment and collection to local government. Prior to the implementation of the system at municipal level, an extensive training programme was carried out for municipal and central government staff, and for political representatives of the institutions involved.

Initiated in 1993, the system is ready to be installed in the 14 major municipalities of the country. Although the system has not yet produced concrete results, it has contributed to a broad political consensus on the need to transfer property tax collection to local authorities, and on the functions of municipal cadastres.

Brief system description
Based on a system developed by UNCHS-Habitat for the city of La Paz, Bolivia, this is a simple, computerised cadastral system intended to be installed in all the municipalities in Nicaragua.

Major applications
- levy of municipal taxes, in particular the newly introduced Real Estate Property Tax
- support for physical planning, land management and municipal investments.

Area coverage
Initially implemented in 14 major urban centres in a pilot scheme, the system is to be extended to all municipalities later. In the initial stage, the system covers only the core areas of the municipalities.

Improvements brought about by the system
- introduction of a Real Estate Property Bill by a Presidential decree in 1995 and agreement on the format and procedures for the new system with all relevant institutions
- design of procedures and a questionnaire for property valuation
- extensive training programmes for mayors, town councillors, municipal staff and other relevant personnel in the functioning of the system.

System components
- data sheets (questionnaires, recorded and documented manually)
- an alphanumeric data base of property information
- digital cartography (survey maps, building block plans, urban and rural land division maps).

Technology and equipment
Since the system aims at full computerisation of cadastral information, integrating alphanumeric data with graphic data, it requires:
- personal computers, standard 486 DX2 or Pentium processor, 66 MHz, 4 MB RAM with additional Video RAM; 540 MB hard disk , 17" colour monitor
- GIS software MicroStation 5.0 and UNCHS-Habitat SISCAT software
- printer with graphic capacity.

Staff requirements
- 2 permanent members of municipal staff
- up to 9 temporary staff for survey work.

Institutional structure
A National Cadastre Commission was established to coordinate the introduction of the system and to supervise its subsequent operations. The actual system will be installed in the municipalities.

Legal status
The legal framework for the system has been defined by a comprehensive reform of the property tax system in Nicaragua, which established the maintenance of property cadastres as a municipal function.

Time requirements
As yet unknown.

URBAN LAND REGISTER AND ADDRESS SYSTEM - BENIN

The last example in this series of case studies presents the experience of a property cadastre developed for larger municipalities in Benin in the context of French technical cooperation. Like most other examples of property cadastres, the Benin system focuses on improving municipal revenues from property taxes and other land-related charges. However, unlike its Latin American counterparts, the municipal authorities in Benin enjoy only limited autonomy and are closely controlled by the central government.

Another unusual feature of the system is that it has been developed by a consulting firm, which was established as a public-private partnership of different governmental agencies, municipal authorities and private shareholders. Since all the municipalities had experienced extremely high rates of random urban growth during the last few decades, the system includes a comprehensive address system to provide geographic reference.

So far, the system has been installed in two major municipalities, Parakou and Cotonou, with about 100,000 and 700,000 inhabitants respectively. Next on schedule for installation is the capital city, Porto Novo, with a population of about 200,000. It is planned that the system will be introduced to the remaining seven major municipalities in the near future.

The local taxation system has been comprehensively reformed, resulting in the introduction of a uniform property tax and a uniform commercial tax. Furthermore, the experience of the system has inspired discussions on a more comprehensive reform of local government to provide more autonomy.

Brief system description
The Urban Land Register (*Registre Foncier Urbain* - RFU) is a multipurpose tool for urban land management, focusing first on the improvement of land-related revenues, but with a longer-term view to supporting other tasks in municipal land management.

Major applications
- collection of municipal taxes and other charges
- property valuation and registration
- address system in support of postal operations and other public services
- urban planning.

Area coverage
So far the system has been introduced in two major cities, with the capital city being the next on the installation programme. The plan is to install the same system in seven other cities in the country.

Improvements brought about by the system
- an average of 100% increase in municipal revenues
- improved transparency of tax and rate assessments
- improved public services (postal operations and emergency services)
- reform of the property tax system.

System components
- cartographic data in both digital and traditional forms
- a new address system
- a computerised data base.

Technology and equipment
Since the system is operated jointly by different institutions, different equipment is needed for each party. The alphanumeric data base is run on standard PCs using dBase software, while the digital cartography uses special photogrammetric equipment and a SUN work station with MicroStation GIS software.

Staffing requirements
- 2 well-qualified local urban planners
- 1 local computer specialist
- 1 foreign technical adviser
- 1 foreign computer specialist
- 3-4 municipal staff members.

Institutional structure
To develop and introduce the system, a special task force was established, lead by a consultancy firm and composed of staff members from the National Tax Office, the National Geographic Institute, the telephone company and the user municipalities. The systems were handed over to the municipalities after they had been established.

Legal status
System development and introduction were carried out under special agreements between the various institutions involved. The intended reform of local government is expected to provide a legal status for the system.

Time requirements
for a municipality with 200,000 inhabitants (20,000 parcels):
- preparatory work and institutional agreements : 2 months
- field surveys, including field checks and data documentation: 10 months
- production of digital cartography: 8 months.

3. CONCLUSIONS AND RECOMMENDATIONS

3 CONCLUSIONS AND RECOMMENDATIONS

SUMMARY COMPARISON OF CASE STUDIES

The overview of case studies in the previous section shows a range of possible **approaches to establishing a simple land information system**, as has been done in technical cooperation projects in the developing world. In this section, their common features and major differences are described, compared and briefly assessed.

Technology and equipment

All of the five systems are **based on personal computers (PC)**, which can now be purchased and maintained locally without major difficulties. Furthermore, although diverse in detail, all systems have a computerised alphanumeric data base and a cartographic component.

Alphanumeric data base

In most cases, the **alphanumeric data base** is run on standard PC software (such as dBase, FoxPro or similar), which can be operated on a standard 486 processor or, depending on the time of system development, even on a 386 processor. The data base software has usually been **adapted to the specific requirements** of the users by local computer experts.

While the data bases have all been developed or modified by work teams and institutions commissioned to introduce the system, the actual **management and operation** of the systems is done **at municipal level**, with the exception of the highly centralised RSI in El Salvador. The initial investment costs for the user municipalities are relatively small, since operations can be started with only one PC, while more PCs and more sophisticated equipment can be purchased subsequently, when the finances of the municipality have improved and sufficient trained staff is available.

Cartographic component

The **cartographic component provides geographic reference** for the systems, thus forming an integral part of each system. However, the approaches to developing and establishing the cartographic components varied considerably between the different systems, depending on the availability and quality of existing cadastres and maps, and the institutional responsibility for map production.

While some systems produced their own maps, either by the municipality's own technical staff or with the help of the agency commissioned to introduce the system (as in Paraguay, Ecuador and El Salvador); other systems rely more on the services of national institutions (as in Nicaragua and Benin). Consequently, the techniques used for map production range from traditional manual production (Paraguay), through a combination of manual production and scanning (Ecuador and El Salvador), to full digitisation right from the beginning (Nicaragua and Benin). However, **all the systems have a fully digitised cartography as a long-term objective**, as this is the only way to build a comprehensive LIS, in which different sets of data can be merged with cartographic information.

As the processing of cartographic and geographic data requires more sophisticated hardware and software (e.g. plotters, more powerful computers and special GIS software), the responsibilities for the cartographic component have also been assigned in different ways, depending on the availability of technical capability and equipment. In most cases, **map production and update** were **initially carried out by the better-equipped central institutions**. Only in Nicaragua was map production assumed by the municipalities right from the

beginning; but, even here, abundant technical assistance was given by the national agency responsible for map production.

Nevertheless, all computerised cartographic components developed for the different systems have been designed to run on PCs, with standard GIS software for urban planning and management purposes, thus allowing the **transfer of functions to the municipalities at a later stage**, when the municipalities have the necessary financial and human resources.

The experiences of the different systems show that such incremental approaches to digital cartography and the establishment of a comprehensive LIS do produce good results in improving expertise appropriate to local conditions.

Data collection and accuracy

In most cases, a **pragmatic approach** is taken **to data collection and data accuracy**. Where possible and available, existing data and cadastres are used to build up the needed information bases for the systems, thus reducing the need for field surveys. These approaches can be summarised as follows.

Use of existing information and focus on core areas

Most systems focus initially only on those **municipal areas where basic cadastral information is already available** and where considerable gain in taxation can be expected with the introduction of the system. Thus, in Ecuador, Benin and Nicaragua, initial system operations are limited to core municipal areas; fringe areas - where the densities are lower, settlements are informal and less information is available - are left to a later stage. In El Salvador, where the role of the system is quite different, property registrations are taken of individual properties or individual groups of properties across the country, rather than as part of a general registration of a particular geographic area.

Scope of surveys

Even with this pragmatic approach, **considerable field work**, including field surveys, is necessary to establish the data base. Most systems have chosen an **expeditious survey method**, which does not guarantee a high accuracy of data. Instead of carrying out exhaustive interviews and precise topographic and geodetic surveys, information is collected from property owners or occupiers.

An important feature common to most of the systems is the **heavy reliance on owners, tenants and even neighbours to provide information** on the land or property being surveyed. The methods used range from simple interviews in Paraguay, Ecuador and Benin, to a complete self-valuation and self-assessment in Nicaragua. In El Salvador, applicants for property registration have to provide all the documents and information, thus reducing the need for field work considerably. In most cases, the information provided in this way is assumed as correct, and only checked if it appears particularly implausible.

In general, all systems aim to establish their data bases incrementally, with a view to gradually improving and extending the information during subsequent system operations.

3 CONCLUSIONS AND RECOMMENDATIONS

Data update and maintenance

All the case studies put a strong **emphasis on the need to continually update the data base**. Without regular updates, the systems will not serve their purposes for very long.

Accordingly, the **requirements for updates were defined right from the outset as an essential part of system operation**. Hence, the data incorporated into the system have to be assessed with regard to the ease of, and procedures for, regular updating.

However, the updating procedures vary considerably from one system to another according to the general context and conditions of their introduction. The Paraguayan system, for example, requires **annual field checks** to update and improve the data base in addition to the regular updates during system operation. Most other systems rely, to different degrees, on **regular information exchanges** between different municipal departments, and between the municipality and other governmental institutions and surveyors or notaries who process land-related information, while more comprehensive field work is planned at much longer intervals, e.g. in Nicaragua, every five to ten years.

For the regular updates during system operation, most of the systems have **routine procedures built into** them.

Another important aspect of system maintenance is the **increase in municipal revenues** as a result of system operations. However, since the systems have only been operational for a couple of years, no information is as yet available on the effect of system updates on municipal budgets.

To ensure the sustainability of the system, the requirements and procedures for updating and maintenance have to be defined from the very beginning of system development.

Expandibility of the system

Although most of the systems presented initially focus on those functions related to municipal revenues and local fees and taxes, by the nature of their **modular design**, they can all be expanded to include **additional functions** to support other aspects of municipal management **at a later stage**.

The Ecuadorian, Nicaraguan and Benin systems were developed with future expansion in mind and their data have been collected and processed accordingly; and they could have taken on other municipal functions right from the beginning. **In practice, the initial focus is on the introduction and consolidation of priority tasks, and other functions are to be incorporated later.**

The system developers in Paraguay and El Salvador, on the other hand, have followed a more incremental approach to the expansion of their systems. Here, the decisions to expand will be based on the evaluation of the operation of the core components and an assessment of demands for further functions.

In general, the main deciding factor for system expansion is the capacity of the users to assume additional tasks, rather than the technical possibilities of the system.

Legal framework and status

The biggest difference between the various systems is the political framework in which they were conceived and introduced, and their legal status.

The systems in Paraguay, Ecuador and Benin were developed within an existing legal framework.

- The **Paraguayan example**, in particular, illustrates the potential of a **pragmatic approach** in an environment of overlapping and unclear institutional responsibilities, where the legal status of the system remains ambiguous.
- In **Ecuado**r, the development of the system took maximum advantage of the scope granted by the Local Government Law to establish a **simple cadastre within existing legal provisions**.
- The same holds true for the **Benin** system, which was also developed initially within the prevailing legal framework, closely supervised and controlled by the central government. However, in this case, the introduction of the system has sparked off a **reform of local tax regulations** and has inspired a discussion of the need for a comprehensive reform of local government.
- In contrast to the foregoing, **El Salvador** and **Nicaragua** had a **comprehensive legal and institutional reform before the introduction** of their new cadastral systems.

The different approaches demonstrate that an efficient LIS can be introduced even in a politically and legally difficult environment. The success of an LIS depends much more on a careful assessment of the scope and possibilities provided by prevailing political conditions than on the inherent nature of a piecemeal or comprehensive approach.

Institutional and organisational structures

Reflecting the different political, legal and institutional environments, the institutional and organisational arrangements for the various systems also differ considerably.

While some systems are meant to be managed **at municipal level**, as in Paraguay and Ecuador, with contributions from central government institutions mainly in the technical realm; other cases have tried to establish **comprehensive interinstitutional agreements** to develop, introduce and operate the system, as in Nicaragua and Benin. In **El Salvador**, where a centralised approach was taken, **a completely new institutional entity** was established to develop and operate the system.

However, in all cases, the initial development received contributions from central institutions involved in urban land management, such as the national cadastre agencies and the central fiscal cadastre institutions. Also, in almost all cases, **special emphasis** has been given to the establishment of a special working unit in the municipality **to anchor system operation at the local level**.

Another feature common to all systems is the **prominence of the lead agency**, which assumed the tasks of system development, interinstitutional coordination, training and providing technical assistance to the end users. In the Latin American cases, this role was assumed by national institutions responsible for technical assistance to local authorities; the **Benin** case presents an interesting example of a **public-private partnership** being established specifically to provide these development and support services.

3 CONCLUSIONS AND RECOMMENDATIONS

Staffing and training

The wide spectrum of institutional and organisational structures presented by the different systems strongly suggests that the development of an appropriate institutional structure is a prerequisite to establishing a fully functional LIS.

All the systems put a strong emphasis on the **development of human resources**, stressing **reliance on local expertise**. Where possible, local experts were employed from the early stages of system development, thus building up the personnel capabilities and capacities for future operation and maintenance. Being better acquainted with local conditions than foreign advisers, local experts also played a key role in the technical assistance and training relating to system introduction.

In all the cases, **special training programmes** were launched **to build up capacities** in the municipalities, and in other institutions involved in the implementation of the systems. In some cases, these training courses were carried out in parallel with system development, and were accompanied by extensive field tests of the procedures and instruments developed.

In general, **training** was provided **on the job** rather than in the classroom. Only a small number of key technical staff, such as the operators of the graphic components, were sent on special training courses, almost all of which were held in-country. Only in the Benin case was a small number of staff sent to France for a special short course.

Technical training courses were occasionally **complemented by training courses designed specifically for politicians, especially mayors and counsellors, to raise awareness** of the importance and potential benefits of the new systems.

After the system had been introduced at municipal level, efforts were often made to **promote information exchange** between user municipalities, as well as to disseminate positive experience to municipalities not yet introduced to the system.

For actual system introduction at municipal level, the most common practice was to form a **small work unit of two to three people**, who were to actively participate in all stages of system introduction, and who formed the core of the more comprehensive administrative unit at a later stage. This core staff was usually trained intensively on the job by local experts during system introduction. This **assistance** was then **phased out gradually following the consolidation of operation** at the local level.

For the labour-intensive **field work** required for the establishment of a data base, all systems, except the Salvadorean case, employed **temporary local staff** from universities, schools or other technical professions, in order to keep cost down, but also to foster local skills.

In summary, the availability of qualified and motivated staff is one of the prerequisites for the implementation as well as the long-term sustainability of an LIS. All efforts to build an LIS, therefore, have to include a good training programme at all stages.

Financial feasibility and sustainability

Although all the systems presented in this report were supported by **external technical and financial assistance in their development and introduction**, their **financial feasibility and sustainability** had been carefully **considered before system development**. This is underlined by the fact that almost all systems focus initially on the improvement of municipal revenues, with a view to generating adequate financial resources to sustain their own operations.

The basic equipment and other expenditure necessary for system introduction, such as the costs of field surveys, were usually covered by external assistance only for a small number of pilot municipalities. Other municipalities will have to pay for the basic computer equipment, the field work and the operations themselves. This provides a **strong incentive** for the municipalities **to recover** their **investment** through the operations of the system.

In most cases, the municipalities were advised to purchase only the **basic equipment** needed immediately to run the system, and to defer investments in more comprehensive or sophisticated equipment till such time as the system was producing tangible financial improvements for the user municipality.

The fact that the municipalities were able to finance these initial investments and that, in most cases, municipal revenues were increased considerably within a relatively short time, amply illustrates the general viability of this venture. The financial feasibility is further underlined by the proposal to involve private banks in the financing of the initial investments, as in Benin and Nicaragua.

In the case of El Salvador, where the focus is different, at least part of the initial investment costs, and all of the operating costs, are covered by the fees received from the registrations of properties.

In general, the financial feasibility of an LIS must be seen as one of its cornerstones; and this can be achieved by focusing initially on those functions which produce direct income before embarking on other uses of less obvious benefits.

3 CONCLUSIONS AND RECOMMENDATIONS

SUMMARY ASSESSMENT

In summary, the differences between the various systems may be reduced to a number of **dichotomic features**, which may be useful to recapitulate here to provide some guidance for determining the approach to be adopted for the introduction of an LIS, and for assessing its suitability for a particular country or region in the developing world.

Piecemeal approaches vs. comprehensive reform

The different cases presented in this report show the range of possible approaches to LIS, varying from a pragmatic approach which "muddled through" an ambiguous political and institutional environment (in Paraguay and, to a lesser extent, in Ecuador), to one which precedes the establishment of the LIS with a comprehensive legal and institutional reform (in Nicaragua and El Salvador). While both approaches can be justified and regarded as generally successful in the respective case studies, their suitability to other situations has to be carefully assessed.

- A **pragmatic, piecemeal approach** may be adopted in a situation **where the likelihood of success of a comprehensive reform is relatively low**, and where the **resources available** for system development are **limited**.

  The piecemeal approach has the advantage of **allowing the system to develop gradually**, with ample opportunities for testing and refining, and without the pressure to achieve ambitious objectives in a short period of time. The users can accumulate practical experience and gain confidence in the benefits of the system by seeing the tangible results of the system. In particular, the Paraguayan example shows that real improvements can be made with limited resources in a relatively short time.

  However, no matter how pragmatic the approach may be, the system still needs a **legal framework to support its existence**. Furthermore, a system that has been built up incrementally needs to be integrated into a more stable institutional framework eventually; otherwise, it is liable to collapse.

- In contrast, a **comprehensive reform of land management and institutional framework** seems **appropriate where the political will and financial resources do exist** to carry out such a reform.

  Such an approach may require **much more time for the preparation**, as it requires a major restructuring of the legal and institutional arrangements; and may require changes in legislation. However, once this framework has been established and the legal status defined, the system can operate on a sound basis, as demonstrated by the Salvadorean example. Its **long-term impac**t would, thus, be much **more far-reaching** in terms both of improvements in land management and of geographic coverage.

  However, given that priorities change frequently in many countries, it must be borne in mind that the success and **sustainability** of such an approach **depends very much on institutional and political continuity**.

Pilot projects vs. national scheme

None of the systems investigated tried to implement an LIS over the whole country all at once. Even in Nicaragua, where the system is envisaged to cover the entire country in the long term, it was first introduced to a number of pilot municipalities. In all other cases, the systems were designed to be run as **pilot projects in a limited number of municipalities or selected regions, or sites** (e.g. in El Salvador). Attempts to disseminate and extend the system were usually made only after extensive testing and refining of the system had been carried out, and after tangible results had been obtained in the pilot projects.

Given the shortage of resources and the complexity of issues to be addressed, the **pilot project approach** seems to be **more realistic** and feasible **than the nationwide approach**, which would **require enormous amounts of financial, technical and human resources**. The existence of successful pilot cases further substantiates the argument for a phased extension of the system.

The eventual **geographic coverage** is **determined** partly **by the institutional and legal status granted to the system**. A nationwide coverage can only be achieved if the system has a well-defined legal status and a strong institutional base.

Localised vs. centralised systems

With the exception of the property register in El Salvador, all cases focus on improving land information to support and strengthen municipal functions and administration. Accordingly, they have established locally managed registers and computer systems. Even in El Salvador, where the system is very centralised, efforts are being made to decentralise the registers. This largely reflects the general trend towards decentralisation in most parts of the world.

Since most land information originates locally, and the majority of prospective users in both the public and private sectors are also local, a **localised land information system** would seem **most appropriate** for ensuring efficient land management and a more prominent role for local government in urban management.

However, as is shown by the case studies, the transition to the local level of the management of land information may need to be gradual, with **some functions being retained at central government level** initially. This would be particularly true of the **coordinating and supervisory functions**, if the consistency of land information were to be safeguarded; it would also be true of **technologically challenging functions**, such as digital mapping, which are as yet too specialised to be taken over by municipalities or other local institutions.

Dedicated systems vs. multipurpose systems

While LIS is usually associated with multifarious uses of data, the experiences of almost all cases show that a focus on only one or a few priority tasks can considerably facilitate the operation of an LIS in its initial stages.

More important than the rapid assumption of all potential functions of the system is the **gradual expansion of the system**. The successful improvement of a few essential tasks can be a much greater incentive to develop and integrate new uses than the acquisition of sophisticated equipment with intensive external assistance.

Manual vs. computerised data processing

All examples demonstrate that simple and appropriate LIS can be established with relatively cheap PC-based technology, financially feasible even for very small municipalities. **Manual data processing** must therefore be considered **largely obsolete**.

Apart from data processing, another advantage of simple computerised systems is their inherent **need to use well-defined formats, to standardise routines and procedures**, and to store data centrally and systematically.

The examples also show that a good LIS does not necessarily require sophisticated equipment; and that **manual and digital data processing can coexist**, provided that common references have been established to link the different data sets. Similar to the extension of LIS functions, the technical equipment and its sophistication can also grow gradually with the increasing capacities of the users.

3 CONCLUSIONS AND RECOMMENDATIONS

RECOMMENDATIONS FOR THE ANALYSIS OF THE CONTEXT FOR THE PLANNED SYSTEM

Based on the foregoing conclusions, a number of **recommendations** can be derived from the experiences of the case studies, which might be useful **for the basic orientation of the design and development of similar systems** in other countries. Furthermore, they may also provide some guidance for the appraisal and evaluation of programmes or projects related to land information systems.

These recommendations are presented in the form of a **checklist** of different aspects of LIS, to be considered when introducing an LIS in a developing country. However, due to their general nature, they are offered here only as preliminary guidance; and not as a replacement for a detailed assessment.

The first step for system development comprises the assessment of the background and rationale of the planned system. Many problems or conflicts - be they technical, political or institutional - can be avoided by a **careful analysis of the environment and context** in which the system is to be introduced, and by the choice of an appropriate approach.

Analysis of the demand for a land information system

- **problems and functions**
  - why is an LIS necessary?
  - what problems should it address?
- **potentialities**
  - what priority functions or tasks can be improved by the LIS?
  - what inputs will be required?
- **benefits and costs**
  - what are the potential benefits of the system?
  - how much will it cost?

Analysis of the legal, institutional and political framework in which the system will be introduced

- general **political priorities** with regard to urban land management
- prevailing **laws and regulations**
- the **roles, functions and interests of governmental institutions** responsible for land management
- the **roles, functions and capacities of local government**
- the **need for institutional and legal reforms**
- the **political will** to support and implement reforms
- **available technical and financial assistance**
- **institutions to be involved**

Analysis of available human resources and technical expertise, including a tentative assessment of training needs

- **capacities and qualifications of** existing **personnel** at end-user level, in local government and other public institutions to be involved
- **local expertise** in
  - technical design and maintenance
  - technical advice and training
  - hardware and software services and maintenance

FOR SYSTEM CONCEPTUALISATION AND DEVELOPMENT

The second stage concerns the **establishment of the foundation and conceptual elements** of the system to be introduced. Only after general context for the system has been sufficiently clarified, the conceptualisation and technical design of the system can begin. This can be done by going through the following steps. It must be pointed out that, although these steps are presented in a sequence, they are closely related, and must be closely co-ordinated and continually revised during the entire exercise.

Development of conceptual elements
- **principal tasks and functions of the system** and its main outputs; definition of **optional functions**
- **main system components** required to support these functions
- **institutional framework** for system development and implementation
- the **phasing** of system introduction

Selection of appropriate technology
- **availability of** existing cadastral, fiscal, cartographic and other **information**; definition of **additional information required**, accessibility and costs of obtaining additional information
- level of **accuracy of information** and **geographic coverage**
- **update and maintenance** of data base
- **manual or computerised operation**
- **local availability of hardware and software**
- the possibility of **incremental system extension**

Detailed design
- **procedures for system operation**
- **development or adaptation of software**
- **procedures for data collection** (field work and surveys)
- **map production and update of cartographic information**, manually or digitally
- **testing and modification**
- estimate of **investment and operational costs**

Establishment of the institutional framework for system introduction
- definition of the **roles, functions and contributions of institutions to be involved** at central and local government levels
- establishment of **procedures for interinstitutional coordination** and collaboration, eventually in the form of official agreements
- **coordination of all parts of system development between these institutions**
- **secondment of personnel** of these institutions to participate in system development

Training and technical assistance
- **estimation of training needs** and assistance for system operation, at both local and central government levels
- **identification of local trainers** and advisers, including training of trainers
- **design of** on-the-job and other **training programmes**
- **production of handbooks and guidelines** on system operations

3 CONCLUSIONS AND RECOMMENDATIONS

FOR SYSTEM INTRODUCTION AND ESTABLISHMENT

The **implementation** of an LIS requires intensive field work to establish its data base. It also requires considerable investments in equipment and personnel. Thus this is **the most cost-intensive stage** of system development. For this reason, in most of the case studies presented in this report, implementation had first been limited to a small number of pilot municipalities before a comprehensive programme to introduce the systems was launched. This stage, therefore, has to be **carefully coordinated and monitored** to allow corrections and modifications to be made before disseminating the system. The main aspects to be considered at this stage - again, closely interrelated - are summarised as follows.

Establishment of advisory services
- **selection of qualified**, preferably local, technical **staff** and **formation of small working teams** to support the municipalities
- **establishment of work programmes** for the technical assistance services

Establishment of the framework for system introduction at municipal level
- **presentation and discussion of the concept** of the system with local authorities
- **clarification of the investments and other contributions required** of the municipality, and of the potential benefits of the system
- **establishment of formal agreements** at municipal level
- **establishment of a municipal working unit to operate the system**, and organisation of temporary staff for field work

Local training courses to prepare for system introduction
- **introductory training** for the municipal working unit, to be complemented by intensive on-the-job training
- **training of survey teams** in survey methods and documentation
- **public relations events or campaigns** for the information of political representatives and the general public

Establishment of the data base
- **compilation and evaluation of existing information** and cartographic materials
- **production of draft maps** for field surveys and **design and adaptation of survey forms**
- **field surveys** and **preliminary, manual processing of collected data**
- **field checks** for plausibility and consistency of data
- **documentation and entry of data** into the computer
- **revision of draft maps and production of cadastral maps** based on geographic and alphanumeric data

Initial system operation

At this stage, intensive on-the-job assistance and training will be required to ensure successful operation.

Monitoring and evaluation
- **difficulties or obstacles experienced** during system introduction at the local level
- **responses of local staff** to training and their capacities to work with the system and **responses of citizens** to field surveys
- **impacts of system operations** at the local level
- **need for revision or amendment** of approach or procedures

Dissemination
- **informing a wider range of potential users** and promoting exchanges of experience between users; **large-scale information events** and training programmes
- **incremental increase of capacities for technical assistance**, and exploration of the possibilities of privatising technical assistance services

FOR SYSTEM MAINTENANCE AND EXTENSION

At this final stage of implementation, the emphasis is on the **consolidation of system operation**, which could serve as the basis for increasing the functions of the system, as well as for extending its geographic coverage. Most of the **tasks** to be performed at this stage **are ongoing or have to be repeated at regular intervals**.

Most of the tasks at this stage will be performed by the municipal working unit, and **much less resources and advisory assistance** will be **required** than at earlier stages. However, a considerable amount of follow-up will still be necessary **to ensure the long-term benefits of previous efforts**. The major aspects to be considered can be summarised as follows.

Update and maintenance of data base
- **update** the data base **at regular intervals**
- **encourage exchanges of information** between institutions and other actors
- **monitor and revise operational procedures** where necessary

Consolidation of operational routines and administrative procedures
- **anchor system operation within municipal administration** (transferring from task force to a regular municipal section or department)
- **consolidate operational routines** within municipal administration
- **consolidate procedures for collaboration with other institutions**
- **gradually raise the qualifications of system operators**
- **integrate additional staff** into system operations
- **transfer all functions which can be managed locally to local staff** (e.g. processing of cartographic data, maintenance and adaptation of hardware and software)
- **monitor the accountability and financial sustainability** of the system

Incremental improvement of data base
- **update and maintain the data base regularly**
- **carry out additional field surveys**
- **improve the quality and consistency** of the data base
- **extend the geographic coverage** of the system

Integration of additional tasks and functions
- **consolidate priority functions**
- assess **user capacities to assume additional functions**

3 CONCLUSIONS AND RECOMMENDATIONS

SUMMARY AND OUTLOOK

The case studies presented in this report illustrate the **wide range of possible approaches to LIS** and their potentialities in the developing world.

The successful approaches have mostly been those which have limited themselves to certain **priority tasks in urban management**. In some areas, such as the support of municipal financial management, efforts to introduce and use LIS have been made on a large scale, and some positive results have already been achieved. In other areas, such as urban planning and slum upgrading, the use of LIS is so far very limited; and, where it is used, it is still in its experimental stage. In yet other areas where LIS would be very useful, such as infrastructure planning and operation or urban environmental management, it has hardly been thought of.

Whilst the fascination for fully computerised LIS still holds sway, most of the case studies presented in this report have followed a more **pragmatic and demand-lead approach**. This perceives **technology as a tool and not an end in itself**. It takes the view that sophisticated technologies are not always necessary, nor even always desirable. Rather, it aims at an **incremental system development**, moving gradually from partial to complete computerisation. More important than the technology are the following factors:

- a careful **consideration of the general political, legal and institutional environment**
- a **demand-oriented approach** to information collection and processing
- **consistency of data** to enable cross-referencing, combinations of different sets of data, and long-term development of the system
- operational procedures which take account of **gradual improvements in the abilities of the users**.

The different examples also show that a well-thought-out approach can contribute significantly to improving administrative routines, and even to institutional or legal reforms. The main advantages of a successful LIS can be summarised as follows:

- the **streamlining and standardisation of administrative procedures**
- the **reduction of political interference** in the use of information
- its **potential as catalyst for institutional and administrative reform** by facilitating communication between different institutions which share a common interest.

While experience with LIS in urban management in the developing world is still rather limited, it can be expected that the increasing need for improved land management will lead to further development of appropriate LIS, and that more positive results will be obtained on a larger scale in the near future.

PART II: DETAILED CASE STUDIES

A. SIMPLE CADASTRE FOR SMALL MUNICIPALITIES - PARAGUAY

A PARAGUAY

BACKGROUND TO SYSTEM DEVELOPMENT

Paraguay currently has a total of 216 municipalities (*municipios*) of varying sizes and economic importance. Like in most other Latin American countries, they normally comprise an urban centre and its rural hinterland (comparable to the British counties or the German Landkreise). Their share of public spending is extremely small, representing only 2% of total public spending, compared to 4-10% in Peru, Venezuela and Chile; 25% in Brazil; and 20-40% in Western Europe. Furthermore, the smaller municipalities have an even smaller share in this tiny part of governmental spending: in 1992, 22% of municipalities spent 83% of total municipal budget; and the annual municipal budgets for administration and investments ranged from US$ 3,200 to US$ 63,000. The majority of municipalities spent less than US$ 3.50 per capita annually; thus, the ability of municipalities to provide utilities and social services is severely limited.

For decades, municipal development had been neglected and municipal autonomy restricted by the central government and the one-party system. Only in the late 1980s, with the beginning of a process of democratisation, were cautious steps taken towards more municipal autonomy and the strengthening of municipal finance. The most important milestones in this process were the introduction of direct elections of mayors in 1991, and the transfer of responsibilities for property taxation to the municipalities in 1992 following the adoption of the new Constitution. However, the management of municipal services and finances was still being hampered by understaffing and the low quality of available staff. In particular, the potential to increase municipal revenues through local taxes and fees was not being fully explored, for the following reasons:

- lack of information for the levy of fees and taxes (i.e. number of taxpayers, land ratings, property and tax registers, etc) due to the fact that cadastres were centrally managed and rarely updated
- lack of appropriate instruments and procedures for efficient levies
- reluctance of citizens to pay due to inequity and lack of transparency in the taxation system
- generally poor management of municipal finances, especially with regard to budgeting and accountability.

Against this background, improved instruments and procedures for the levy of municipal taxes, especially developed for smaller municipalities, were introduced in the context of a technical cooperation project, jointly implemented by the Paraguayan Municipal Institute (*Instituto de Desarrollo Municipal* - IDM) and the GTZ (German Technical Assistance) since 1987. This system, which focuses on improved procedures for revenue collection, can also be used to support other municipal tasks, such as urban planning and general administration.

MAIN AREAS OF APPLICATION

The land information system (LIS) developed by the project can be used to support the following tasks:

General urban management
To provide information on

- demographic structure and characteristics
- urban land uses
- type and quality of municipal infrastructure and social services
- municipal assets, in particular land and other real estates.

Municipal levies
To collect

- land taxes as the most important source of municipal revenues
- other municipal fees and charges, such as building permits, development tax, trade and industrial taxes, waste collection fees, etc.

Physical planning
To supply

- a range of land-related data in the form of maps and data bases
- information for the development of new settlements and the extension of technical infrastructure.

IMPROVEMENTS BROUGHT ABOUT BY THE SYSTEM

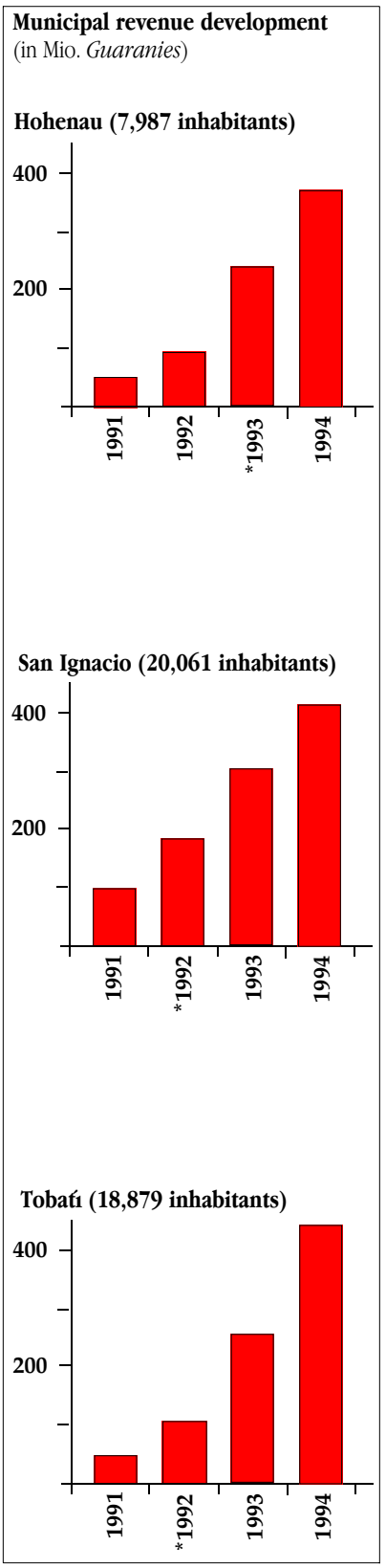
At the time of writing, the system had been introduced to about 20 municipalities at different levels and on different scales. In most of the municipalities, municipal revenue collection had improved considerably, with an average increase of 300% from 1991 to 1993. Three of the pilot municipalities assisted intensively by the technical cooperation project almost succeeded in achieving a 100% collection of municipal taxes.

In addition to improved collection of property taxes, other municipal revenues from the following sources were also improved: taxes on unbuilt sites, fees for building permits, fees for the parcelling of building land, charges for maintenance of municipal roads, taxes on industrial and commercial concessions, leasing of municipal real estate, and fees for solid waste collection and disposal.

In addition to a significant increase in municipal revenues, some other important changes have also been brought about by the standardisation and automation of revenue collection:

- the usual bargaining between taxpayers and the municipal administration has been replaced by a better understanding of the municipal revenue system on the part of the taxpayers
- tax assessments, now based on clearly defined criteria, have become more transparent for the average taxpayer
- the accountability of the municipal financial administration has been improved considerably
- administrative procedures for tax assessment and collection have been significantly streamlined
- more accurate estimates of potential municipal revenues have lead to more reliable and more rational budgets.

Municipal revenue development
(in Mio. *Guaranies*)



SYSTEM COMPONENTS

The simple cadastre developed by the project combines information processed manually with a data base which documents, processes and evaluates these data by computer. To establish this data base, a special computer program (based on dBase) was developed, which was tailored to meet the specific requirements of small municipalities, and which can be run easily on a personal computer.

The various system components were developed by a special working unit within the municipal office for cadastre and urban planning. The establishment of this working unit must be seen as one of the most important prerequisites for the introduction of the system.

Cadastral survey maps

Cadastral survey maps, scaled at 1 : 5,000 to 1 : 20,000, were used as the geographic reference to identify rural and urban properties. The maps, based on existing but often outdated maps or aerial photographs, provided the following information:

- a geographic grid
- names/numbers of streets and building block numbers according to the national cadastre
- built-on areas and vacant areas
- boundaries of agricultural lands and farm numbers
- special topographic features, where necessary.

Block unit maps

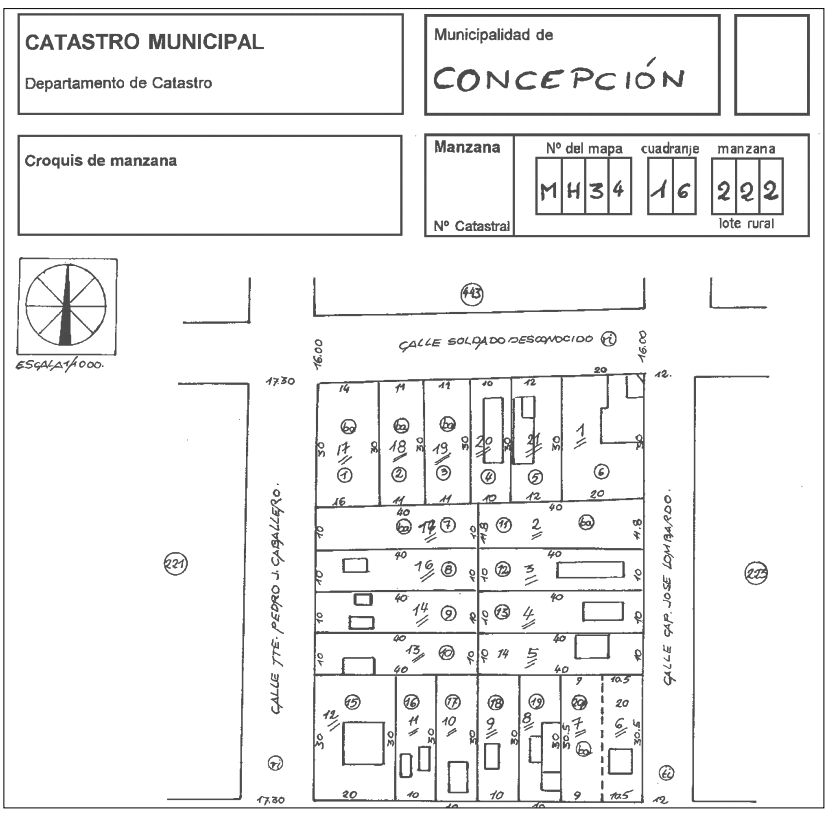
The second main element of the information system was the maps or sketches of building blocks, scaled at 1 : 1,000. These gave the following information:

- names/numbers of streets and numbers of building blocks
- boundaries of a building block and the boundaries of individual land parcels within it
- consecutive numbering of land parcels within a building block
- street-front lengths of land parcels
- a sketch of the built areas indicating size and shape.

The most important components of the Paraguayan municipal cadastre:

- Survey maps of the municipality.
- Maps or sketches of building blocks *(croquis de manzana)*.
- An automated urban management system, *Sistema Integral de Gestion Municipal Automatizado (SIGMA)*.

Example of a block unit map



Data sheets on properties and uses

For each plot or parcel, detailed information on property characteristics and uses was documented on a data sheet, with cross-references to the information in the block unit maps. The data sheet included the following information:

- plot number and indication of land value according to the assessment zone in which the property was located
- type of ownership
- plot size (lstreet front and total area) an total built- on area
- land use, infrastructure provision and access
- building category
- total built-on area.

This information was normally summarised on the back of the building block maps.

Example of a data sheet

CATASTRO MUNICIPAL

Departamento de Catastro

Municipalidad de

CONCEPCIÓN

Datos de las propiedades

Manzana

Nº Catastral

Nº del mapa: M H 3 4 | cuadrante: 1 6 | manzana: 2 2 2 | lote rural

Nº de Parcela	auxiliar	Propietario/Ocupante Apellidos, Nombres	ubicación	tenencia	área de terreno m²	frente(s) m	tipo de calle(s)	uso del suelo	servicios básicos	uso construcción	categoría	área construída m²	observaciones
6	1-	Valiente, María Edelmira	U	Pér.	600	20/30	ri-ti	re-co	e-t	vi/co	b/2	220	2 pisos
11	2-	Roreda, Fernando Alberto	U	P	472	11.8	ti	ba	e	ba			
12	3-	Areco Saavedra, Luis	U	Pér.	400	10	ti	re	e	bi	b	102	
13	4-	Duarte Acosta, Daniel	U	Pér.	400	10	ti	re	e	vi	c	78	
14	5-	Castillo, González Mariano	U	Pér.	400	10	ti	re	e	vi	c	96	
20	6-	Ramírez, Juan Angel	U	P.	300,25	325/ma	ti	re	e	bi	b	56	
20A	7-	~~Guarías, Elisadora~~ ~~Arcayos, Luis~~	U	P.	234,5	9	ri	ba	e	ba			
13	8-	Vega Paniagua, Francisco	U	Pér.	300	10	ri	re-co	e	vi/co	c	180	
18	9-	Coronel, Pedro	U	P.	300	10	ri	re	e	vi	c	70	
17	10-	Ortega, Catarina Duarte de	U	Pér.	300	10	ri	re	e	vi	c	120	
16	11-	Saavedra, Antolín	U	P.	300	10	ri	re	e	vi	c	100	
15	12-	Ríos, Valentín Isael	U	Pér.	600	20	ri	re	e	vi	c	100	
10	13-	Vega Paniagua, Francisco	U	P.	400	10	ri	re	e	vi	c	70	
9	14-	Romero Sosa, Anselma	U	P.	400	10	ri	re	e	vi	c	70	
8	15-	González, Francisco	U	P.	400	10	ri	re	e	vi	c	70	

SIGMA - an automated cadastral system

This system consists of a data base especially developed for small municipalities in the context of the technical cooperation project. It allows the users to update their data base regularly, and to carry out relatively simple data processing.

In its initial stage of implementation, the system focused on processing data for taxation purposes, in particular for property taxes. At a later stage, it is possible to extend the system to carry out other tasks relating to municipal financial management, such as general accounting and budgeting.

The design of the data base is flexible enough for integrating additional data, if required. As the municipal staff become more proficient in system operation, they can adapt the system to other uses.

The general geographic reference for all system components was provided by the cadastral survey maps and the geographic grid established by the national cadastral system. The design and size of the maps, as well as the keys used, all conformed to those used in the national cadastre to ensure compatibility.

A PARAGUAY

INTRODUCTION OF THE SYSTEM

In most municipalities, the basic information and maps required to establish the system were either not available, incomplete or outdated. Consequently, this information had to be collected while the system was being implemented. Once the town council had made an official decision to introduce the system, three main steps were taken to establish the system, as follows.

- **Preparatory work** to evaluate the readily available information and to structure and plan further work.
- **Field work** to collect or update the required information.
- **Documentation and analysis** of the collected information.

Preparatory work

This comprised the following tasks:

- selecting staff and training them for the establishment and operation of the system
- allocating offices and other facilities within the municipality for the operation of the system
- informing the community of the planned introduction of a cadastre of real estate properties
- gathering all available maps by contacting relevant public institutions as well as private surveyors
- having a local surveyor prepare preliminary survey maps of the municipality based on existing information
- preparing data sheets for the collection of information in order to produce preliminary block unit maps
- training auxiliary staff for the field work, including short pilot surveys.

The time required for the preparatory work differed considerably from one municipality to another. In most cases, it took about six months.

Field-work

The main field work comprised:

- a rough survey of all building blocks, marking plot boundaries on block unit maps
- a rough estimate of the sizes and locations of buildings: these were roughly sketched on the block unit maps; at the same time, the uses of the plot and buildings were recorded in the respective data sheet
- obtaining other relevant information through interviews with owners or neighbours.

Again, the time required for field work differed according to the size and structure of the municipality. With good preparation and planning (with good-quality base maps, good route planning, etc), a team of two was able to cover two building blocks in a day. Corrections and revisions took an additional 30% of the time required for data collection.

ACCURACY OF DATA

Data processing

The data collected during the field work by the survey teams were then processed in the office by the staff assigned to these tasks, following the procedures below:

- the final block unit maps were drafted in the scale of 1 : 1,000, and the cadastral survey maps were revised
- the plot-related data compiled by the survey were checked and analysed; and, if necessary, amended or revised following additional field work, after which the final data sheets and summary tables were organised according to survey sectors and buildings blocks
- the information from the final data sheets was then entered into the computer, to be processed and analysed electronically.

The time required for data processing was similar to that for the field work, depending on the quality of the field work. Corrections and revisions again took between 25% and 30% of the time required for data processing.

For the sake of simplicity and speed in data collection and documentation, the plots were only surveyed roughly, relying largely on a pragmatic approach and gradual increase in the competence of the survey teams, rather than striving for a high level of accuracy. Plots were measured using a measuring tape and without triangulation, the error margin of this type of survey is approximately 50 cm. The survey also depended to a certain extent on the cooperation of local residents, who were usually willing to help.

The level of accuracy achieved by this simple survey was deemed sufficient to establish the system and start operation. It is expected that the accuracy of the data base will be gradually increased during subsequent system operation and continual update.

In any event, the quick improvement of the data base was considered more important than legal proofs of property ownership, or a full verification of the statements made by owners or neighbours.

SYSTEM OUTPUTS

In addition to the basic components (survey maps, block unit maps and data sheets), the electronic data system has other outputs which can facilitate the collection of municipal revenues and support general planning and management tasks. These are described below.

Summaries of land information

To facilitate the analysis of information, the system can process data and present information in many different ways. For example, the system can provide all information relating to a specific plot of land; it can also give an overview of all real estate properties under different ownerships (individuals, businesses, institutions, etc). Moreover, the presentation of data and summary tables can be easily adapted to the specific needs of individual users.

The main options for data selection and presentation currently available are:

- alphabetical arrangement of data in different categories, e.g. by street names, land uses, types of infrastructure provision, ownerships, etc
- summary of owners of selected building blocks according to block numbers
- summary of properties owned by individuals or institutions
- presentation of all available information on individual plots of land.

Basis for tax and rate assessments

To facilitate the collection of municipal taxes and other charges, the automated cadastral register SIGMA can transfer all plot-related data to the accounts of the property owner and print out this information on the tax demand.

Other taxation records that may be kept on the system include

- property tax
- building permit fees
- development tax
- special tax on vacant plots
- property transfer tax
- road maintenance fees
- solid waste collection fees.

In addition to calculating taxes due from existing taxpayers, the system can also identify those who should be paying rates but are not currently registered as taxpayers, e.g. by merging the data on existing taxpayers with data on the uses of individual plots.

Example of a computer print out (information on plot and building / property tax)

```
S.I.G.M.A. PROCESO: modif.a maestro de información          FECHA:  14/01/96
INSTALACION: I.D.M.- PIRIBEBUY                              HORA:   12:50:57

                        [N964] [08] [010]            [05] [00]
   Fecha de Actualización:  01/06/95

   Propietario (Ocupante)            R.M.C.  PADRON :        Cta.Cte.Ctral
   GONZALEZ (DE) CUBILLA, BASILIC        379

Ten. Finca          Frente            Area  Suelo Tipo Calle  Mejoras Ubica.
 PP      0   10.6+  0.0+  0.0+  0.0      424  RE  TI\  \  \   A\E\ \  Z1

   Construcciones:  Uso Construccion Metros Categoria
   1.                     VI           36       BA

   2.                                   0

   3.                                   0
```

```
S.I.G.M.A. :  CONSULTA MONTO DE IMPUESTO INMOBILIARIO       FECHA:  14/01/96
INSTALACION: I.D.M.- PIRIBEBUY                              HORA:   12:56:49

   GONZALEZ (DE) NUÑEZ, AUREA

   IMPUESTO INMOBILIARIO                          63.051

   Total:                                         63.051

   Area total:                                      627
   Edificado:                                       148

   V.Fiscal tierra:                           6.305.112
   V.Fiscal Edifi.:                                   0
   Valor Fiscal Total para Cálculo:           6.305.112
```

MAJOR APPLICATIONS

Tools for urban planning

Tools for urban development planning may be derived from the data stored in the system, including:

- amendment and update of cadastral survey maps (scale 1 : 10,000 or 1 : 5,000)
- preparation of thematic maps to present:
  - district and municipal boundaries, as well as boundaries of individual building blocks
  - type and condition of roads and streets
  - networks and condition of infrastructure (mainly water, sewerage, electricity and telephone)
  - type and location of major social services
- analysis and presentation of statistics for planning purposes, e.g. on municipal demography, land use and condition of services and utilities.

At present, the system is used mainly for the collection of municipal taxes and charges, and the data are regularly updated using the SIGMA computer program. The taxes and fees to be paid are set in accordance with the legal provisions for setting these charges, which are then automatically transferred to the demands for payment.

Payment demands are prepared and issued according to schedules set for different levies. In the follow-up on payments, those taxpayers in arrears can be identified and located easily on the system.

EXPANDIBILITY OF THE SYSTEM

Owing to its modular design, the system can easily be extended and adapted to support other municipal tasks. The obvious choices of additional modules would be those for general accounting and budgeting.

It is further possible to extend the system to support other municipal functions (e.g. operation and maintenance of infrastructure), either by adding information derived from traditional sources (e.g. maps) or by adding other computer software packages. The expandability of the system is limited only by the capacity of the hardware. At the time of writing, simplified methods of developing a fully computerised land information system, by integrating manually prepared maps with a data base, were being tested in some municipalities.

The major limiting factor for the establishment of more complex systems is the weak administration and low personnel capacities of most municipalities. Given this constraint, most municipalities have to concentrate their efforts on priority tasks, at least at the initial stages. Only later - after the information required for priority tasks has been fully consolidated and procedures improved - can the system be extended to undertake other tasks without the risk of overloading the municipal administration.

Basic system components

System components	System outputs	Applications
municipal survey map	topographical and thematic maps	building control and regulation of settlement development land use and plot coverage control
building block maps		map production
data sheets on ownership and land use	alphabetical listings summary tables	detailed information on planning and municipal investment projects updating of municipal revenue registers assessment of real estate rates

A PARAGUAY

LEGAL AND POLITICAL FRAMEWORK

The political and institutional framework for the introduction of the simple municipal cadastre in Paraguay is provided by the Local Government Act of 1987 and the new Constitution of 1992.

After centuries of negligence of local government issues, municipal functions and responsibilities were revised for the first time by the Local Government Act in 1987. This law decrees that municipal responsibilities shall include:

- provision, management and maintenance of technical infrastructure and community facilities (water supply, sewerage, markets, slaughterhouses, bus stations, etc)
- provision and management of social services (schools, public health care, etc)
- maintenance of municipal roads and streets
- control of building activities through building permits
- planning and management of urban development through land use control and zoning, and development of new settlements
- establishment of property cadastres albeit without a legal status (as the official property register is maintained centrally).

However, most municipalities are still too weak to assume the newly assigned functions efficiently. Furthermore, the municipalities have to depend almost entirely on their own revenue sources to carry out these tasks.

Owing to extremely low rates of general taxation, a very limited number of direct taxes - hitherto no personal income tax has been raised - and a general predominance of the central government, there was hardly any transfer of funds from the central government to the municipalities in the past. Only a small share of the general property tax (*impuesto inmobilario*), collected centrally by the Ministry of Finance until 1993, was transferred to the municipalities (16% up to 1987 and 30% subsequently).

The Constitution of 1992 sets the local government share in the property tax at 70%. However, it does not divide the responsibilities for levying this tax clearly between the central government and the local authorities. From the remainder of the property tax revenue, 15% is allocated to a special fund to help those municipalities which are particularly short of funds, and the remaining 15% is destined for the provincial administrations (*departamentos*) established under the new Constitution.

According to this new framework, the main sources of municipal income and their share in total local government revenues are presented in the box below.

Taxes	
land tax	approx. 15 - 20%
property transfer tax	approx. 1 %
tax for unused parcels	no information
road maintenance tax	no info.
commercial or industrial franchises	no info.
motor vehicle tax	approx. 25%
Fees	
garbage disposal	no info.
car-spec.	no info.
water / sewage	no info.
street lightning	no info.
Other incomes	
through hiring or leasing of municipal land properties	

However, the levy of these taxes and fees requires accurate information on properties and their owners, which is not usually available to municipal administrations, as property registers had been kept centrally, and hardly ever updated, by the Ministry of Finance until 1987.

The Local Government Act of 1987 assigns the establishment and management of municipal cadastres (*Catastro Municipal*) to local government, without clearly defining its functions and responsibilities. Furthermore, the existing national cadastre is still being maintained centrally by the National Cadastre Service (*Servicio Nacional de Catastro*).

The establishment of municipal cadastres, as supported by the technical cooperation project, had therefore to take place in an uncertain legal and institutional environment, without clear terms of reference. Consequently, the development of the system had to be pragmatic. Even so, the form and contents of the system have been designed in such a way as to be compatible with those of the National Cadastre Service and the Ministry of Finance.

ORGANISATIONAL AND INSTITUTIONAL STRUCTURES

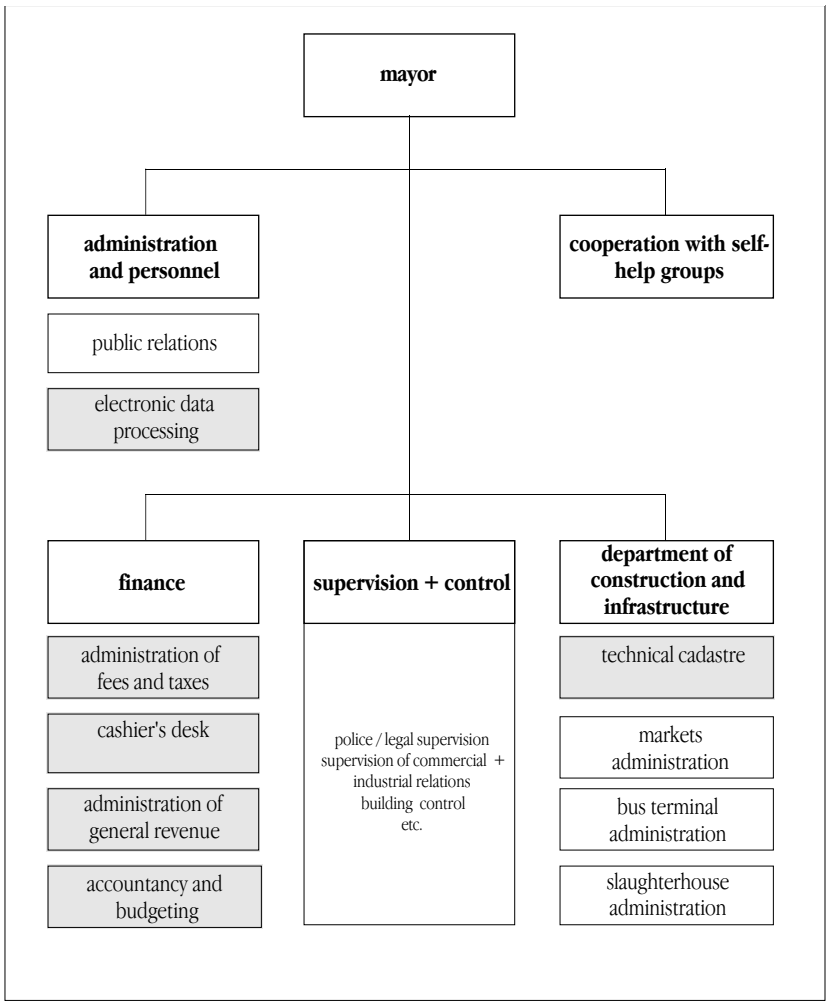
In most of the municipalities, the staffing and organisation of the administration were very inadequate: in 1992, only 30 of the 216 municipalities had more than 30 staff members, while about 70% of municipalities had less than 12 staff members. Under these circumstances, a flexible approach had to be adopted, when introducing the new cadastral system, to take account of both the capacities and the limitations of the existing administration.

One of the most important prerequisites for introducing an electronic cadastre to a municipality is the establishment of a separate working unit within the municipal administration. This working unit will take responsibility first for the establishment and development of the system, and later for its operation. At the initial stage, this working unit might consist of just one qualified technician, to be augmented at later stages. As most of the tasks of this working unit are technical tasks in the initial stages, it would normally be attached to the part of the administration responsible for building control and urban planning.

To allow for sufficient flexibility in the initial stages of system development, the task of setting up the system might be undertaken by existing municipal staff, on a part-time basis, in parallel with their other routine work. However, the status of the working unit should eventually be formalised, and it should be staffed with properly qualified personnel with clearly defined functions.

To assist the municipalities in setting up an appropriate organisational structure, the IDM project developed a model organisational structure for the smaller municipalities. Based on this model, the municipal administration would undergo a process of incremental improvement and development. In the final stage of system implementation, the tasks related to the technical aspects of the cadastre and those related to the management of municipal revenues would be separated and assigned to different municipal departments / sections.

Proposed municipal administrative structure (cadastre-related tasks on shaded background)



STAFFING AND TRAINING

To introduce the system to a municipality, only one qualified staff member is required in the beginning, who will initiate and coordinate the data collection and processing for the establishment of the system. The staff member assigned to these tasks should have some experience with the setting up and management of cadastres and, if possible, also some basic knowledge of electronic data processing. In addition, some experience in technical drafting is required for the preparation of maps (updating of municipal survey maps, preparation of block unit maps, etc).

Where necessary, temporary staff may be employed to assist with establishing the data base. In some municipalities, the field work was performed by two or three locally contracted auxiliary staff; in others, larger numbers of students were temporarily employed for these tasks. The minimum staffing requirement for these tasks is, depending on the size and nature of the municipality, a work team of two to three persons. In general, the time required for the establishment of the data base is determined by the number and qualifications of the staff available.

The most practical way to document and process the data obtained in the field work is to use a small work team of two to three members of the municipal staff.

For the actual operation of the system in the initial stages, which is normally limited to the collection of municipal revenues, one qualified staff member is usually sufficient for a small municipality. However, due to absenteeism and frequent changes in personnel, it may be necessary to train two to three staff members for these tasks. The time per month required for the operation of the system and tax collection varies considerably between municipalities, again depending on the size of the municipality and the number of taxpayers. In most small municipalities, these tasks can be performed on a part-time basis.

Following the step-by-step extension of the system and the integration of other urban management and planning tasks into the system, the staff assigned to these tasks can be increased accordingly. The increased revenues generated by the system will allow the municipality to employ more staff without straining the municipal budget.

Due to the simplicity of the design and the user-friendliness of the software, requirements for the qualifications of the staff are relatively modest. In most cases, the basic training can be done on the job.

However, to put the system on a firm footing, it is essential to have continuous assistance from well-qualified professionals in the beginning. In the case of Paraguay, this assistance was provided by the IDM/GTZ technical cooperation project, which explained the system and its objectives and benefits to both the staff and the political representatives of the municipalities, as well as gave support to the subsequent development of the system.

Normally, it would take three to four man-months of professional time to set up the system and to assist in data collection. Subsequently, another two man-months would be required, during a period of six months to one year, to introduce the system to the municipal staff and train them in its operation.

The advisory assistance provided by the technical cooperation project was complemented by a number of working aids and handbooks, which explain working procedures in detail and serve as a basic reference for all questions on system operation. Furthermore, training courses on system operation are available, which also facilitates the exchange of experience between different municipalities.

To ensure the long-term sustainability and the further use of the system to improve municipal administration generally, the municipal administration needs to have a better understanding of a wide range of municipal functions and their respective scope of action. To support this process, the IDM/GTZ technical cooperation project offers further training and advisory assistance to both the technical staff and the political representatives of the Paraguayan municipalities.

Another important aspect is the possibility of adapting the computer data base to other functions. Although the municipal staff themselves may not be capable of modifying the software, support from software developers can be provided through the technical cooperation project. To further improve access to such services, a private distribution channel was under discussion at the time of writing. Additional modules or applications to support other municipal tasks can also be obtained from private software developers, if necessary.

INVESTMENT AND RUNNING COSTS

Because of the flexibility of the system, the capital investment and operation costs can be adjusted to the financial ability of individual municipalities.

The most essential equipment comprises:

- a drafting board and drafting instruments for the preparation of base maps
- shelves and cupboards to store the maps and data sheets
- a typewriter for filling forms.

The SIGMA cadastre, which is optional at the beginning, requires:

- 1 personal computer, 486dx (40/60 MHz) processor, 4 MB RAM, minimum 120 MB hard disk, VGA monitor, MS DOS/Windows operating system
- 1 dot matrix printer.

This basic equipment, which is usually sufficient for a municipality of up to 5,000 inhabitants, can be purchased at a cost of about US$ 3,000 in Paraguay. For those municipalities with more than 5,000 inhabitants and with an annual budget of more than US$ 70,000, it is recommended to install a computerised system from the beginning.

This basic system may be upgraded later, according to the financial ability of the municipality and the amount of data to be processed. If additional computers are purchased, they would be best operated in a network. The cost of three additional computers and the network would amount to approximately US$ 10,000.

The personnel cost for operating the basic system will amount to approximately that of two to three members of municipal staff.

The costs of establishing the data base are also relatively small. The cadastre for the municipality of Tobatí, with a total of 2,500 plots, was established by one architect with two assistants within 18 months, working two days per week, at a total cost of about US$ 3,400. In other municipalities, the data collection and survey work was performed at similar costs by employing students on a part-time basis.

SYSTEM UPDATE AND MAINTENANCE

To maintain the efficiency of the system, it is necessary to update the data base continually or, at least, regularly. Most of the updating work concerns changes to existing data, in particular changes in the ownership of properties, or changes in land use. Possible sources for such information are other municipal departments (e.g. the department responsible for issuing building permits), the central property register managed by the National Cadastre Service, and, most importantly, regular field surveys.

According to prevailing regulations, notaries are legally obliged to report changes in ownership and real estate transactions. Similarly, architects and property owners are also obliged to notify local authorities of construction activities and changes in land use. However, in practice, such reporting is the exception rather than the norm. To ensure the availability of this information, the IDM/GTZ technical cooperation project is promoting formal agreements between the municipalities and local notaries and architects.

The exchange of information between governmental institutions and departments is difficult to achieve in practice; so is the continual updating of the data base as part of routine operation. Therefore, the most reliable way to ensure the up-to-dateness of the data base is an annual survey of the areas in which changes have occurred. This survey may be carried out as part of the collection of property taxes; and, generally speaking, this has the support of local inhabitants because they consider it to be in their own interest to keep correct and up-to-date information on their properties.

In the long term, it is expected that the enforcement of the law obliging owners to report any changes in their properties will enable the municipalities to keep their data bases up to date.

A PARAGUAY

ADAPTABILITY OF THE SYSTEM

The simple municipal cadastre developed in Paraguay can be adapted for use in other countries and regions which have similar development problems. In particular, there are many small municipalities, in Central and South America, as well as in Sub-Saharan Africa, which urgently need to improve municipal revenues, manage growth and upgrade their administrations. This system may be very useful to them.

The major condition for the introduction of a similar system is sufficient legal and political latitude to allow local government to establish an information system and to levy local rates and taxes. Depending on circumstances and priorities, there are the following options for adaptation:

- to adopt only the concept of adding plot-related information to municipal maps to develop appropriate solutions for a particular situation
- to adopt some selected system components particularly appropriate for a given environment, such as the rapid preparation of base maps, or the compilation of data by simple and standardised data sheets
- to adopt all of the components to suit a particular situation, including the types of taxes and fees to be levied.

The system may either be set up manually first, or by a computer system right from the beginning. While those system components which can be done manually can be adapted without much difficulty, the adaptation of the computerised parts, which have been designed to suit the Paraguayan municipalities, may require much more work. In some cases, it may be necessary to develop special software; in other cases, a common data base software (e.g. FoxPro, Quattro, dBase or MS Access) may be used.

CONDITIONS FOR ADOPTION

The adoption of the system should be based on the following criteria:

- legal provisions exist to allow the development and operation of a cadastre at municipal level albeit without a legal status
- local government has the powers to levy municipal taxes, fees and charges, to justify the establishment of a cadastre at municipal level
- municipalities are responsible for the planning of urban development and the management of urban land
- municipal staff are sufficiently qualified to establish and operate an information system
- technical assistance, from either public or private sources, is available to assist and support the introduction and development of the system
- the political will exists to introduce a more efficient and transparent way to collect municipal revenues which is acceptable to the community.

SOURCES OF INFORMATION AND TECHNICAL ADVICE

In the course of developing the system and introducing it to a large number of municipalities, the IDM has accumulated a lot of invaluable experience which can be passed on to other interested parties. Indeed, it is already actively exchanging information with other GTZ projects, both in the Latin American region and in other parts of the world.

Other contacts within Latin America have been made through the Regional Office of the Urban Management Programme in Quito. Support to be provided may include:

- contacts of experts from other Paraguayan projects or institutions
- on-the-job training in system development and operation
- short-term secondment of staff members to support system development in other countries.

However, owing to the work load in assisting a growing number of municipalities within Paraguay, the capacity of the IDM for detailed advice is limited, and it may not always be able to comply with requests for intensive assistance. Additional advisory capacity will eventually be available from a number of private consultants who have participated in the different stages of the development of the Paraguayan cadastre.

More detailed information on the Paraguayan cadastre can be obtained from the working aids and handbooks prepared by the IDM/GTZ technical cooperation project:

- ***Manual para Elaboración de Catastro Municipal***
- ***Catastro Municipal - Manual para el Usario del Sistema Integral de Gestión Municipal Automatizado (SIGMA)***
- ***Manual de Administración de Terrenos Municipales***

These documents are available at the GTZ head office or the IDM in Paraguay (see addresses listed in the next column).

ADDRESSES OF LOCAL INSTITUTIONS AND EXPERTS

IDM - Instituto de Desarrollo Municipal
Programa de Desarrollo Local
Ygatimí 705 es. J.E. O'Leary
Asunción / Paraguay

Tel: +595 - 21 - 444 542
Fax: +595 - 21 - 442 079

Programa de Gestión Urbana
Oficina Regional para America Latina
y el Caribe
Av. Naciones Unidas 1084,
Ed. Bco. La Previsora, Torre B
Casilla 17-17-1449
Quito / Ecuador

Tel: +593 - 2 - 462 132
Fax: +593 - 2 - 462 134

Mr Reinhard Frotscher
Programa las Verapaces
GTZ/PVB Guatemala
15 Calle 3-20, Zona 10
Edificio Centro Ejecutivo, Oficina 302
Guatemala City / Guatemala

Tel: +502 - 2 - 370 125
Fax: +502 - 2 - 370 124

B. AUTOMATED MUNICIPAL INFORMATION SYSTEM - ECUADOR

B ECUADOR

BACKGROUND TO SYSTEM DEVELOPMENT

The situation of urban development and local government in Ecuador is characterised by a fast growing urban population, weak municipal administration and a severe crisis of municipal finances. As in most other Latin American countries, the municipalities (*municipios*) are relatively autonomous territorial units, and usually consist of a large urban centre and its rural hinterland of villages (*parroquias*).

Today, Ecuador has a total of 193 municipalities, while 25 years ago there were only 130, signifying an increase of 45 %. Each year, as former rural settlements grow into small towns and local politicians demand an autonomous political status, about two to three municipalities are established as spin-offs of existing, larger municipalities.

As a consequence of these spin-offs, new municipal administrations have to be established and municipal resources, scarce to begin with, have to be further divided among the new local authorities. Since most Ecuadorian municipalities are already rather weak and unable to cope with the increasing challenges of urbanisation, this subdivision and the creation of new administrations make things worse in most cases.

At the same time, the municipal share in total public spending was reduced from 55% in 1972 to only 16% in 1992. With the strain on public budgets caused by a sharp decline in oil revenues in the 1980s, the total amounts of governmental allocations for municipalities were further reduced. In spite of these cuts, most municipalities are still heavily dependent on government funding, which usually still accounts for 80-90% of total municipal budgets.

The greater part of this funding comes from a general allocation of 10% of total public spending transferred directly to local authorities, while a minor part comes in the form of project-related funds. Furthermore, municipal finances also depend heavily on political preferences and patronage, since no clear criteria exist for the distribution of government funds to local authorities.

For most municipalities, the improvement of their revenues would seem to be of paramount importance if they were to maintain and extend their services to a growing urban population. The most important source of potential revenue is the land tax on urban properties, which is within the powers of local authorities to levy. However, there are a number of problems which are hindering the municipalities from improving their revenues. These can be summarised as follows.

- Local governments are generally highly politicised, with little continuity in their administration or political make-up, because the law does not allow direct reelection of local councils and mayors.
- The capabilities of municipal staff in planning, management and financial administration are rather low, especially in smaller, remote municipalities, where qualified personnel are difficult to come by.
- Municipalities, thus, often have to depend on overpriced contracts with private companies for assistance in the establishment of a property register or a data base.
- Many municipalities do not have a property cadastre at all. Even where a cadastre does exist at municipal level, they are usually obsolete because they have not been updated.
- The cadastral systems promoted by national institutions are inappropriate for the requirements of municipalities.

In 1990, an ambitious development programme to strengthen local authorities, the *Programa de Desarrollo Municipal* (PDM), was implemented by the National Development Bank (*Banco del Estado*), with financial and technical support from the World Bank, the Inter-American Development Bank and the GTZ (German Technical Cooperation). The improvement of municipal revenues and municipal financial administration was one of the priority issues to be addressed by the PDM. Other components of this programme included the identification and planning of investment projects to improve municipal technical and social infrastructure, the provision of loans to finance such projects, general capacity building of municipal staff and the promotion of participatory approaches in urban planning and management.

To increase municipal revenues, the PDM developed a computerised municipal information system, the *Sistema de Informacĭon Automatizado Municipal* (SIAM). This was initially developed in 1993 and tested in a number of municipalities. At the time of writing, it was being introduced to most of the municipalities supported by the programme.

MAIN AREAS OF APPLICATION

At its initial stage, the *Sistema de Informacíon Automatizado Municipal* (SIAM) focuses mainly on fiscal and financial tasks, but it has been designed right from the beginning as a multipurpose system to support the following functions:

Levy and collection of municipal taxes
by identifying taxpayers and calculating

- land tax, the most important source of municipal revenues
- other municipal fees and charges, such as tax on vacant land, property transfer tax, fees for building permits, road maintenance tax, etc.

Physical planning
by providing maps and other information on

- built-up municipal areas and their respective land uses
- types and quality of infrastructure at neighbourhood level, as well as on individual plots (water supply, sewerage, solid waste collection, electricity, etc)
- the condition and extent of road networks
- other information (general topography, population characteristics, etc).

Building control and supervision
by providing information on

- plot size, plot coverage, building heights and number of storeys
- building/site characteristics (e.g. construction materials, age, condition).

IMPROVEMENTS BROUGHT ABOUT BY THE SYSTEM

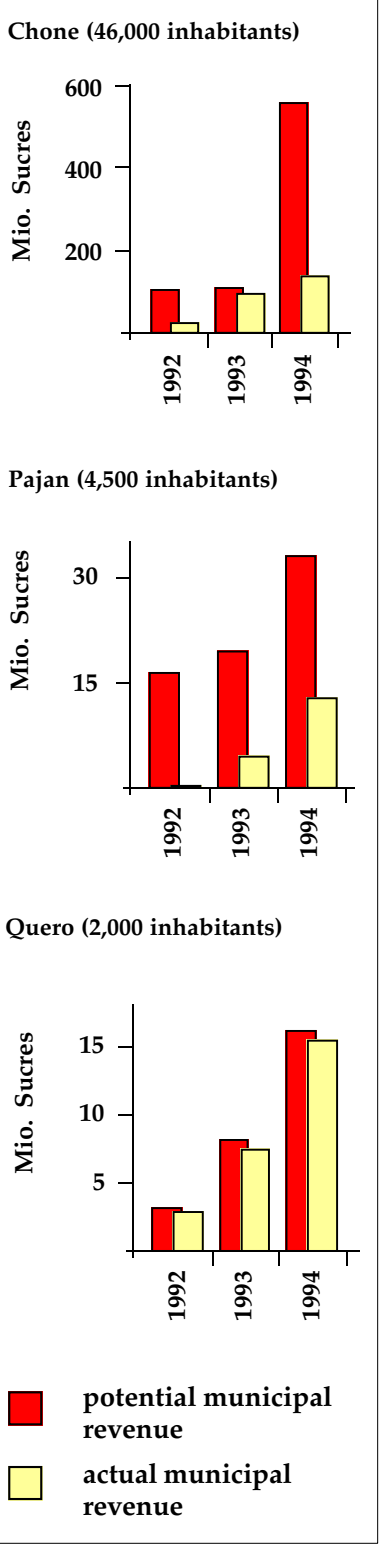
Although introduced only in 1993, at the time of writing, there were as many as 14 municipalities where the new system was operational; 9 municipalities where the system was being installed; and steps were being taken to introduce the system to another 21 municipalities by the end of 1995.

In the 14 municipalities, where the system was already fully operational, a comprehensive update of the cadastre as the basis for land valuation was completed within a relatively short time. With the updated cadastre, the collection of municipal taxes and charges - mainly the land tax - became considerably more efficient. This increased municipal revenues from local sources in most of the 14 municipalities by 100-450%, with an average of 300%. Furthermore, the procedures for tax assessment and collection were rationalised and made considerably more efficient.

With the assessment of taxes and charges being based on well-defined and transparent criteria, the confidence of taxpayers has been increased. This confidence is further boosted by annual reports, prepared with the help of the system, which inform the citizens of how their tax monies are being spent by the municipality.

In general, most pilot municipalities are very satisfied with the system, as it has improved their financial prospects and widened their scope to improve and extend municipal services.

Municipal revenue in pilot municipalities 1992-1994



SYSTEM COMPONENTS

The system developed by the PDM consists of a set of data base computer programs, plus other records which can be kept either traditionally as written material or electronically on the computer.

The SIAM is not a cadastral system to be built entirely new, but one that builds on cadastres already in use in municipalities or other public institutions. Its aim is to improve existing cadastral procedures and facilitate data integration. As existing cadastres and procedures vary considerably from one municipality to another, the system has been designed in such a way that it can easily be adapted to specific requirements. Because of this flexibility, the systems in individual municipalities may differ somewhat, but the basic structure and components of the systems are the same.

Main SIAM components:

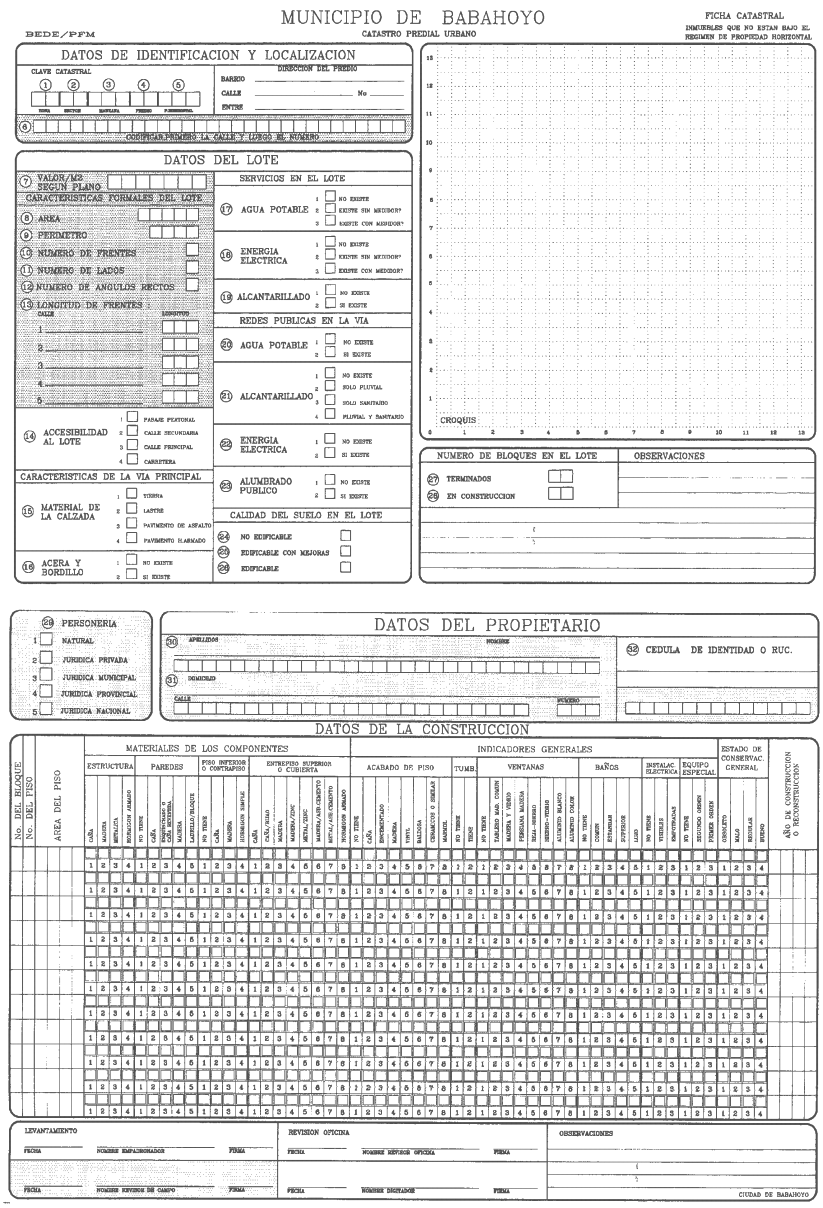
- Traditional records, consisting of data sheets (*ficha catastral*) for each individual plot and building.
- A model for the valuation of lands and buildings.
- CATRAL computer program for storing and processing cadastral information.
- IMPREDIAL computer program for preparing tax assessments, issuing demands for payments, and administering other municipal charges.
- Maps (either on paper or in digitised form) to serve as geographic references for the cadastral system.

Basic property registers
(Ficha catastral)

The SIAM system is based on existing property registers, and the PDM has hitherto only provided assistance to municipalities which have at least a nucleus of a cadastre system.

Depending on the quality of the existing information, old plot data sheets can be used, or new standardised data sheets developed by the PDM are introduced. In most cases, it was necessary to carry out a comprehensive update of registers as well

Example of a property data sheet (*ficha catastral*) as introduced by the PDM (front and back side):



as to introduce a new, standardised cadastral coding system (*clave catastral*).

The new coding system is based on a hierarchical reference system, with standardised keys for zones, sectors, blocks and plots.

The standardised double-sided data sheet gives different information on the front and the reverse sides. On the front is general information, usually accompanied by a rough sketch of the plot and the built area, on

- plot identification by cadastral code
- plot size and ownership
- accessibility and condition of access
- standards of technical infrastructure provision (on site and in the general area)
- topography and soil condition.

The reverse side of the data sheet gives more detailed information on the building(s):

- number of storeys and building height
- structural characteristics and building materials
- standards of sanitary facilities and finishing
- condition of building(s).

The data sheet does not include information on the horizontal division of ownership. This has to be recorded on separate data sheets, using the same coding system.

With the computerised SIAM cadastre, the data sheets, which previously constituted the municipal cadastral register, are used only as survey sheets. After the information has been entered into the computer, they are filed in the municipal archives.

A model for the valuation of land and buildings

An important component of SIAM is the model for the valuation of land and buildings (*modelo de avalíuo*), which highlights the differences between the municipalities.

To obtain up-to-date information on land values, real market prices of recent property transfers are documented on a survey map. Based on this information, the municipality is divided into zones by land prices per building block, taking into consideration different factors, such as distances from the town centre, provision of social services and utilities, characteristics of individual plots, etc. The survey maps are hitherto prepared manually and kept on paper. It is envisaged that they will be converted to electronic data and stored on computers at a later stage.

The values of buildings are determined by total floor area, age, condition and actual costs at the time of construction. The use and the location of the building are not usually considered for the valuation of buildings, since they are used to determine the value of the land.

The CATRAL program
(Catastro Predial Urbano)

The CATRAL program processes all municipal cadastral data provided by the property data sheets (*ficha catastral*). It is normally operated by the municipal cadastral department.

The geographic references of all data processed by CATRAL are the hierarchical codes (of zones, sectors, blocks and plots) as defined by the system. This coding system provides easy reference to the different maps; it can also be used to integrate alphanumeric data with geographic data at a later stage.

Apart from being a simple data management tool, the main function of CATRAL is the calculation of property values based on cadastral information and valuation factors, which have to be updated each year. These property values form the basis of property tax assessments.

To make the annual tax assessment more transparent for taxpayers, CATRAL can print out all the factors considered for the valuation of each plot of land (*padron catastral*).

The IMPREDIAL program
(Impuesto Predial Urbano)

The second computer program, the IMPREDIAL program, carries out the actual calculations for tax assessments, issues of tax assessments and monitor payments.

Tax assessments are automatically generated, based on the real property values determined by CATRAL. Because the old land values and rates of assessment, as determined by the Ecuadorian Local Government Act*, are now out of date and unrealistically high, they are generally discounted by a local rate (usually 10-50%) defined by the municipal council, before another general discount (*rebaja general*) of 40% is applied, to arrive at a taxable property value (*base imponible*), ranging between 20% and 36% of real market values. This is then used for tax assessment (*tittulo de crédito*).

To enable the local authorities to arrive at realistic tax rates, the local discount rates can be reduced every year by the local council. An increase, however, is not permitted, since this would usually lead to unrealistic tax assessments.

The IMPREDIAL program does both the issuing of tax assessments and the monitoring of payments. Tax assessments and payment receipts can be issued immediately for those who pay at the municipal cashier. Furthermore, all the factors used in the tax assessment can be supplied upon request.

* The Local Government Act of 1966 specifies tax rates according to property categories. Owing to inflation and increases in real estate prices, almost all properties fall into the highest category today, resulting in extremely high taxes if the original tax rates were applied. Various discounting formulas have therefore been introduced to arrive at more realistic tax assessments.

Example of a tax assessment (*titulo de crédito*)

****** MUNICIPIO DE FRANCISCO DE ORELLANA ******

TITULO DE CREDITO PARA EL IMPUESTO PREDIAL URBANO

FECHA EMISION: 07/15/95 AÑO: FECHA PAGO: 07/15/95 FORMULARIO: 95-410

CLAVE CAT	APELLIDOS NOMBRES	CEDULA/RUC
01020101	ANDRADE RAFAEL	1701897652

DIRECCION: NAPO

AV.COM.: 10,083,567 BASE.IMP.: 6,050,140 EXENCION: REBAJA:

CONCEPTO		VALOR	CONCEPTO		VALOR
IMPUESTO PREDIAL	:	79,892	RECARGO FECHA DE PAGO:		0
MEDICINA RURAL	:	6,050	ASEO PUBLICO	:	40,000
MAGISTERIO	:	36,301			
EDUCACION ELEMENTAL	:	6,050			
CUERPO DE BOMBEROS	:	9,075			
VIVIENDA RURAL	:	0			
SOLARES NO CONSTRUIDOS	:	0			

LIQUIDO A PAGAR : 177,368

TESORERO FINANCIERO RENTAS

Maps

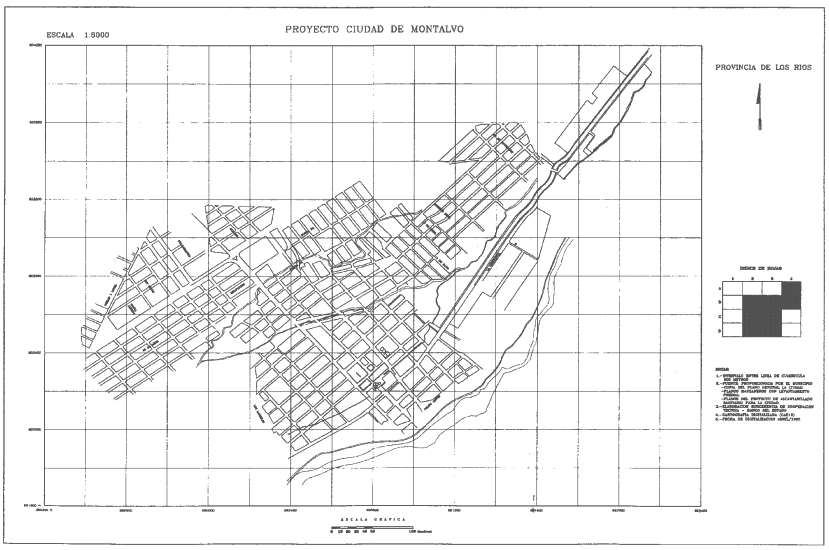
The last component in the system is a set of maps which provide geographic references for all the information processed by the system.

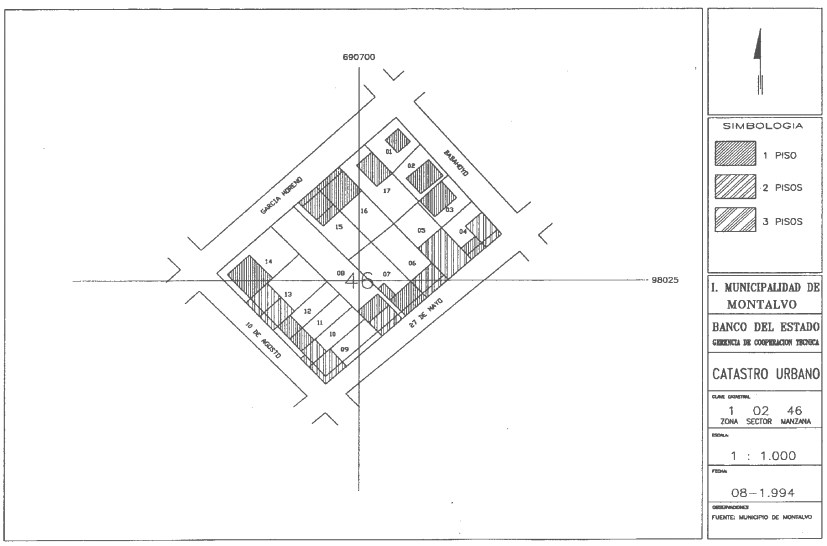
Although most municipalities have base maps drawn up by the National Statistical Institute (*Instituto Nacional de Estadistica y Censos*), or by private survey firms, these maps are usually extremely old. For the purposes of establishing the cadastre, they have to be updated and, where necessary, surveys of newly developed urban areas have to be carried out. The maps prepared for the SIAM usually comprise the following:

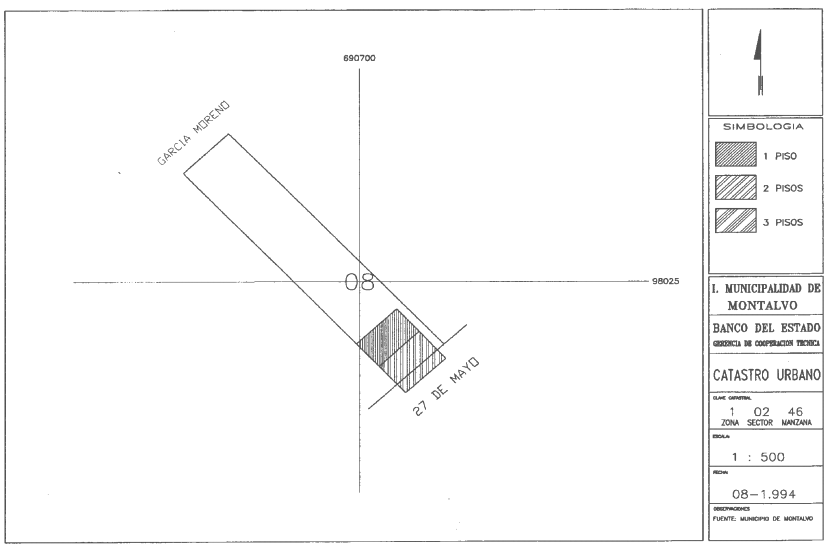
- an overview map of the whole urban area, scale 1 : 10,000 - 5,000
- maps of different zones, scale 1 : 2,000
- maps of individual building blocks, scale 1 : 1,000
- maps of individual plots, scale 1 : 500.

All the maps are first drafted manually by local surveyors employed by the municipality, and harmonised with the national grid. These draft maps are then digitised by the PDM head office in Quito and returned to the municipality for a last check, before they are finally revised and plotted in Quito. The plotted maps are then issued to the municipality, while the electronic records are kept in the PDM head office.

While most municipalities do not have enough financial resources to purchase the equipment to produce their own digitised map at present, it is envisaged that they will eventually do the digitising themselves. It is expected that the use of the system will enable the municipalities to buy additional equipment and slowly build up a comprehensive system.







B ECUADOR

INTRODUCTION OF THE SYSTEM

So far, the system has only been introduced to those municipalities which already had at least a nucleus of a local cadastre, and which had applied to the PDM for technical or financial assistance. The speed of introducing the system depends largely on the quality of existing information.

To introduce the system, a municipality and the PDM enter into a formal agreement, which defines the scope of assistance provided by the PDM according to the preference and capacity of the municipality. There are three options for assistance:

- Direct technical assistance by PDM advisers, who provide intensive support at the introduction stage, and subsequently advises the municipality on a regular basis to evaluate progress.

- Technical assistance by other external experts along similar lines, where the PDM gives only essential instructions and supervision of the external experts.

- Provision of a loan to enable the municipality to contract consultancy assistance on its own. This usually applies to municipalities which are too large for the PDM to assist directly, or when other factors, such as distances, render a direct PDM support difficult. In such cases, the PDM defines the terms of reference for the consultants and evaluates the results.

In addition to these basic options, combinations of different approaches are also possible. In some cases, the PDM provided initial advice to assess the needs of a municipality and to establish a plan for action, and a consulting firm was then contracted for the installation of the system. Regardless of what option is selected for advisory assistance, the actual establishment of the system requires a number of steps which are common to all municipalities.

The main steps to introduce and establish the SIAM:

- Assessment of the existing cadastre and identification of improvement needs.
- Adaptation of existing records and field work.
- Documentation and data processing.
- Map production.

Assessment of existing cadastre and identification of improvement needs

The first step in the introduction of the SIAM is a comprehensive evaluation, by PDM advisers, of problems, constraints and usefulness of the existing municipal cadastre. For this purpose, existing records and registers, as well as all existing cartographic materials, are gathered and examined to see if there is enough information to form the basis of a comprehensive cadastre.

Based on this assessment, the possibilities for improvement and adaptation to the requirements of electronic data processing are investigated by the PDM advisers in close cooperation with municipal staff.

The results of these discussions, usually in the form of a small workshop, are then turned into a detailed plan for action, defining further activities. The action plan also forms the basis for the selection of an appropriate option for technical assistance.

Time requirements:
Time requirements differ considerably, depending on the size of the municipality. As a guide: a municipality with 25,000 inhabitants and about 7,000 plots would take three months to complete this part of the work.

Adaptation of existing records and field work

As the second step of system introduction, a standardised geographic reference system is introduced, dividing the municipality into zones, sectors and building blocks. For this purpose, all existing maps, such as the municipal survey maps, zoning maps, block unit maps and land use maps, as well as aerial photographs where available, are used to provide an overview of all urbanised areas to be included in the cadastre.

Based on this newly established geographic reference system, existing records and registers are codified and adapted to the new system. In those areas where records are incomplete or do not exist at all, field surveys have to be carried out to collect the necessary information. Other surveys may also be required to update the maps.

The field survey results and draft maps are then used to prepare a map of land value zones to determine building values to be used for tax assessments.

Time requirements:
About 50 plots can be surveyed by one person per day.

Data processing an map production

The information collected in the field work is documented on the plot data sheets (*fichas catastrales*). It is also used to draft block unit maps manually, on the scale of 1 : 1,000 or 1 : 500, covering the whole urban area. These draft maps are matched with the national grid and organised according to the zones and sectors described above.

All these records are then entered into a computer data base, which has usually been adapted from the standard PDM data base format to the needs of the municipality in question.

As a final step, a set of updated cadastral maps is prepared. Based on the draft maps described above and existing cartographic materials of the National Statistical Institute, the maps are digitised by the PDM head office in Quito, and returned to the municipality for a last check before they are finally revised and plotted in Quito. The plotted maps are then sent to the municipality, while the electronic records are kept by the PDM head office.

Time requirements:
About 250 property files can be entered per person per day.

ACCURACY OF DATA

Although maps prepared by the National Statistical Institute and basic registers were available for most municipalities, these were usually out of date or incomplete. However, in most cases, existing maps and registers could be used as a starting point, thus reducing the need for comprehensive surveys.

In a few cases, the existing registers, though incomplete or obsolete, provided far more information than needed for an efficient management of property taxes.

In general, a high level of accuracy is required of the information used for establishing the new data base; therefore, detailed and comprehensive information should be gathered and checked conscientiously, and surveys should be undertaken by professional surveyors to conform with established standards.

B ECUADOR

SYSTEM OUTPUTS

Basis for tax and rate assessments

The system is currently used mainly for improving the administration of municipal revenues from land-related taxes and fees. While it focuses on the collection of land taxes as the most important municipal revenue, it also provides information and instruments for the calculation and collection of the following taxes and fees:

- building permit fees
- development tax
- special fees and taxes on vacant plots
- fees and taxes on property transfers.

The system facilitates the administration of these taxes and fees by issuing tax assessments, payment demands and receipts automatically; and by identifying defaulters.

Furthermore, it provides easily accessible information on the total potential revenue from land-related taxes and fees, thus enabling the municipality to assess its financial position and to monitor the success of revenue collection.

Other functions of the system are currently very underused due mainly to the priorities and capacities of the municipalities. These are as follows.

Various land related information

The computer programs, in particular the CATRAL program, are capable of organising and presenting data in many different ways, including

- presentation of all plot-related data by owner, by cadastral code or by identity number
- presentation of all site-related, building-related or ownership-related data on individual plots.

Basis for urban development

Based on the data stored in the system, maps for urban development planning can be produced in addition to the cadastral maps (sector maps, block unit maps and plot maps). These include

- municipal survey maps, in the scale of 1 : 10,000 or 1 : 5,000, showing boundaries of urban areas as well as boundaries of individual plots
- thematic maps in different scales showing:
  - existing land uses
  - status and condition of public roads and streets
  - standards of services and utilities
  - condition of building, building height, etc.

However, since the base maps are currently kept in digital form only in the PDM head office in Quito, without being related to the alphanumeric data bases, thematic maps are still being prepared manually, without taking advantage of the available technology.

In addition to map production, other data relevant for planning purposes can be analysed and presented as special statistics.

EXPANDABILITY OF THE SYSTEM

SIAM has been designed to allow easy expansion of the system at later stages. Owing to the particular structure of the data base and its modular nature, other programs can be added to the system one at a time, when required.

At the time of writing, the PDM was working on improving the method for monitoring defaulters. The existing components are already able to carry out this task, but in a rather cumbersome way. The new method under development will store default items in a separate data base, to be transferred automatically to subsequent tax/rate demands. Other considerations for system extension include the development of additional modules to administer other municipal fees.

The system design also allows the establishment of an interface between the alphanumeric data and the geographic data to develop the system into a fully computerised land information system, provided there are enough financial and human resources to purchase and operate the necessary hardware and software.

However, due to the limited capacities of the PDM staff to provide technical assistance, and the limited financial and technical capacities of the municipalities, these extensions are not expected to take place in the near future.

Given the circumstances, the current focus of PDM assistance is on a further consolidation of the system in the municipalities where it has already been introduced, and on dissemination to more municipalities.

LEGAL AND POLITICAL FRAMEWORK

The institutional and legal framework for the introduction of SIAM is provided by the Ecuadorian Local Government Law (*Ley de Regimen Municipal*) of 1966, together with a number of bylaws and regulations (*ordenanzas*).

According to this Law, the main responsibilities of the municipalities are:

- provision and management of water and sewerage systems
- construction and maintenance of municipal roads
- solid waste collection and disposal
- provision and maintenance of public facilities (slaughterhouses, markets, bus stations, cemeteries)
- food control and hygiene
- street lighting
- urban planning and building control
- establishment and maintenance of urban property cadastres.

To enable the municipalities to fulfil their responsibilities, they receive a share of 10% of total public spending in the form of direct government transfer, which is supplemented by additional funding programmes for special projects or investments. Furthermore, municipalities are entitled to raise funds by levying local taxes and fees, the most significant of which are taxes on urban land.

The Local Government Law distinguishes between the urban property cadastre maintained by the municipality and the rural cadastre maintained by the Department of Statistics and Cadastre (*Direccĭon National de Avalúo y Catastro*).

Main local revenue sources and their share in local municipal income:

Taxes	
land tax	approx. 50 %
property transfer tax	approx. 10 %
commercial or industrial franchises	approx. 10 %
tax on vacant plots	approx. 2 %
others	approx. 3 %
Fees	
solid waste disposal	approx. 10 %
water and sewage	approx. 10 %
road maintenance tax	approx. 3 %
others	approx. 2 %
Other incomes	
markets	approx. 1.5 %
slaughterhouses	approx. 0.5 %
total other income	approx. 10 %

Since municipal areas also include their rural hinterlands, the urban property cadastre comprises the land inside the boundaries of the urbanised area (*limite urbano*) as well as some small settlements or villages (*parroquias*) beyond the urban boundaries. These municipal areas are already established and will eventually be extended as urbanisation progresses.

The Local Government Law also defines a general framework and guidelines for the establishment and maintenance of urban cadastres, as well as setting detailed regulations for the taxation on land.

However, the guidelines for urban cadastres which require comprehensive information to be collected and documented were hardly followed by the municipalities. In fact, owing to a lack of supervision and a general neglect of municipal matters over the last few decades, urban cadastres were generally incomplete and differed considerable from one municipality to another. Furthermore, the legal provisions and parameters for land taxation, established by the Law, have become virtually obsolete.

With rapid urbanisation and the crisis in municipal finance as a result of the high dependency on the ever-decreasing government funding, it was obvious that the urban cadastral system was due for a reform, but few initiatives to this end had been taken.

In fact, the development of urban cadastres in Ecuador was in a kind of vacuum, without clear political guidance or supervision. Under these circumstances, various public institutions and private organisations began to develop and promote new cadastral systems, most prominent among which are the National Development Bank (*Banco del Estado*) (in the context of the PDM), the Ecuadorian Towns Association (*Asociacĭon de Municipalides Ecuadorianas*) and the Development Programme for the Southern Region (*Programa Ecuadoriano del Desarrollo del Sur*).

The SIAM, developed by the PDM to strengthen municipal finances in the context of an overall urban development programme, has been based on existing legal provisions, with some concessions to accommodate current municipal needs and to take account of the overall objectives of the PDM.

ORGANISATIONAL AND INSTITUTIONAL STRUCTURES

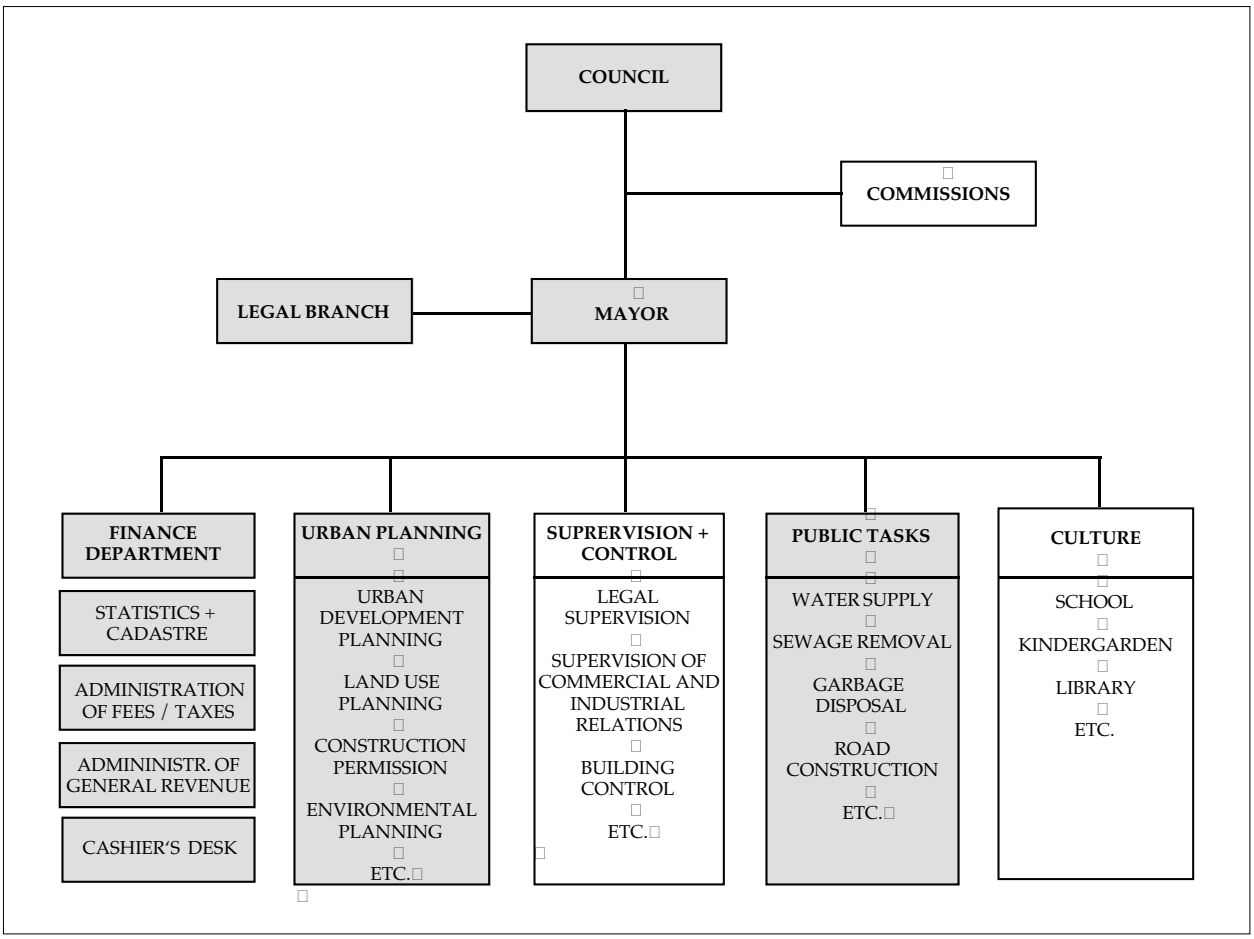
The PDM took a pragmatic view with regard to the institutional requirements for setting up the SIAM system, taking into consideration the particular conditions of individual municipalities. Since municipalities supported by the PDM varied significantly in size, ranging from 1,900 inhabitants in the smallest local authority (Quero) to 140,000 inhabitants in the largest municipality (Manta), their administrative capacities and structures also differed considerably. However, in most cases, even in larger local authorities, the personnel capacity was severely limited relative to the wide-ranging tasks and functions that the municipality had to carry out.

A prerequisite for the introduction of SIAM is the establishment of a working unit within the municipal administration, attached to one of the municipal departments concerned with urban registers and land information, such as the municipal finance department, the urban planning department or the public works department.

While larger municipalities usually have a more elaborate administration with fully fledged departments and sections, smaller local authorities may have only the rudiments of one or two departments. Since all municipalities have at least a finance department, and the initial focus of SIAM is on municipal revenues, in most cases, this working unit was set up in the finance department, which usually also had a section for statistics and cadastre (*avalúo y catastro*) under it. Only in a very few cases was the new SIAM unit assigned to other departments.

Quite independent of the organisational requirements, the need to establish links for information exchange between different departments has been stressed, and so other relevant departments have been involved right from the beginning of system introduction.

Proposed organisational structure (cadastre-related tasks on shaded background)



STAFFING AND TRAINING

The municipal working unit, established to introduce and run the SIAM by the PDM, was usually made up of a core staff of at least one person, and might involve up to five staff members in larger municipalities. Since most municipalities were not in a position to contract additional qualified personnel, usually, existing technical staff were assigned to the new working unit after a careful assessment of their capability. The qualifications required included experience with urban registers and cadastres, and a basic knowledge in cartography. Although experience with electronic data processing would be very desirable, only a few members of municipal staff had this experience.

Owing to the low technical capacities of municipal staff, the introduction of the SIAM depended heavily on the support of PDM advisers, especially in the early stages. PDM advisers usually took the leading role in defining system requirements and adapting the basic SIAM software to the requirements of individual municipalities. For general advice in system development, on average, about eight visits of a PDM adviser would be needed (totalling up to 36 working days, or 1.8 man-months), while the actual installation and modification of the system would take about one week of the time of an experienced PDM programmer for a municipality of 25, 000 inhabitants.

Only in very few municipalities were the local staff able to take on this programming task on their own, with only limited advisory support from PDM staff. In most cases, the software had to be carefully protected against haphazard modifications by inexperienced users. In a small number of municipalities, the local staff even refused to work with computers initially and preferred to continue in their traditional way - keeping records manually.

In contrast to the conceptual and programming work, the field work to update or extend existing records was mostly done by local staff. To survey an area of 10 hectares, it would take a working team of three (one qualified surveyor plus two assistants) about four to five days.

The entering of data into the computer would take about one day per 200-300 property records, totalling about 30 working days for a municipality of 25,000 inhabitants. This task was also performed by local staff, trained and supervised by PDM professionals.

In all stages of system introduction, the PDM relied on a continuous on-the-job training to familiarise the local staff with the system and to gradually transfer the responsibility for the management of the system to the municipality. The intensive support and direct involvement in the initial stage were thus gradually reduced to a more advisory role, evaluating and monitoring the progress made by the municipality.

For the purposes of assisting municipalities to establish the SIAM cadastre, the PDM was maintaining a team of 12 full-time professionals at the time of writing, working exclusively on cadastres - six of them in the head office in Quito, two in the regional PDM office in Cuenca and four in another regional office in Guayaquil. While the staff of the regional offices only gave advice and support to user municipalities, the head office staff had the additional responsibility of digitising the cartographic information for the municipalities and the further conceptual development of the SIAM.

With its team of 12 professionals, the PDM attended to the needs of 44 municipalities, which fully absorbed the advisory capacity of the team.

INVESTMENT AND RUNNING COSTS

Because of the flexibility of the system, the necessary investment for equipment and running costs can be largely adapted to the financial capacity of each user municipality. However, since the CATRAL and IMPREDIAL computer programs are the core of the system, some minimum computer equipment will be necessary right from the outset. The different options for equipment provision are as follows.

- Basic equipment sufficient for small municipalities of 5,000 to 10,000 inhabitants:

  - 1 personal computer (286, 386 or 486 processor), minimum 1 MB RAM, standard hard disk
  - 1 dot matrix printer
  - operating system MS-DOS 3.1
  - data base software Clipper 5.2.

  This basic equipment, which has been installed in the majority of the user municipalities, can be purchased locally at about US$ 1,600 (1995 prices).

- More elaborate equipment:

  - 3-4 personal computers, 486dxz processor, 4 MB RAM, standard hard disk
  - operation system MS-DOS 3.1
  - 3-4 dot matrix printers
  - data base software Clipper 5.2
  - additional software Novell-Network.

  With this equipment, a basic network can be established with two to three terminals. The PDM suggests to place the computers in different municipal departments concerned with the cadastre, to allow better integration of different types of information.

  The costs of such a network, which can also be purchased locally, is about US$ 6,000 (1995 prices)

- Optimum equipment:

  In addition to the basic network described above, this option can process graphic data and requires the following equipment:

  - 1 personal computer, 486dxz processor, 66 MHz, 8 MB RAM, 240 MB hard disc, SGVA colour monitor
  - operating systems MS-DOS 6.2 and Window 3.1
  - graphic tablet 36" x 48" (digitiser)
  - Autocad Version 12 for Windows.

This equipment can be purchased at about US$ 5,000 - 6,000 (1995 prices). There would also be the additional cost of an A0 inkjet plotter for printing maps. Since such plotters are not available in Ecuador, it would have to be imported. At the time of writing, only one local authority, the municipality of Puyo, has embarked on this investment, while all other municipalities were relying on the digitising and plotting services of the PDM.

In addition to the computer equipment, some essential office furniture would also be required:

- a drafting board and drafting equipment
- shelves and cupboards to store the maps and data sheets.

The expenditure incurred for surveys and field work is relatively small. In most municipalities, temporary assistants (e.g. students) were employed and instructed in a two-day workshop by PDM staff. In other municipalities, the local surveyor and his staff took on the data collection and survey work.

The operational costs of the system consist of staff salaries, usually for two to three staff members in smaller local authorities, and four to six in larger municipalities.

SYSTEM UPDATE AND MAINTENANCE

While most existing cadastres developed by municipalities along the guidelines of the Local Government Law require an extensive and comprehensive data base, which has proved difficult to establish and update, SIAM reduces the amount of data required, thus reducing the amount of work needed for updating.

The establishment of links with other municipal departments at an early stage of system development enables a constant exchange of land-related information. This exchange of information will be further enhanced when computer networks are established to connect the different departments. Since, according to the law, all land and property transfers have to be reported to the local authorities by the notaries handling these transfers, and all building activities require a permit, most information on these matters within the urban area can be obtained directly from the departments concerned.

In reality, however, not all notaries and citizens complied with regulations, especially in the growing informal urban settlements. Furthermore, due to limited managerial and personnel capacities, regular and organised exchanges of information between departments remained difficult.

Another major impediment to system maintenance was the totally antiquated criteria for land taxation as defined by the Local Government Law, which had not been revised for more than 30 years. Although the system allowed for revision, the assessment of taxable values according to real market values remained difficult and further hampered the efficiency of the system. However, the fact that the SIAM has been adopted by a large number of municipalities was expected to help highlight the need for a comprehensive reform of land taxation.

ADAPTABILITY OF THE SYSTEM

The concept behind the SIAM is to rationalise existing municipal cadastres; and to increase the efficiency of municipal revenue collection. Consequently, the approach adopted reflects strongly the particular institutional and legal environment in Ecuador. The possibility of transferring this system directly to other countries would seem rather limited.

However, it may be used as an example of how existing, manually kept cadastres and registers of small and medium municipalities can be made more efficient by rationalising their underlying structures and introducing relatively simple electronic data processing. It also provides an example of how to incrementally build up a more comprehensive land information system which can support a wider range of urban management functions.

The conditions for adopting a similar approach may be summarised as follows.

- The establishment and maintenance of urban cadastres is within the competence and remit of local authorities.
- Existing cadastral information and records can be used as a basis for a more efficient system.
- Existing laws and regulations allow the modification and rationalisation of local cadastral systems.

SOURCES OF INFORMATION AND TECHNICAL ADVICE

Limited technical assistance and training can be provided by the PDM's SIAM advisory team of 12 professionals to interested parties in the following forms:

- short-term secondment of PDM personnel to help with the development of similar systems in other countries
- advice to individuals and groups on short visits to Ecuador
- on-the-job training as part of the advisory support to Ecuadorian municipalities.

However, since the programme in Ecuador has first priority and human resources are scarce, the PDM can provide only very limited assistance, which would have to be carefully coordinated. Owing to language barriers, such support can be provided mainly within Latin America.

Limited support can also be given by a small number of Ecuadorian consultancy firms which have collaborated with the PDM. Their addresses and other information are listed in the last column on this page.

More detailed information on the Ecuadorian SIAM can be obtained from various working aids and handbooks prepared by the PDM/GTZ for the purposes of training municipal staff and PDM personnel. They were still in draft form at the time of writing, but were scheduled to be published in the spring of 1996.

- ***Gúia para la Evaluacïon del Catastro Urbano Municipal***
  (guidelines for the evaluation and assessment of municipal cadastral systems)
- ***Gúia para la Programacïon del Sistema de Informacïon Automatizado Municipal***
  (guidelines for programming the SIAM data base)
- ***Instructivo para Empadronamiento*** (instructions for municipal staff in data collection and field surveys)
- ***Sistema de Informacïon del Catastro Predial Urbano***
  (step-by-step description of the application of CATRAL and IMPREDIAL)
- various working papers written for municipal staff, explaining the instruments and procedures for the valuation of land and other real estate properties.

ADDRESSES OF LOCAL INSTITUTIONS AND EXPERTS

Programa de Fortalecimiento Municipal
PFM BdE / GTZ
Av. Atahualpa # 628 - Edificio Doral
Casilla 17 - 21 - 914
Quito / Ecuador

Tel: +593 - 2 - 250 137
Fax: +593 - 2 - 250 130

Arq. Carlos Pallares Sevilla
CONSULPLAN
Finlandia 224 y Suecia
Quito / Ecuador

Tel: +593 - 2 - 439 849
Fax: +593 - 2 - 433 886

Arq. Erik Naranjo Raddatz
Russia 323 y Shyris
Quito / Ecuador

Tel: +593 - 2 - 431 908
Fax: +593 - 2 - 465 585

C. DATA BASE FOR THE LEGALISATION OF TENURE - EL SALVADOR

C EL SALVADOR

BACKGROUND TO SYSTEM DEVELOPMENT

Located in the middle of Central America, El Salvador has a total population of 5.05 million, of which 50% is urban. The national territory is divided into 262 municipalities, which comprise both urban centres and rural areas. The majority of municipalities are extremely small; only 57 (22%) of local authorities have more than 5,000 inhabitants.

Being one of the most densely populated countries in Central America, with a population density of 254 inhabitants per square kilometre, one of the major social problems in El Salvador is an extreme concentration of land ownership: about 80% of all land is in the hands of only 10% of the population, while the vast majority of the population own only small parcels of land or no land at all. A high proportion of the population live in illegal settlements, in large squatter settlements or on small "pirate" parcels, without infrastructure or social services, and under permanent threat of eviction. It has been estimated recently that about a third of the population live below the extreme poverty line, with another third in poverty.

The extreme poverty and the insecurity of tenure prevailing all over the country were two of the main causes of the civil war which ravaged the country from 1981 to 1992. They are still major sources of social conflict and obstacles to social development; and they inhibit investments in house improvements which could otherwise better the living conditions of the majority of the population.

With the end of the civil war, solutions to these conflicts and to improve security of tenure were explored. In 1991, shortly before the end of the civil war, the government embarked on a large-scale programme, entitled "El Salvador, Land of Owners" (*El Salvador, Páis de Propietarios*), with technical and financial assistance from the United States Agency for International Development (USAID), to tackle these pressing problems and to promote low-cost housing for the poor.

To advise the government on organisational reform and administrative modernisation, a special organisation, the Institute for Liberty and Progress (*Instituto Libertad y Progreso*), was founded under the auspices of the Ministry of Justice, to carry out the following tasks:

- to establish a new Social Property Register (*Registro Social de Inmuebles* - RSI)
- to identify programmes and projects for social improvements, especially with regard to low-cost housing.

One of the main issues addressed by the RSI is the regularisation of land tenure and the acceleration of property registration, which, so far, had been hampered by a number of serious problems, namely:

- long and complicated procedures with an outdated charging system, resulting in an average of up to three months to have a property registered
- extensive corruption and manipulation of the existing registers for private gain
- a high level of inaccuracy in the existing property registers.

MAIN AREAS OF APPLICATION

The major tasks undertaken and services rendered by the RSI may be summarised as follows.

- **Legalisation and regularisation** of land tenure in informal settlements for
  - urban squatters
  - unauthorised use of small urban plots
  - agricultural land developed by the government for small farmers.
- **Registration** of land for urban low-income housing projects.
- **Facilitation** of access to formal financial assistance for disadvantaged groups.
- **Supervision** of the legalisation and regularisation of tenure.
- **Access** for the general public to information on individual properties.

IMPROVEMENTS BROUGHT ABOUT BY THE SYSTEM

Since it started its operations in August 1992, almost 93,000 entries have been registered in the RSI. Of these, approximately 45,000 are registrations of new properties, generally as a result of the subdivision of a large plot; the others include mortgages or transfers of property rights already registered in existing registers. In general, the main impacts and results of the RSI can be summarised as follows.

Legalisation and registration of land tenure

The major achievement of the RSI to date is the legalisation and registration of tenure for those social groups which had previously been denied land. By mid-1995, legalisation of property tenure in existing informal settlements accounted for about 14% of the new registrations in the system. Although this figure may seem small in comparison with new developments, it marks a considerable shift of government policy towards the informal housing sector. The regularisation of informal settlements has a great impact on both individuals and society, namely:

- Social integration: security of tenure is very important to an individual or a family, as it allows them to regard themselves, and be regarded, as part of the mainstream society.
- Access to formal financial assistance: secure tenure provides a reliable basis for family investments and improves access to formal financial assistance for construction or house improvements.
- The legalisation of tenure is also an important step towards the construction of a state governed by law, by resolving social conflicts over land and considering the legitimate claims of disadvantaged groups, which have no choice but to occupy vacant land to satisfy their basic need for shelter.

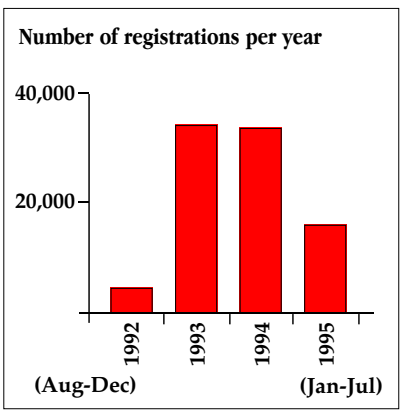
Registrations of land divisions and property transfers for low-income housing

The RSI has created an institutional framework and expeditious procedures for managing the substantial increase in the registration of property transfers and mortgages, as a result of the large-scale low-income housing programmes undertaken by the government.

Approximately 86% of total registrations (almost 40,000 new registrations between 1992 and 1995) taken by the RSI up to mid-1995 are related to low-income housing projects. The RSI has managed to overcome the major shortcomings of the previous registration system and to open up the formal real estate market to those people formerly confined to the informal sector. The main improvements achieved by the system in this context are:

- a substantial reduction in the time required for registration (from three months to an average of three days)
- a substantial reduction in registration fees, now based on clearly defined charging rates
- improved accountability in registration procedures, reducing the possibilities for corruption
- public access to real estate registers and easily available information on the property market.

Type of settlement	No. of reg.	%
squatter and marginal settlements	4,874	
illegal site developments	905	
agricultural parcels	654	
legalisation of tenure in existing substandard settlements	6,433	14%
new housing projects	38,348	86%
total	44,781	100%



SYSTEM COMPONENTS

As the RSI was primarily oriented to implement speedy procedures to register properties, it focused from the very beginning on those instruments and information crucial for its main objectives. It started operation mainly as a more efficient and modern substitute for one part of the traditional, manually kept register and cadastre system.

Initially the RSI consisted only of a computer data base, based on a standard software (FoxBase+) and run on a personal computer. Only when this component was working smoothly was a graphic component introduced for map production.

For reasons of simplicity and economy, and confined to the technology available, the graphic component was first conceived as a stand-alone application, without being linked to the alphanumeric data. The full integration of geographic and alphanumeric data was accomplished afterwards.

Both system components are now operating on a network of personal computers, based on a 486 server, using a standard network software, Novell.

The computer program for the management of property registers

This program, which was developed in the first stage of RSI implementation, represents the core component of the system. It was especially designed for speedy and transparent registration procedures and, at the same time, to meet the legal requirements for property and mortgage registration in El Salvador. It contains, therefore, only the information directly required for these purposes and, so far, no other data that might be useful for other land management tasks.

The information stored in the data base is compiled from the applications for registration submitted by individuals or developers, elaborated and updated in the registration process by the RSI working unit.

The information is organised on a coding system, with a special code for each property (*Folio Real*), which enables each property to be identified on site and on maps. The information on each individual property includes:

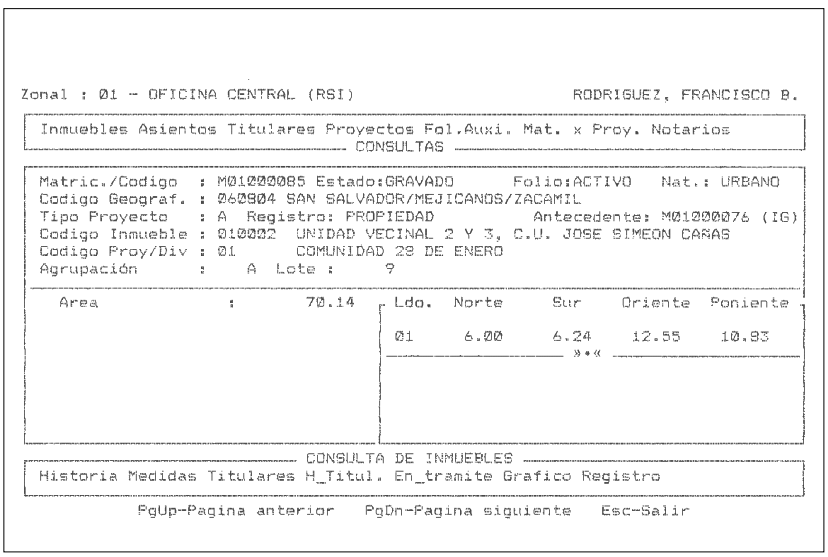
- identification of owner(s)/tenant(s) and buyer(s)/seller(s) (names, identity numbers, type of ownership)
- address, area, location and boundaries of property; and adjoining properties
- transfer value
- records of previous transfers
- type and amount of mortgage
- name of notary in charge
- status of application within the registration process.

The data base was initially established on a flat (unrelational) data base software and later, with the increasing amount of data, transferred to a fully relational data base structure.

Basic RSI components at the present stage of system development:

- A computer program for the management of property registers.
- Cartographic information (general and detailed cadastral maps).

Example of computer-print out (courtesy of the RSI)



The cartographic component

This component was developed to provide geographic reference for the system. It is currently focused on producing basic cadastral maps and plans for registration purposes. It does not include any other information, such as type of construction, land use, urban services or taxation criteria.

The outputs of this component are:

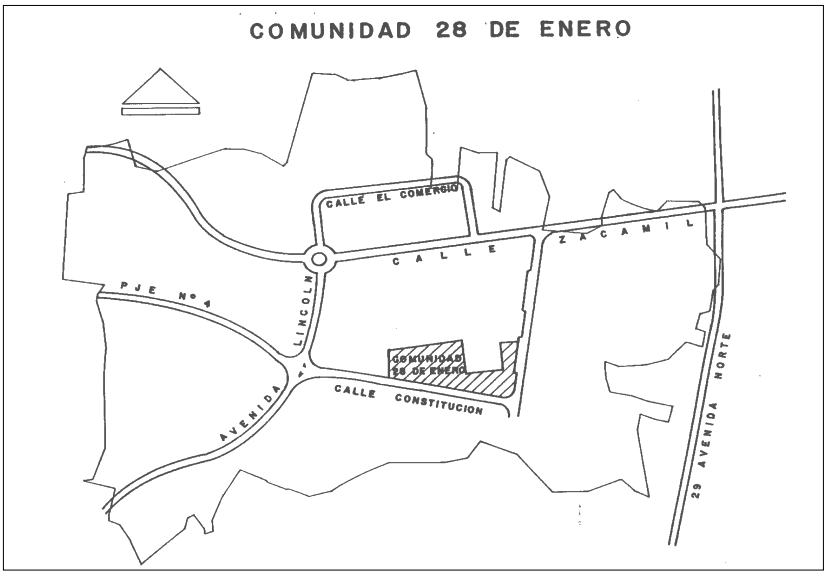
- general cadastral maps, in the scale of 1 : 10,000 or 1 : 5,000
- detailed plans of sectors, building blocks and individual properties in various scales (1 : 5,000 to 1 : 500).

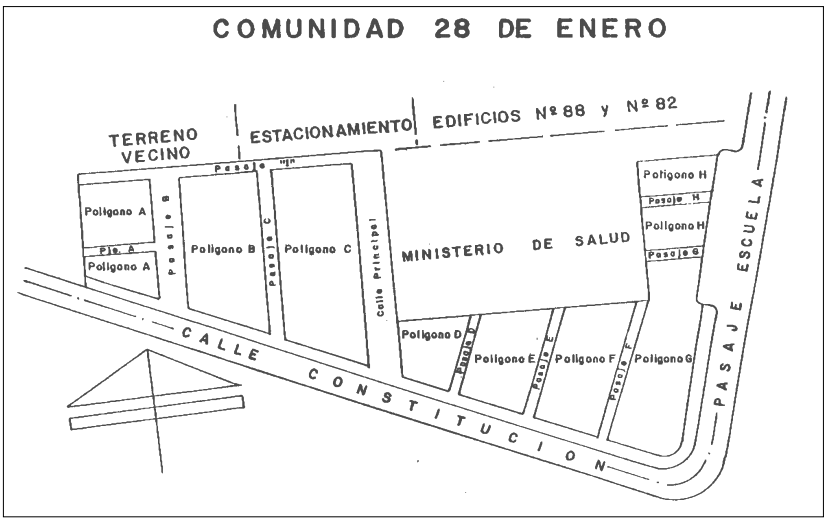
The general cadastral maps are based on the official national geodetic maps produced by the National Geographic Institute (*Instituto Geográfico Nacional*), which is the institution responsible for the national geographic cadastre.

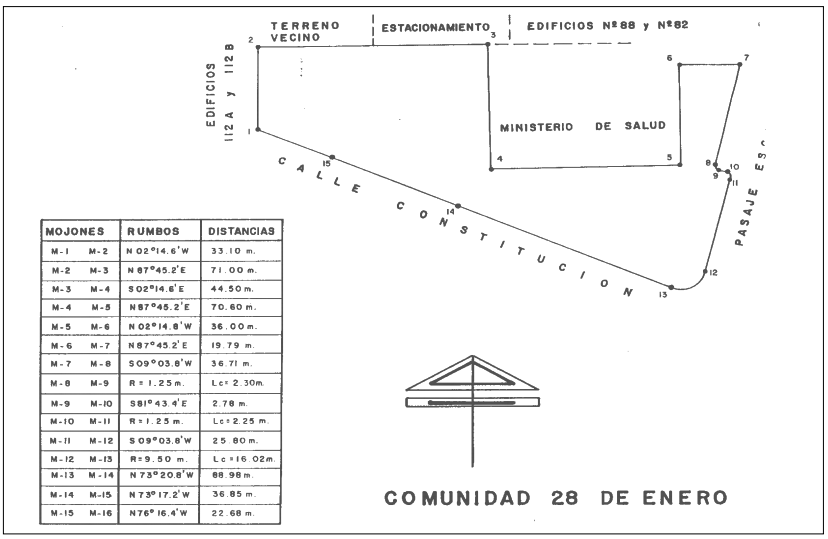
The detailed cadastral maps are prepared with the information obtained from the registration applications, in the format and scale required by the RSI.

Part of the current tasks of the RSI is to register transfers of parts or parcels of larger properties, which have been subdivided into smaller plots; and to register the individual shares of a cooperative ownership. The detailed cadastral plans, therefore, usually include the location and boundaries of the original property, as well as those of the parcels to be transferred. Other information provided by the detailed maps includes:

- a cadastral code for each plot
- widths and lengths of individual plots
- street widths and orientation







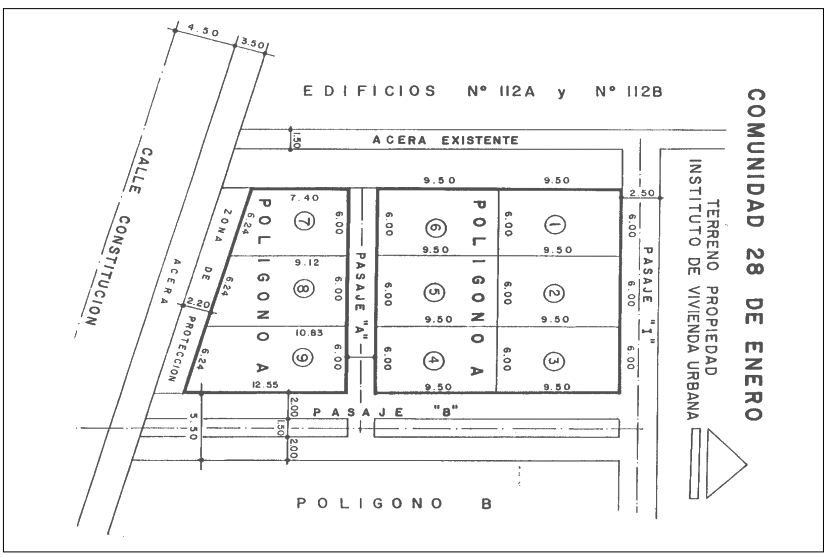
MOJONES		RUMBOS	DISTANCIAS
M-1	M-2	N 02°14.6'W	33.10 m.
M-2	M-3	N 87°45.2'E	71.00 m.
M-3	M-4	S 02°14.6'E	44.50 m.
M-4	M-5	N 87°45.2'E	70.60 m.
M-5	M-6	N 02°14.8'W	36.00 m.
M-6	M-7	N 87°45.2'E	19.79 m.
M-7	M-8	S 09°03.8'W	36.71 m.
M-8	M-9	R = 1.25 m.	Lc= 2.30m.
M-9	M-10	S 81°43.4'E	2.78 m.
M-10	M-11	R = 1.25 m.	Lc= 2.25 m.
M-11	M-12	S 09°03.8'W	25.80 m.
M-12	M-13	R= 9.50 m.	Lc =16.02m.
M-13	M-14	N 73°20.8'W	88.98 m.
M-14	M-15	N 73°17.2'W	36.85 m.
M-15	M-16	N 76°16.4'W	22.68 m.

- larger neighbouring plots owned by public institutions.

Like the data base, the cartographic information is also processed and stored on a personal computer system. The graphic information was originally derived from traditional maps and stored in a format (PCX type) that could neither be edited nor integrated with other systems.

Recently, the cartographic data have been transferred to a software (MicroStation) which has better facilities for processing geographic information. It is now possible to edit both the general cadastral maps and individual property plans, and to merge them with the alphanumeric data base.

All maps are stored both electronically and in print-outs.



INTRODUCTION OF THE SYSTEM

To introduce the system, a number of major modifications of the legal and institutional framework for property registration were necessary, which were made possible by strong support for the RSI at the highest government levels.

Prior to the actual institutional reform and system development, the following strategic factors were considered:

- the advantages and disadvantages of a centralised registration system versus a more decentralised structure (e.g. involving local authorities in system management)
- the possibilities of modifying existing institutions versus the establishment of a new agency
- the types of settlement and property, and social groups to be covered by the system
- the choice of appropriate equipment (sophisticated high-tech work stations or mainframe computer systems versus modest PC-based system).

Based on a careful evaluation of the different options and a scrutiny of the experience of a similar project in Peru, it was decided to take the following steps:

- Creation of a new, specialised agency, the *Instituto Progreso y Libertad* (ILP), to be located in the Ministry of Justice and managed by a board of directors consisting of high-ranking central government officials.

  Some of the tasks previously performed by the Registry of Land Property and Mortgages (*Registro de la Propiedad Ráiz e Hipotecas*) within the Ministry of Justice were transferred to the ILP by a government decree, accompanied by the necessary amendments in the law.
- Creation of a new programme, the *Registro Social de Inmuebles* (RSI), and a working group within the ILP to specialise in property registration for low-income groups. This programme was funded mainly by the national budget, with a little financial help and with technical assistance from USAID.
- Amendments of legal provisions and setting of procedures for the new property registration system.

Preparatory work

The main activities to establish the system and to prepare for the operation of the RSI were:

- the design of the information system and the structure of the data base, including the selection of appropriate computer hardware and software (The RSI design was based on a system previously developed in Peru. However, although the Peruvian experience provided useful references and sources of technical assistance, substantial modifications were needed to meet Salvadorian requirements.)
- detailed definition of the organisational structure and operational procedures
- selection, hiring and training of personnel
- provision of office facilities and equipment
- testing of the system, during which the system design was constantly revised and adjusted.

All preparatory activities were closely coordinated and were completed within two years.

Establishing and operating the system

Once the system was in place, the data base started to grow with each application for property registration. In the beginning, some new development projects and existing informal settlements were selected for registration, and the idea of property registration was promoted among target groups. Subsequently, after the system had gained some publicity, its operation extended from government projects to ordinary citizens, mostly private developers and real estate companies.

The procedures for property registration are as follows.

- Reception of application: an applicant submits the appropriate documents. If the documents are complete and have been filled in correctly, they are accepted and the applicant receives an entry number. By quoting this number, the applicant can check the progress of the application at any stage of the registration process.

- Checking and approval of documents, plans and maps: RSI staff examine and verify the different documents, deeds, maps and plans. The detailed property plans submitted by the applicant are compared with the general cadastral maps.

  If inconsistencies or errors are found, the documents are returned to the applicant with relevant comments and request for revision.

  If the documents are complete and comply with legal requirements, they are approved for registration.

- The information is then entered into the data base and the registration process is completed. A registration code (*matrícula*) is given to the property if it has no previous registration.

The registration is the last step in the legalisation of a property. It provides the applicant, on request, with a certification confirming that the property has been registered in compliance with the legal procedures prescribed for the transfer of property rights on a particular piece of land. However, it does not constitute a formal title or deed.

ACCURACY OF DATA

Since the cadastre aims at securing tenure and does issue certificates of registration, the data fed into the system have to be accurate and sufficiently detailed.

The responsibility for the accuracy of all property information rests with individual applicants, who have to supply all the required information, documents and maps. To this end, they need the services of a registered notary to provide adequate proofs of a transfer.

The detailed cadastral maps of the plots to be registered also have to be provided by the applicants. For this purpose, they have to commission a qualified surveyor to survey the plot and prepare the required maps, locating it in the national geodetic grid.

Only the general cadastral maps are provided by the RSI.

SYSTEM OUTPUTS

The RSI system can analyse different data and prepare reports in different formats to meet the requirements of different users. The main options are presented to the user in various screen menus that facilitate the operation. These are:

- a report on all data related to a selected property, which can be accessed through its registration number, entry number, address, settlement, project name or name of its owner
- a report on all properties belonging to the same owner
- a report on all properties and/or owners of a selected settlement, housing project or block
- a status report on an application for registration under process
- general analysis and sorting of data for operational and administrative purposes.

In addition to this alphanumeric information, the cartographic component of the system can print out maps and plans in different scales.

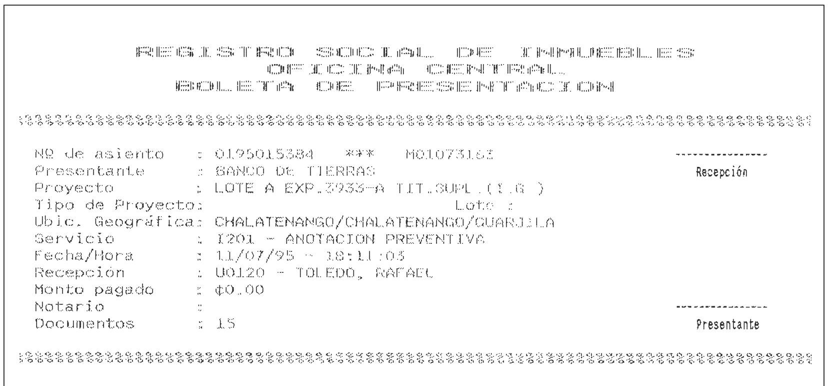
The information provided by the system is available to the general public. Individual citizens can obtain printed reports on any piece of property, including its ownership and registration status. This information is issued through a window open to the public in the RSI offices.

With prior authorisation from RSI officials, professional users, such as central or local government officers, notaries and private developers, may even gain direct access to RSI computers to obtain or analyse information related to their work. Because of the good quality of the information and the accessibility of the system, it is being used intensively. Apart from RSI operators, other major users include:

- government agencies dealing with property transfers, housing and land (e.g. the Ministry of Housing and Urban Development, municipalities)
- banks and other savings and loans agencies
- public notaries, developers, real estate companies and individuals interested in property transfers and mortgages.

Access to the system is currently provided by local computer networks in three RSI offices in the country (San Salvador, Santa Ana and San Miguel).

Example of a registration form (courtesy of the RSI)



REGISTRO SOCIAL DE INMUEBLES
OFICINA CENTRAL
BOLETA DE PRESENTACION

Nº de asiento : 0195015384 *** M01073163
Presentante : BANCO DE TIERRAS
Proyecto : LOTE A EXP.3933-A TIT.SUPL.(1.6)
Tipo de Proyecto: Lote :
Ubic. Geográfica: CHALATENANGO/CHALATENANGO/GUARJILA
Servicio : I201 - ANOTACION PREVENTIVA
Fecha/Hora : 11/07/95 - 18:11:03
Recepción : U0120 - TOLEDO, RAFAEL
Monto pagado : ¢0.00
Notario :
Documentos : 15

Recepción

Presentante

EXPANDABILITY OF THE SYSTEM

Since the system has proved both efficient and effective in the management of information relating to real estates and land, it provides a good basis to develop a broader range of applications. Current considerations for the extension of the system include the following.

Integration of all real estate registers and mortgage registers into the RSI
Because of the system's success, it is planned to combine the RSI and the National Geographic Institute (responsible for the geographic registers) into a new National Registers Centre (*Centro Nacional de Registros*), which will manage all types of property registration at national level. Initial steps to this end have already been taken.

Pilot project of comprehensive cadastre in the province of Sonsonate
This project aims at a systematic incorporation of all real estate information of the province into a new cadastre. Present plans include the updating of geographic registers with the help of aerial photographs and maps, and the rectification and revision of existing real estate registers with World Bank finance. A working unit has already been established within the *Direccíon Nacional de Registros* for these projects.

National coverage
Based on the experience of the pilot project, it is planned to extend the system to cover the whole country. It is envisaged that a broader geographic information system (GIS) will produce a wide range of information for regional and urban planning, municipal administration, etc. To extend the user base, discussion is under way to give municipalities direct access by connecting them into a computer network via modems and local terminals.

C EL SALVADOR

LEGAL AND POLITICAL FRAMEWORK

The legal and political conditions for the introduction of the system were determined, on the one hand, by the political will of the Salvadorian government to address the pressing land and housing problems of the country in the context of the peace process; and, on the other hand, by the inadequacy of the previous land management institutions and procedures.

Until the establishment of the RSI in 1991, the national geographic registers and real estate cadastre were managed exclusively by two central government institutions, which are even now still responsible for most of the cadastres and registers, since only a small part is currently managed by the RSI. In more details:

- The national geographic registers are managed by the National Geographic Institute, under the Ministry of Public Works. So far, it is the only source of cadastral and topographic maps, and related land information. Since the national cadastre has not been updated for 10 years, many cadastral maps are obsolete, resulting in a general lack of information for urban and regional planning and management.

- The real estate register is also centrally managed by the Ministry of Justice (*Registro de la Propiedad Ráız y Hipotecas*). In most parts of the country, real estate registration still follows the procedures established in 1881. Under this system (*Folio Personal*), the property is manually registered and filed under the name of the owner, which is the only key to find information on any property.

  In 1986 the system was changed to a filing of property transfer records and registrations under a property code (*Folio Real*), but this reform has so far only been carried out in the capital city, San Salvador.

  Like the geographic registers, the real estate register is largely obsolete and dogged by tedious and cumbersome procedures.

On the other hand, the local authorities, which in many other countries have an important role in land management, are traditionally weak in El Salvador. Most infrastructure and social services (e.g. water and sanitation, drainage, electricity, education, health) are centrally managed by government ministries or agencies, while only minor services (e.g. personal identification registers, solid waste collection, maintenance of streets, pavements and street lighting) are provided by the municipal administrations. Municipal funds come mainly from central government budget. Even the property tax, which was abolished in 1994 in favour of a new value added tax (IVA), had been managed by the central government.

Against this background, the establishment of a new agency at central government level was perceived as the best solution to address the pressing land management problems of the country. Hence, in February 1991, the *Instituto Libertad y Progreso* (ILP) was created by a Presidential decree and entrusted with the task of developing a property register oriented toward social welfare. With a further decree issued by the Legislative Assembly (*Asemblea Legislativa*) in April 1991, the RSI was established as a special administrative task force in the Ministry of Justice, independent of the existing real estate registration office in the same Ministry. The remit of the RSI was confined to:

- squatter settlements and urban fringes
- illegal land developments
- low-income housing projects in urban and rural areas
- agricultural land developed for social purposes.

To enable the new agency to cope with its tasks, the above decree also established new and simple procedures for the registration of properties within the remit of the RSI.

While these laws and decrees provide the legal framework for the new system, minor reforms were made later on to regulate and streamline administrative procedures. One of these amendments, made in 1994, allows the Ministry of Justice to broaden the remit of the RSI to provide a legal basis for the planned extension of the system.

Although the government has recently adopted decentralisation as the guiding principle for modernisation, no major steps in this direction have been made so far. However, discussions are under way to transfer a large part of the responsibilities for social services and infrastructure to the municipalities. At the same time, it is proposed that the municipalities should also take over the management of the finances of these services, including the possible resurrection of the recently abolished property tax.

While such reforms would require an increase of land management capacities at municipal level, the proposed extension of the RSI system is not steered in this direction; instead, it aims to consolidate registration and cadastral services as centralised functions, operated and managed by central government agencies.

ORGANISATIONAL AND INSTITUTIONAL STRUCTURES

The RSI was introduced as a centralised cadastral system and established as an agency with full autonomy in its own management and operation. Political support was secured by the appointment of high-ranking governmental officials to the ILP Board of Directors, which comprise Vice Ministers of important Ministries - Housing and Urban Planning (Board President), Public Works, Social and Economic Development Planning and Coordination, and Justice - and a representative of the National Secretariat for Family Affairs.

The RSI working group within the ILP is organised into function units under an Executive Director, who is assisted by a Monitoring Unit, which assesses the progress of projects and programmes. The main function units are:

- Registration
- Technical Support
- System Management
- Finance/Administration.

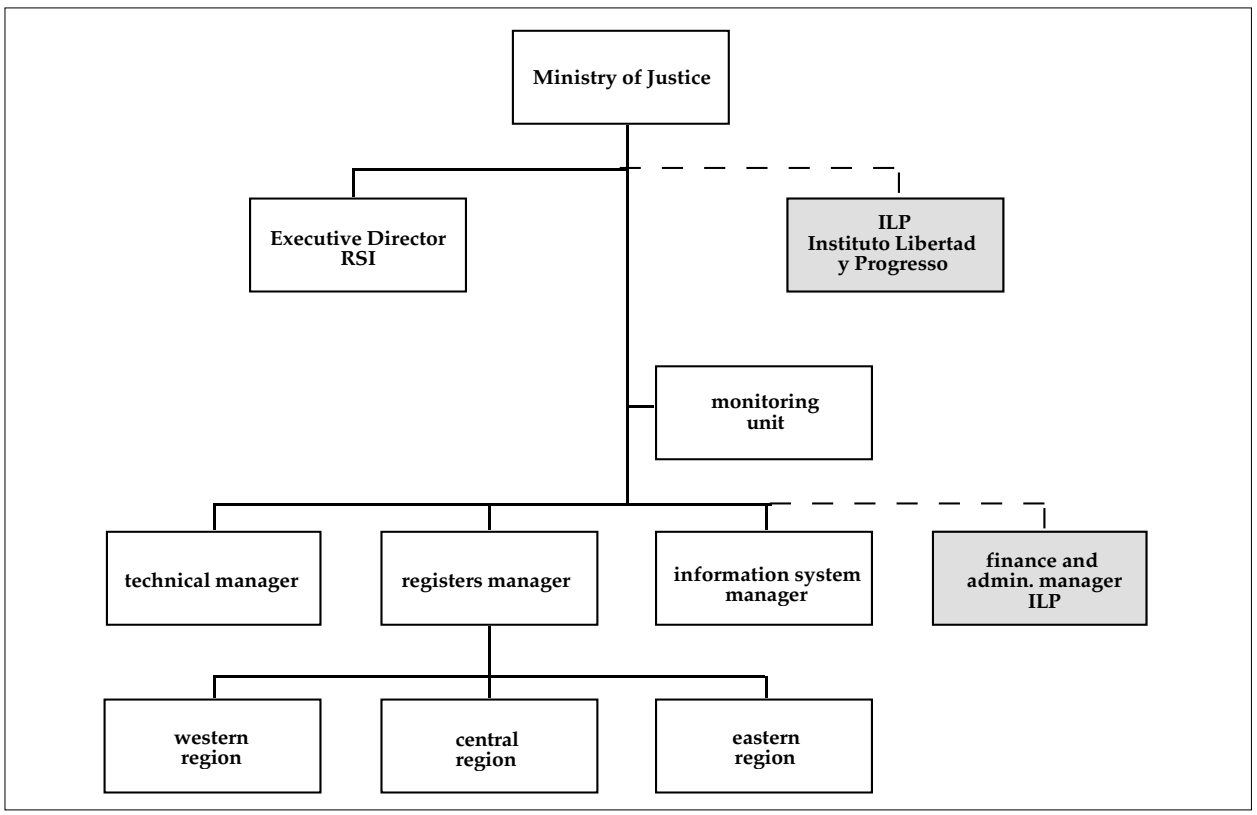
The Registration Unit is responsible for examining applications, approving documents and operating the alphanumeric program. Three regional offices have been established under the Registration Unit, headed by a Registrar (a qualified lawyer) and staffed by a small team of legal assistants.

The Technical Unit is responsible for examining and approving maps and plans, and for overall cartographic support for the Registration Unit. These tasks are usually carried out by engineers, architects or surveyors.

The System Management Unit is in charge of the development, operation, administration and maintenance of the hardware and software of the system. It comprises system engineers, computer technicians and programmers.

The total staff of the RSI central office numbers approximately 75, with each of the regional offices employing another 15 staff. The RSI working group has now been incorporated into the new National Cadastre Centre (*Centro Nacional de Registros*), as mentioned above.

Organisational structure (*Registro Social de Inmuebles*)



INVESTMENT AND RUNNING COSTS

Owing to the pragmatic and highly focused approach of the system, the initial investment needed to get the system operating was relatively modest. Apart from the provision of new office facilities for the RSI, the only significant initial investment was the purchase of computer equipment, which carried out the basic tasks in the early stages of system operation, and which consisted of:

- 1 PC, 486dx processor, minimum 50 MHz, 4 MB RAM, minimum 240 MB hard disk, VGA monitor
- 1 dot matrix or inkjet printer with graphic capacity
- 1 flat-bed scanner
- tape back-up system
- operating system MS DOS/Windows
- standard relational data base program (dBase, Foxpro, etc), CAD software (AutoCAD, MicroStation).

With increased remit and the establishment of regional offices, the system was gradually extended to a small network of three to four computers of the same specifications.

However, the initial system design and development required the specialised expertise of highly qualified professionals with broad experience. Access to the experience of other cadastral systems, in particular the Peruvian system, and the technical assistance provided by its experts, made a substantial contribution to the establishment of the system. Once the system was set up and ready to operate, the training of the operational staff was generally done on the job.

Since the required information is supplied by applicants for registration, the running costs, apart from office premises, relate mainly to personnel salaries. A basic system operation team consists of three to five staff, usually made up of:

- 1-2 registrars (one qualified lawyer plus legal assistants)
- 1-2 cartographers (civil engineers, architects or surveyors)
- 1 computer technician (eventually).

Depending on the complexity of the information, a basic team can carry out 700 to 1,500 registrations per month.

Based on the experience obtained so far, it is estimated that the pilot project in the province of Sonsonate, which will involve the comprehensive updating of a cadastre of about 100,000 properties in an area of approximately 1,227 square metres, will require the following staff:

- Management and coordination: 6 persons for 21 months
- Operation: 12 persons for 18 months
- Administrative support: 11 persons for 21 months.

The project also includes a large contract for aerial photographs and mapping. The total project cost is estimated at approximately US$ 6.8 million - approximately US$ 70 per property registered.

SYSTEM UPDATE AND MAINTENANCE

The requirements for updating and maintenance are relatively low, as the system is supposed to be constantly updated by the registration process. However, to ensure the integrity of the data base, it is necessary to promote and reinforce the idea of registration. The most important factor determining the success and long-term sustainability of the system is the benefits of the system to the applicants, which constitute the ultimate encouragement for registration.

The hardware and software need only periodic check-ups to ensure the quality and integrity of the information. An important element of the management of electronic data is the daily back-up of all files, following well defined back-up procedures. Back-ups are carried out by using tape streamers and are constantly supervised by the system technicians.

ADAPTABILITY OF THE SYSTEM

The RSI system provides an example of successful development and implementation of a simple and efficient real estate cadastre. Just as the Salvadorian experts have benefitted from the Peruvian experience, other countries with similar legal and institutional frameworks may very well benefit from the Salvadorian experience. First such contacts have already been made by some Guatemalan institutions. However, this type of exchange is not necessarily confined to countries in Central America. Countries in other regions, which have similar problems in managing property registrations, are welcomed to make contact with the Salvadorian institutions, or they may consult one another.

The political will and support have been indispensable to the success of the RSI in El Salvador. Without clear political direction and the will to implement these policies, it would not have been able to overcome the resistance to reform from individuals or groups interested in maintaining their sources of income or other fringe benefits through the old system.

The pragmatic but focused approach, and the incremental development of more complex and sophisticated system components, have also contributed to the success of the system. The modular nature of the design allows the alphanumeric data base and the cartographic component to be developed separately. Thus, when introducing the system to another country, the whole system may be established all at once, if circumstances allow; alternatively, the alphanumeric data base may be installed first, and the cartographic component may be added subsequently.

The system could also be adapted to include additional information for more complex tasks in urban management, such as urban infrastructure management, property taxation, urban and regional development planning and management, etc. However, the advantages and disadvantages of more comprehensive approaches should be carefully investigated, since the success of the Salvadorian system owes much to the fact that its tasks are confined to those of property registration. For the more complex tasks in urban management, other systems, especially designed and developed to meet comprehensive urban management needs, may prove better alternatives to an extension of the RSI system.

While the Salvadorian system adopted a centralised approach, more decentralised options may be more suitable for those countries where municipalities have a stronger role in land management.

From a technical point of view, the RSI system can be managed and operated either by a central government office or by local authorities, with only minor adaptations to their particular needs and capacities. As the regional offices of the RSI demonstrate, the system allows the establishment of regional service centres, where municipalities, singly or jointly, can operate their own cadastres.

In summary, the decision to adopt a centralised or a decentralised approach depends very much on individual circumstances, and has to take account of prevailing institutional and political framework.

CONDITIONS FOR ADOPTION

- The problems of real estate registration are similar to those in El Salvador.
- The legal framework is flexible enough to allow a reform of cadastral systems.
- The government and the relevant institutions are willing to introduce and support a more efficient and transparent registration system.
- The executing agencies have enough qualified staff and resources to introduce and operate the system.
- Advisory and technical assistance is available to adapt and develop the system to suit local conditions.

C EL SALVADOR

SOURCES OF INFORMATION AND TECHNICAL ADVICE

Since the RSI has recently been incorporated into the National Cadastre Centre (*Centro Nacional de Registros*), which was established to unify the different cadastre systems on the RSI model, requests for assistance or information will have to be addressed to the new institution. The RSI is generally prepared to assist other governments and institutions undertaking similar reforms. Some technical assistance has already been given to support the Guatemalan government to develop a similar system.

Another source of information is the agency recently created to implement the pilot project in the Sonsonate province, which also borrows from the RSI experience.

Although no published handbooks or brochures are available, the laws and decrees issued to create the system provide useful information on the legal and institutional framework and the corresponding procedures. These documents can be obtained through the RSI office.

ADDRESSES OF LOCAL INSTITUTIONS AND EXPERTS

Centro Nacional de Registro
Lic. José Silverio Henriquez Toledo
Director General
Prolongación Calle Arce y 41 Ave. Norte
San Salvador / El Salvador

Tel. +503 - 223 2460

Registro Social de Inmuebles-RSI
Lic. Cecilia de Sillis
Directora
Dr. René Balmore Madrid
Gerente área legal
Alameda Roosevelt 913
San Salvador / El Salvador

Tel. +503 - 223 0554

Unidad Ejecutora
Proyecto Piloto Barrido de Sonsonate
Sr. Dervez
Gerente Internacional del Proyecto
Paseo Gral Escalón 1678
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D. PROPERTY TAX CADASTRE AT MUNICIPAL LEVEL - NICARAGUA

D NICARAGUA

BACKGROUND TO SYSTEM DEVELOPMENT

In 1995, Nicaragua had a total population of approximately 4.2 million, 63% of which lived in urban areas. For the previous 16 years, the country had been facing serious social and economic difficulties:

- An armed conflict during the 1980s lead to the displacement of thousands of families.
- Inflation rates ran highest in Latin America and devastated the country's economy.
- Harsh fiscal measures implemented to reduce inflation further exacerbated the economic problems of the country.
- Complex land tenure procedures heightened social tensions and hampered foreign as well as domestic investments.

These problems resulted in high levels of unemployment and a steep increase in both urban and rural poverty.

To address these problems, the government embarked on a process of decentralisation and privatisation of public services in 1991. A wide range of public services were transferred from the central government to the 143 existing municipalities, creating enormous pressures on local authorities to deliver better services and increase their revenues to finance these endeavours. Hence, the strengthening and modernisation of local authorities became a high priority in the government's development agenda.

In 1991, the responsibility for the collection of the Real Estate Property Tax was transferred to municipal authorities, on the assumption that local authorities would take more initiative in increasing their income if they were to have direct control over it. In the event, only the municipality of Managua was able to carry out this new function satisfactorily, while the majority of other municipalities had neither the institutional nor the technical capability to set up and operate a municipal cadastre and taxation system.

By 1993, only 42 municipalities had a land and property register, and only 77 municipalities had property valuation data, all of which were, unfortunately, too unreliable to be used as a basis for tax collection. Land property register offices generally suffered from a lack of coordination and an inability to collect reliable data. It was estimated that only 53% of all urban and rural properties had been registered, albeit not necessarily accurately.

In 1992, about 85% of total municipal revenue came from taxes, rates, fees and charges. Although the amount of revenue was significant compared to other Latin American countries, it was not enough to meet the fast-growing demands for new infrastructure and social services, especially in urban areas. In any case, in absolute terms, the total revenue of local authorities was only US$ 60 million. The main source of municipal income was the Sales and Services Tax, which constituted about 48% of total revenue, while funding from central government amounted to 4% and the Real Estate Property Tax (*Impuesto de Bienes Inmuebles*) constituted 9.14% - way below its potential value.

To improve the situation, the government sought external funding and technical assistance. In June 1993, a cooperation agreement was signed between Nicaragua, Sweden, the United Nations Centre for Human Settlements (UNCHS-Habitat) and the United Nations Development Programme (UNDP), for the development and implementation of a national cadastral system suitable for local government. The cost of the project was estimated at US$ 712,000, to be spread across a two-year programme (US$ 518,000 and US$ 129,000 as a grant respectively from the Swedish Government and UNDP, and an in-kind contribution of US$ 65,000 from the government of Nicaragua).

While the technical assistance to the project came from UNCHS-Habitat, a number of Nicaraguan national institutions were also involved, including:

- the Nicaraguan Municipal Development Institute (*Instituto Nicaragüense de Fomento Municipal* - INIFOM), acting as representative of the municipalities and as national coordinating agency
- the Territorial Studies Institute (*Instituto de Estudios Territoriales* - INETER), responsible for the production of maps and cadastral registers
- the General Office for Revenue-Fiscal Cadastre (*Direccíon General de Ingresos-Catastro Fiscal*) of the Ministry of Finance (*Ministerio de Finanzas - MIFIN*), responsible for the valuation of real estates.

The main objective of the project was to strengthen the abilities of local authorities to increase their own revenues through a Real Estate Property Tax (*Impuesto de Bienes Inmuebles*).

The cadastral system developed by the technical cooperation project was conceived as the main instrument to enforce the new Real Estate Property Tax Law (*Ley Sobre el Impuesto de Bienes Inmuebles*). According to this Law, municipalities will be the exclusive collectors of this tax. The idea was to transform this property tax into a municipal tax, and not simply a delegated responsibility.

The idea developed by the project was based largely on the experience of the *Sistema de Catastro Urbano* (SIS-CAT), a computerised cadastral system developed by UNCHS-Habitat in a pilot project for the city of La Paz, Bolivia.

MAIN AREAS OF APPLICATION

Although the standardised cadastral system focuses strongly on improving the collection of property taxes, it also aims to generally improve other areas of municipal management and administration - such as investment, land use management and physical planning - through the use of a multipurpose cadastral data base (*catastro multifinalitario*). More specifically, the system has been designed to support the following tasks:

Levy of municipal taxes and charges
by carrying out

- property tax assessments at local government level
- tax collection and monitoring of late payments and non-payments.

Urban planning
by providing information, in the forms of maps and data bases, on

- urban areas and their respective land uses
- type and quality of infrastructure and other services at neighbourhood level and on individual land parcels
- general topographic characteristics
- population statistics.

General urban management
by supporting

- municipal investment planning
- budgeting procedures.

IMPROVEMENTS BROUGHT ABOUT BY THE SYSTEM

It is still too early to know what the real impact of the new system will be, as the project was, at the time of writing, still at the preparatory stage of defining the overall conceptual, legal and institutional framework for the new cadastral system. The main achievements in the first two years of the programme can be summarised as follows.

Legal framework

- The introduction of the Real Estate Property Tax Bill, and the enactment of this Bill by a Presidential decree in January 1995 to authorise the nationwide creation of a real estate valuation scheme and a real estate property cadastre at local government level, to cover both urban and rural properties.
- The agreement reached with 102 municipal councils (about 71% of all the municipalities in Nicaragua), including the municipality of Managua, to introduce standardised formats and procedures for property valuation.

Technical preparation

- Design of the procedures, forms and contents for the valuation of real estate properties at local government level; and production of calculation tables, to be used by local authorities and individual taxpayers, for the declaration and assessment of the Real Estate Property Tax.
- Acquisition of computer hardware and software, and installation of central office facilities at the premises of INIFOM and MIFIN's Fiscal Cadastre in Managua.
- Adaptation of SIS-CAT, a computer program originally developed for Bolivia, to the needs of Nicaraguan municipalities.
- Pilot surveys in the municipality of Leon, with the participation of the staff members of INETER, INIFOM, MIFIN and the municipalities of Managua and Leon.
- Preparation for the introduction of valuation procedures in selected neighbourhoods in Managua, using the questionnaire designed by the project and the SIS-CAT program.

Training

- An extensive training programme for mayors, town councillors, municipal staff, members of INIFOM and other government institutions, resulting in a general, strong support for the introduction of the Real Estate Property Tax Law.
- Training courses on the operation of SIS-CAT for the staff of the municipalities of Boaco, Leon, Managua, Estelı, Granada, Somoto, Rivas, Ocotal, Jinotepe, Jinotega, Juigalpa, Chinandega, Matagalpa and Masaya; as well as for the staff members of INETER, INIFOM and MIFIN.

D NICARAGUA

SYSTEM COMPONENTS

The Nicaraguan municipal cadastral system was designed as a comprehensive land information system, consisting of an alphanumeric data base (SIS-CAT) and a cartographic component, which is capable of producing data sheets, maps and plans. Although the two data bases can be operated independently, they can also interact through a SIS-CAT program interface. Therefore, it is possible to access graphic information from the alphanumeric data base, and vice versa.

While the alphanumeric component of the system has been adapted from SIS-CAT (the software developed for La Paz, Bolivia, by UNCHS-Habitat), the graphic component has been built on Microstation 5.0, a standard GIS software.

The system is capable of integrating existing data bases where these are available.

The cartographic component

The cartographic component has been designed to provide maps needed to establish the cadastral system. While it is intended, in this particular instance, to input cartographic information manually to the computer, the system is capable of scanning and converting aerial photographs and traditional maps to digital maps.

The cartographic information is derived from existing cadastral maps, in the scale of 1 : 1,000. Although these maps are often out of date, they are readily available from INETER for most of the core municipal areas. However, in most cases, field surveys or aerial photographs will be needed to supply adequate information to the system. From this digital cartographic information, two sets of base maps in different scales will be produced on durable material, such as plastics (polyester) or cronaflex, to be handed out to the municipalities as bases on which to build their cadastral registers.

General survey maps

- general survey maps, scale 1 : 5,000 and/or 1 : 10,000
- building block maps, scale 1 : 500.

Cadastral maps
based on general survey maps, with added cadastral codes

- general cadastral maps, scale 1 : 5,000 and/or 1 : 10,000
- cadastral mosaic maps (overview of all building blocks), scale 1 : 1,000
- cadastral building block maps, scale 1 : 500
- building plans in A4 format, scale 1 : 1,000 or 1 : 500 or 1 : 200, depending on building size
- other plans, in A4 format, scale 1 : 1,000 or 1 : 500 or 1 : 200, depending on property size.

The standardised Nicaraguan cadastre for local government consists of two major components:

- An alphanumeric data base program for processing and managing property records and tax assessments, based on the SIS-CAT 4.0 software developed by UNCHS-Habitat for La Paz, Bolivia.
- A graphic component for map production, based on Microstation 5.0, a standard GIS software.

Example of a block unit map *(manzana)*

The alphanumeric data base, SIS-CAT

Although initially focused on the management of property registers and tax administration, the SIS-CAT program has in fact been designed as a multipurpose land information system. It is therefore capable of handling a wide range of data once it is fully operational. Since the software was specially developed by UNCHS-Habitat to suit the circumstances of Latin American municipalities, only minor modifications were necessary to adapt the software used in La Paz to the cadastral procedures and traditions of Nicaraguan municipalities. The data base will hold information obtained from two different angles:

- from field surveys, to establish the geographic references for the system, including cadastral codes, land parcel and building block boundaries, etc.
- from self-assessments of land and buildings by owners (assisted by municipal staff), to provide detailed information for taxation purposes.

After analyses and sorting, the data base will be able to supply the following sets of data on any individual property:

Basic cadastral information

- cadastral code for the region and municipality in which the property/building is located
- cadastral code within the municipal area
- plot size, street front, length and width of the plot
- ownership and legal status; name and address of owner
- land valuation zone in which the property is located.

Land use and site description

- present land use and legal status of present land use
- topographic features
- types of land improvement (e.g. brick walls, block walls, gardens, water pump, garage, water tank, lighting)
- site level relative to street level.

Accessibility and infrastructure provision

- type of access or neighbouring land uses (e.g. main or secondary road, open space, public park, parking space, cemetery, water course)
- accessibility (e.g. small vehicles, cycles, pedestrian)
- street surface (e.g. asphalt, paving stones, gravel, cobblestones)

Example of a computer print-out

SIS-CAT

Sistema de Catastro Municipal
Municipalidad de LEON

Salida 2 | REGISTRO DE VIAS Y LUGARES | Código de vía o lugar:

Nombre de vía o lugar:
Tipo de vía o lugar:
Accesibilidad:
Excavación:
Estado de conservación:
Calzada:
Aceras:

SERVICIOS PUBLICOS
Agua potable: Alcantarillado sanitario:
Alcantarillado pluvial: Gas domiciliario:
Energía eléctrica: Teléfonos:
Eliminación basuras: Alumbrado público:
Transporte público masivo: Transporte público liviano:

NORMAS URBANISTICAS:
Retiro frontal exigido (mts): Altura fachada permitida (mts):

ZONA DE VALORACION:

MEJORAS

	Sigla	Descripción	Cantidad	Unidad
1)				
2)				
3)				
4)				
5)				
6)				

Ancho promedio (mts):

Pendiente promedio (%):

Superficie (m²):

Valor unitario bruto de terrenos sobre la vía:

Valor unitario neto de terrenos sobre la vía:

INFORMACION INTERNA:
Encuestador: Fecha de encuesta:
Operador: Fecha de carga: Hora carga:
Fecha salida: Hora salida:

Description of building(s)

- condition of access roads and streets
- road and neighbourhood improvements (e.g. pavements, ditches, shoulders, steps, traffic lights, sports grounds, public telephones)
- utilities (e.g. water, sewerage, electricity, solid waste collection).
- condition of building(s)
- type of building(s) (luxury, modest, etc)
- use of building(s)
- internal and external wall materials and finishing
- ceiling and roof materials
- floor materials
- door and window materials
- sanitary facilities
- special technical installations and additional improvements.

Example of a property data sheet *(declaración para el autoavalúo municipal de inmuebles)*

FORMATO PARA EL AUTOAVALUO MUNICIPAL — ALCALDIA MUNICIPAL DE:

IMPUESTO SOBRE LOS BIENES INMUEBLES (I.B.I.)

DECLARACION para el AUTOAVALUO MUNICIPAL de INMUEBLES URBANOS

8.5 Cálculo del Valor del Terreno

A=Zona No.	B = V.U.T.(C$/M2) (Córdobas)	(Ctvos.)	C = Area Terreno (M2) (Miles)	(Unidades)	(Decimales)	D=BxC=Valor del Terreno (Miles)	(Unidades de C$)
(Tabla No. 1: Zonas Valores)							

9.0 CARACTERISTICAS PREDOMINANTES Y VALOR DE CADA EDIFICIO INDEPENDIENTE

9.1 MATERIAL DE PAREDES	9.1.1EXTERIORES(X)	9.1.2INTERIORES(X)	9.2 CUBIERTA TECHO Material	"X"	Pje	9.3 AMBIENTES Número	"X"	Pje	9.4 CIELO RASO Material	"X"	Pje	9.5 PISO Material	"X"	Pje	Puntaje Total
Bloque de Concreto			Teja de barro		9.0	9 ó más		4.0	Madera fina		9.0	Terrazo		10.0	
Losetas Conc.Prefab.			Zinc		7.0	5 á 8		3.0	Fino integral		8.0	Ladrillo terrazo		7.5	
Concreto Monolítico			Fibro-Cemento		5.0	2 á 5		2.0	Asfalto/Poropl.		6.0	Madera fina		7.5	
Ladrillo Cuarterón			Losa de concreto		9.0	1		1.0	Machimbre		6.0	Ladr. cemento		5.0	
Piedra Cantera			Palma		3.0	9.7 BAÑOS/INODOROS			Plywood		4.0	Ladrillo barro		5.0	
Madera			Ripios		2.0	Número	"X"	Pje	Fibro-cemento		2.0	Embaldosado		5.0	
Minifalda			Otro		0.0	5 ó más		10.0	Durpanel		2.0	Madera rústica		2.5	
Taquezal			9.6 ELECTRICIDAD			3 á 4		7.5	Otro			Otro			
Adobe			Número	"X"	Pje	1 á 2		5.0	No hay		0.0	Suelo natural		0.0	
Fibro-cemento			Entubado bajo		8.0	Letrina/baño inf.		2.5							
Lám. metálica			Entubado cte.		6.0	No hay inodoro		0.0							
Bambú			Visible suficien		4.0	No hay letrina		0.0							
Ripios			Visible mínimo		2.0	No hay baño		0.0							
Otro			No hay		0.0										
No hay															
PUNTAJE TOTAL															

9.8 DETERMINACION DE LA CLASE DE CADA EDIFIC.INDEPEND. (Localizar intersección entre el Mat. de pared, ext. y la cubierta techo)					9.9 DETERMINACION DE LA CALIDAD Intervalo Pje.	Calidad	Puntaje Total	Calidad	9.10 RESUMEN DATOS PARA CALCULAR COSTO
					00.0 á 10.0	1			9.10.1 Clase
					11.0 á 20.0	2			9.10.2 Calidad
					21.0 á 30.0	3			9.10.3 C.B.U. (C$/M2)
Mat.Paredes Exteriores	Cubierta techo/Clase Tejas	Zinc	Madera	Losa	31.0 á 40.0	4			9.10.4 Area Construida (M2)
									9.10.5 Edad Edificio (años)
Bloque de Concreto	B	B	B	BC					

9.11 DETERMINACION DEL FACTOR PARA DEPRECIACION DE CADA EDIFICIO INDEPENDIENTE

Losetas Pref. Conc.	MC	MC	MC	MCC	CLASE	CALIDAD	Años de edad del edificio independiente 0 á 5	6 á 10	11 á 15	16 á 20	21 á 25	26 á 30	30 á 40	40 á más	FACTOR DEPREC.
Concreto Monolítico	MC	MC	MC	MCC	B, MC, LC, PC,LM	1	0.84	0.71	0.60	0.51	0.43	0.36	0.26	0.23	
Ladrillo Cuarterón	LC	LC	LC	LCC											
Piedra Cantera	PC	PC	PC	PCC	M, MF, T, A, LM		0.81	0.66	0.54	0.44	0.36	0.29	0.20	0.20	
Madera	M	M	M		B, MC, LC, PC,LM	2	0.88	0.78	0.68	0.60	0.53	0.47	0.36	0.28	
Minifalda	MF	MF	MF		M, MF, T, A, LM		0.84	0.71	0.60	0.51	0.43	0.36	0.26	0.23	
Taquezal	T	T	T		B, MC, LC, PC,LM		0.90	0.82	0.74	0.67	0.60	0.54	0.44	0.36	
Adobe	A	A	A		M, MF, T, A, LM	3	0.88	0.78	0.68	0.60	0.53	0.47	0.36	0.28	
Lámina Nicalit	LN	LN	LN		MC, MCC, LCC, PCC		0.93	0.86	0.79	0.73	0.68	0.63	0.54	0.46	
Lámin metálica	LM	LM	LM		B, MC, LC, PC,LM	4	0.92	0.85	0.78	0.71	0.66	0.60	0.51	0.43	
Otro (Especif.)	OT	OT	OT		BC, MCC, LCC, PCC		0.93	0.87	0.82	0.76	0.71	0.67	0.58	0.51	

9.12 CALCULO DEL VALOR DE CADA EDIFICIO INDEPENDIENTE EN LA MISMA PROPIEDAD

	A C. B. U. (C$/M2) (No usar centavos)	B Area Construida(M2) (Enteros)	(Decimales)	C= A x B Costo Reemplazo Nuevo (Millones)	(Miles)	(Unidades C$)	D = C x FACTOR DEPREC. Valor Depreciado (C$) (Mill.)	(Miles)	(Unidades C$)
1a.									
2a.									
3a.									
4a.									
5a.									
TOTAL									

(Redondear al Córdoba más cercano) (Redondear al Córdoba más cercano)

Financial and legal information

- mode and date of acquisition
- currency used for acquisition
- type of finance used for acquisition
- legal status and ownership title
- tenancy and occupancy
- tax exemptions/reductions applicable to property

INTRODUCTION OF THE SYSTEM

As the aim is to build standardised cadastres and land information systems at local government level, much emphasis has been given to consistency and transparency; and a lot of effort has been spent on the adaptation and clarification of the legal and institutional framework. The team of the multilateral technical cooperation project, which started working in 1993, has been working towards this aim. The preparation of the system is now largely completed, but its implementation at municipal level remains a task for the future.

Based on the documentation of the project and personal communications with the project team, it would seem that the major tasks in the initial development of the project, though closely related to one another in practice, can be divided into three distinct parts, as follows.

- Conceptual development and definition of legal and institutional framework.
- Development of working procedures and operational details.
- Training of professional staff, and public relations campaigns to inform politicians and the general public about the new system.

For the implementation of the system at municipal level, the major tasks will be:

- Field surveys to obtain information for the data base.
- Data processing and map production.

Conceptual development and definition of legal and institutional framework

To design an overall structure and to define a legal framework for the new cadastral system, the following activities were carried out:

- A detailed study of the existing cadastral system in Nicaragua, examining its shortcomings and potential, with the involvement of INETER, MIFIN and various municipalities.
- A comprehensive revision of the legal framework and the taxes that had been transferred to the municipalities.
- Preparation of a new Real Estate Property Tax Bill, which was discussed with all relevant political and social sectors, at both central and local government levels.
- Development of a general concept for a new cadastral and land information system, adaptation of the Bolivian SIS-CAT software to the Nicaraguan situation, and investigation of other hardware and software.
- Preparation and discussion of proposals for the institutional structure of the system, and of the contributions to be made by each institution and each agency involved.

Development of working procedures and operational details

Based on the general design of the system, and parallel to the reform of the political and institutional framework, operational procedures were developed and tested in selected municipalities. The specific tasks are summarised as follows.

- Developing procedures for inputting, storing and processing cartographic information; and defining the roles of INETER (central and regional offices), MIFIN's Fiscal Cadastre, INIFOM and the municipalities in this aspect of the system.
- Pilot digitisation of existing cadastral maps to test the practicality of the approach.
- Preparing cadastral building block maps in the scale of 1 : 500.
- Developing procedures for providing graphic cadastral information to municipalities and for processing this information at local level.
- Harmonising existing cadastral information held by different institutions (INETER, MIFIN's Fiscal Cadastre, the Public Land Property Register and selected municipalities); eliminating duplications; and selecting a data base software (FoxPro) compatible with SIS-CAT to enable data exchange.
- Installing the adapted SIS-CAT hardware and software in INIFOM and in selected municipalities.
- Developing a coding system and procedures for updating land information and property registers in coordination with INETER and selected municipalities.

- Designing a survey questionnaire and procedures for field surveys.
- Undertaking technical studies to determine land values, building costs and costs of property improvements.
- Designing a self-assessment and self-valuation system, including tables and factors to be used in valuation, and procedures for interinstitutional coordination and update.
- Designing and publishing tax assessment forms; and preparing instructions, handbooks and other information materials.
- Setting procedures for the collection of the Real Estate Property Tax.

Training and public relation campaigns

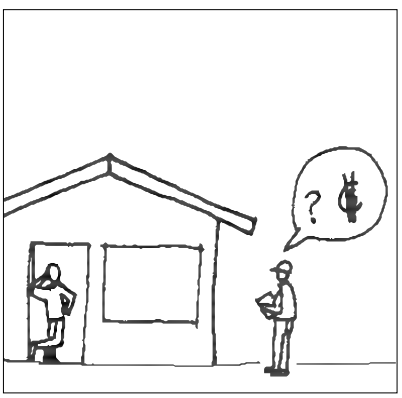
To further prepare for the planned nationwide introduction of the system, a comprehensive training and public relations campaign was launched to raise the awareness of the staff of relevant central government institutions, the municipalities and the general public. This comprised:

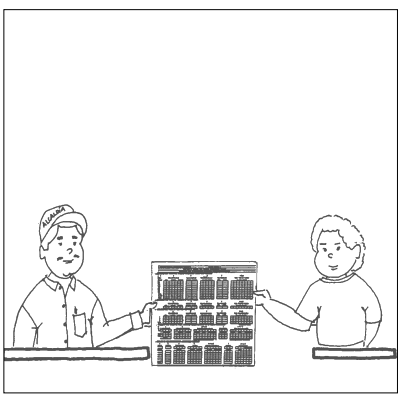
- Selecting and training personnel from the different institutions (central and local governments) that will later operate the system.
- Designing and launching public relations campaigns to inform local politicians and the general public of the new Real Estate Property Tax, the advantages of the SIS-CAT cadastral system, and the methods of self-valuation and self-assessment.
- Training municipal staff in cadastral survey, property valuation and tax assessment.

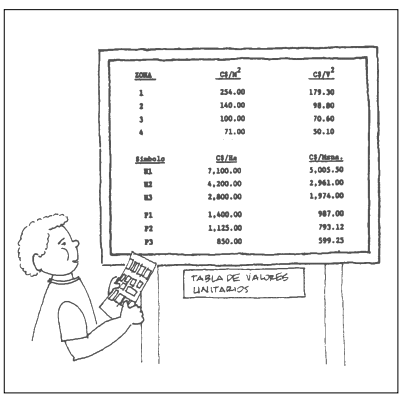
Establishment of the data base

Having carried out comprehensive preparatory work, it is expected that the actual establishment of data base at municipal level can be performed with relative ease. The main tasks of this phase are expected to include:

- Further local training for municipal staff in social and cadastral surveys, in the use of survey questionnaires, and in property valuation.
- Selection of municipal areas to be evaluated.
- Revision of existing cadastral maps of the selected areas, carrying out additional surveys where necessary.
- Market studies to define urban zones according to land values.
- Distribution of cadastral questionnaires to owners or tenants of selected blocks, together with guidance and instructions in the use of the forms.







ACCURACY OF DATA

Map production

The final phase of system establishment is the processing of the collected information using both the alphanumeric and the graphic components. This involves the following tasks:

- Entering the data collected in the field surveys and from the cadastral questionnaires into the alphanumeric data base program.
- Entering the information from the updated or newly prepared cadastral maps into the cartographic program.
- Merging the alphanumeric data with the cartographic data.
- Producing new cadastral maps.
- Proposing property value zones to be approved by the municipal council; and entering the approved land values into the data base to form the basis for tax assessment.

Since the primary objective of the new cadastral system is to provide an efficient way to collect property taxes at municipal level, a pragmatic and expedient approach will be taken with regard to data collection and their accuracy, focusing initially on information easy to access and update.

- At the initial stage of system introduction at municipal level, only selected areas of the municipality will be covered by the system. The main criterion for the selection of these areas is the availability of basic cadastral maps from previous cadastral surveys. Suburban or rural areas with more informal developments, which are difficult to tax or presumed to be below taxable values, will not be considered at this stage.

  However, in the next phase, rural areas will be included, mainly in those municipalities that have a predominantly agricultural economy and high real estate values, where self-valuation will be used to determine property values.

  The demarcation of the taxable areas can be decided by the mayor, but the municipal council determines the values to be used in the valuation and assessment tables.

- Although most existing cadastral maps are inaccurate or out of date, they are taken as the starting point in order to reduce the need for surveys. However, in most municipalities, field work will inevitably be required to revise existing maps.

- The system relies heavily on self-valuation and self-assessment by individual taxpayers, from which a large part of the information for the alphanumeric data base will be obtained.

It is expected that the accuracy of the data bases will be improved over time.

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SYSTEM OUTPUTS

For the main purposes of tax assessment and tax collection, the system can carry out the following tasks automatically:

- show the values of the land and building(s) of individual properties, or the aggregate values of blocks, neighbourhoods and whole municipal areas
- assess the Real Estate Property Tax of individual properties and issue demands for payments
- monitor tax payments
- calculate potential municipal income from the Real Estate Property Tax.

The system can further process and analyse a wide range of other information on individual properties, such as:

- characteristics of the land and the improvements carried out on it
- present and potential land uses
- tenure status
- levels of public service and utility provision
- condition of building(s)
- accessibility
- etc.

Once the cartographic component of the system is fully operational, it will be possible to merge it with the alphanumeric information to produce a wide range of maps. Furthermore, the software is able to present land information in different formats, such as digital models of the topography of selected areas.

SYSTEM UPDATE AND MAINTENANCE

The eventual operation of the system will primarily be the responsibility of individual municipalities, which will have to create special administrative units for this purpose. Following the establishment of the system and its data base, the administrative unit will have to undertake the following routines:

- prepare tax assessments
- issue tax demands
- monitor and follow up tax payments
- update the alphanumeric and cartographic data bases regularly.

According to the Real Estate Property Tax Law, tax assessments are to be issued once a year, between January and March, for all properties liable to tax on the 31st of December of the previous year. The tax may be paid in two instalments, the first one between January and March, and the second one by the end of June.

The updating of the data bases relies on information obtained from building and development permits, and the registrations of property transfers. Procedures have been established, in the preparatory phase of the technical cooperation project, between the municipalities and INETER (which is responsible for the updating of cadastral maps), and the regional offices of the Supreme Court throughout Nicaragua (which handle property registrations) for the communication of this information.

EXPANDABILITY OF THE SYSTEM

Although there are no specific plans for the expansion of the system at present, the system can be extended to carry out other tasks in urban management and administration. The incorporation of these tasks and their information requirements have already been considered in the original design of the system.

The system can integrate and process economic, legal, physical and social information to support various aspects of urban management, such as:

- physical planning
- planning of municipal investments in social and technical infrastructure
- operation and maintenance of public utilities
- maintenance of road networks
- municipal accounting and budgeting.

Furthermore, the present, limited coverage of central urban areas could be extended to include the whole urban area and, in the long run, even the rural hinterlands.

However, in the near future, the emphasis will be on the levy of property taxes. Other tasks will most probably only be addressed after the priority objective of improving municipal revenues has been achieved.

LEGAL AND POLITICAL FRAMEWORK

The legal and political framework for the introduction of the system is provided by the comprehensive reform of the property tax system in Nicaragua, as promoted by the multilateral technical cooperation project.

Although property taxes had existed in Nicaragua in a different form since 1939, the reform was necessary as municipalities had only had a minor share in the revenues. The levy of property taxes used to be a central government function and only 25% of the revenue generated was allocated to the municipalities. Moreover, tax revenues had been falling over the past decades, due to a general neglect of the cadastres, and a lack of coordination between the central government institutions involved in these tasks.

Most of the previous cadastral information dated back to 1967 when, with US assistance, aerial photographs were taken of a total area of 29,000 square kilometres, and 1,753 cadastral maps of urban and rural areas of the Pacific and Central regions of the country were produced. These cadastral maps were used by the Ministry of Finance to form the basis for property valuation. However, the area covered by this cadastral system represented only 22% of the national territory.

While these cadastres were updated during the 1970s, they deteriorated greatly in the 1980s due to a lack of resources, an institutional crisis and the civil war. Consequently, the revenues from property taxes decreased from 2% of total national revenue in 1980 to a mere 0.58% in 1988.

To improve municipal revenues from property taxes, the new Real Estate Property Tax Law brought in two major items of reform:

- The establishment of a coordinating body, the National Cadastre Commission, made up of members of the main governmental institutions responsible for cadastral and fiscal information.

- The transfer of responsibility for tax assessment and collection to the municipalities, which will now administer the property tax as a municipal tax.

The new Law also calls for a comprehensive updating of fiscal cadastres at municipal level and a re-valuation of taxable properties. For these purposes, it has also set new taxation procedures for the municipalities.

- Property valuation: the market value of a property is evaluated by following the valuation manual published by the General Revenue Department of MIFIN, using standard unit costs for buildings and building materials as proposed by individual municipalities and approved by the National Cadastre Commission.

- Self-valuation by taxpayers: the taxable value of a property is evaluated by its owner, using a valuation form issued by the municipal council. In the declaration, the taxpayer describes and evaluates his/her property using the cost tables attached to the valuation form. Municipal staff can be asked to assist in self-valuation, if necessary.

- Valuation based on estimated book value: a property is evaluated according to its book value or its purchase price, less depreciation. This method is the last choice for property valuation.

Each municipality establishes a range of local property values according to the local property market and following the guidelines of the National Cadastre Commission. These values have to be adjusted annually according to the General Consumer Price Index published by the Central Bank.

The tax rate is usually 1% of the taxable value of the property, with possible reductions for residential uses or low-cost housing. The Law also provides for tax exemptions for low-income families whose properties are evaluated at less than US$ 5,000; but, even in these cases, an valuation declaration is still required of the owner.

Main sources of municipal income (1991-1992)

Revenue source	1991	1992
sale and service tax	48.14%	54.29%
vehicle and road maintenance tax	12.25%	2.82%
real estate property tax (nation wide)	10.68%	9.14%
• *for the municipalities of Managua*	*9.90%*	*6.40%*
• *for the rest of the municipalities in the country*	*7.50%*	*7.50%*
other transfers, rates and fees	28.93%	33.75%
Total	**100.00%**	**100.00%**

Source: Baldizón, Y. (1994) "Modelo de Financiamiento Municipal, transferencias e impuestos en el marco de la descentralización fiscal", mimeo, Managua.

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INSTITUTIONAL AND ORGANISATIONAL STRUCTURES

To coordinate the introduction of the new cadastral system and to supervise and monitor its subsequent operations, a National Cadastre Commission has been established under the new Real Estate Property Law on which the following institutions are represented:

- the *Direccíon General de Ingresos-Catastro Fiscal* of the *Ministerio de Finanzas* (MIFIN)
- the *Instituto Nicaragüense de Fomento Municipal* (INIFOM)
- the *Instituto de Estudios Territoriales* (INETER).

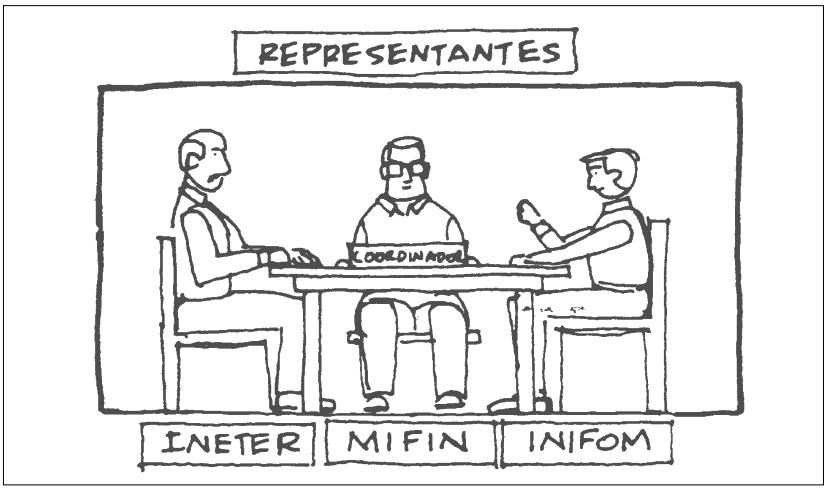
The main tasks assigned to the different institutions in relation to the introduction of the new cadastral system are as follows.

National Cadastre Commission

- to coordinate the actions of the institutions represented on the Commission
- to authorise municipalities to inform the public about the forthcoming property valuation
- to authorise and register the establishment of private professional services in property valuation
- to approve property values and building costs for property valuation submitted by municipalities
- to approve the indexes for the updating of property values and building costs for valuation purposes
- to approve tax reductions for residential buildings proposed by the municipalities
- to approve work plans for the introduction of SIS-CAT and to monitor its progress.

Direccíon General de Ingresos

- represented by its Director to coordinate the National Cadastre Commission
- to prepare manuals for property valuation
- to train, assist and supervise the municipalities in the preparation and updating of municipal property values and building costs for property valuation.



***Instituto de Estudios Territoriales* (INETER)**

- to train, assist and supervise municipalities in the preparation, updating and maintenance of cadastral maps
- to support other cadastral functions and surveys of natural resources.

***Instituto Nicaragüense de Fomento Municipal* (INIFOM)**

- to coordinate the multilateral technical cooperation project nationwide
- to represent the municipalities on the Commission
- to provide training and technical and legal assistance to the municipalities.

The municipalities

- to prepare, publish and distribute annual tables of property values and building costs
- to propose local rates of tax reduction for residential buildings
- to propose tax exemptions
- to receive, process and approve/reject tax assessments
- to carry out cadastral surveys

STAFFING AND TRAINING

- to define land and property value zones, and to revise them regularly

- to keep an up-to-date and comprehensive record of property values.

The technical cooperation project is currently administered by INIFOM and the local UNDP office. In the long term, it is intended to found an independent, self-financing firm to be affiliated with INIFOM or the Nicaraguan Municipal Association (*Asociacĭon de Municipios de Nicaragua*). The advisory assistance to municipalities, currently rendered as part of the technical cooperation, will then be offered as private consultancy services, to be paid for by the user municipalities. However, whether this will go ahead depends on the results of the trial runs of the new system on a large scale, together with the necessary adjustments to the institutional framework.

For the development and introduction of the system, the multilateral technical co-operation project employed seven professionals: a project coordinator, a graphic expert, a training expert, a cadastral valuation expert, a computer operator, a secretary and an administrative assistant.

Furthermore, each of the central government institutions involved with the project assigned two to three staff members as counterparts to the project personnel, participating in the training, discussions and development of the system.

Additionally, in its preparatory phase, the project launched a massive training programme to familiarise mayors and town councillors with the idea of the new system, and to build up the necessary technical capacity for the introduction of the system.

The staffing requirements for implementing and operating the system in a municipality will be as follows.

- Two permanent members of municipal staff to operate the graphic and alphanumeric programs: these operators have to undergo at least four weeks of training (minimum 160 hours of practical and theoretical training) to learn to operate the system, including loading, processing and updating the data bases; and to print out cadastral registers, tax demands, etc.

  It is envisaged that the municipalities will bear the training costs.

- An average of nine temporary survey assistants will have to be hired for a period of at least three months to carry out the cadastral surveys. These temporary employees will receive the necessary training locally. The three main sources from which they may be recruited are:
  - underutilised members of municipal staff
  - students of local universities or technical institutes
  - temporary employees.

  The number of persons to be hired varies according to the amount of survey to be done. On average, a group of three persons can complete six surveys in a day.

Training of personnel (municipal and of other institutions) by the technical cooperation project in property valuation (December 1993 - September 1995)

TARGET GROUP	Number	%
Mayors	118	11
Town Councilors	70	7
Municipal Staff	640	60
INIFOM members	196	18
Other professionals	39	4
Total	**1,063**	**100**

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INVESTMENT AND RUNNING COSTS

Based on the Bolivian experience, it is estimated that the cost for the introduction of the system in a Nicaraguan municipality will be approximately US$ 13.50 per cadastral parcel, about 4% of which is for the updating and maintenance of the system. The single highest expenditure is for the updating of existing cadastres. The costs of the required field work and surveys are expected to amount to 60% (US$ 8.00 per cadastral parcel) of the total cost. However, these costs will incur only once every five or ten years when the data base has to be updated comprehensively.

For the establishment of the system at municipal level, the technical cooperation project intends to create a revolving fund to finance the purchase of computer equipment and the initial costs of implementation in the country's 14 major municipalities. If the cost proves recoverable, then the system will be introduced to other municipalities, which will receive a loan from the revolving fund for the period of one year, at an annual interest rate of 15% plus inflation.

SIS-CAT hardware requirements:

- personal computer(s) 80486DX2 or Pentium (with mathematical processor), 66 MHz, BUS Architecture: PCI/Local BUS of 64 Bits
- SCSI II hard disk, 540 MB, video access accelerator board of 4MB RAM 1280 x 1024;
- 17" colour monitor 1024x768, ppi 16.7 millions of colours.

Software requirements:

- A geographic information system (GIS) program with computer-assisted drawing and design functions (CADD), including a manager for each of them. The software used in Nicaragua is Microstation 5.0.
- The SIS-CAT program designed by UNCHS-Habitat in Bolivia has been adapted for Nicaragua. It is estimated that the cost of adapting this software is about a quarter of the cost of comparable data base software offered by private firms.

On a personal computer with a high-density disk drive and 540 MB hard disk, 8 MB RAM, 33 Mhz, the entrance to the SIS-CAT program takes less than one second even if it holds information for more than 200,000 land parcels.

The processing speed is not crucial to the daily use of SIS-CAT, given that cadastral values are calculated only once a year. As an example, the time needed to calculate 500 parcels is one minute with a 25 Mhz processor. This means it can do about 300,000 parcels in 10 hours (once a year). The equipment proposed above has a higher processing speed, but the difference in cost between that and a slower processor is very small.

Costs of basic equipment for installing the system per municipality (October, 1995)

Description	Items	Unit Cost US$	Total Cost US$
Computer (Hardware and software included)	1	3,142.00	3,142.00
Digitising Table	1	1,377.00	1,377.00
Printer	1	350.00	350.00
Electric current stabilizer	1	172.00	172.00
Current power unit	1	260.00	260.00
Sub-Total 1			5,291.00
plus			
Insurance, freightage, and custom fees			261.00
Sub-Total 2			5,552.00
15% annual interest			832.80
Total			6,384.80

ADAPTABILITY OF THE SYSTEM

Once fully operational, the municipal cadastre can prove economically and socially very beneficial. The way it is financed, through a revolving fund, also ensures its financial sustainability, which can also provide a good model for the financing of similar projects.

The fact that the Nicaraguan system is an adaptation of the urban cadastre for La Paz indicates that it is generally adaptable to other countries, especially those with similar problems and similar level of municipal autonomy. Indeed, some other Central American countries, where decentralisation is being discussed, such as Costa Rica, Honduras and Guatemala, have already expressed their interest in the system.

One aspect of the system, which is particularly worth noting, is the training of a large number of local professionals and consultants prior to the introduction of the system, thus providing a more receptive environment for its implementation.

CONDITIONS FOR ADOPTION

In summary, the system is generally appropriate for those countries with the following conditions.

- The responsibilities for establishing and maintaining urban cadastres and for levying property taxes rest with the municipalities.
- Alternatively, the political conditions allow for a change in the legal framework for taxation.
- Cooperation with national institutions involved in cadastral matters can be assured.
- Basic cadastral information is already available, with only limited need for updating.
- Municipalities have the technical capability to manage computerised cadastres, or are able to train or hire the necessary staff.
- Adequate technical assistance can be obtained for the adaptation of the system.

PROBLEMS AND OUTLOOK

So far, the Nicaraguan project has received approval from a wide range of governmental and municipal authorities for establishing a standardised cadastral system at municipal level, and for the legal and institutional reforms necessary to accommodate the new system. The Presidential decree of January 1995, promulgating the *Ley de Impuesto de Bienes Inmuebles*, bears witness to the enormous efforts that have been injected into the project.

Backed by the Presidential decree, the Bill is effectively law even if it has not been ratified by the National Assembly yet. However, during the second half of 1995, a massive press campaign was launched against the Municipality of Managua for levying the Real Estate Property Tax. The main objection of the campaign was that inherited properties were also being taxed. This aspect, if it was to be reversed, would have to be renegotiated between Congress, the association of Nicaraguan Municipalities (AMUNIC) and INIFOM.

Another problem was that many mayors were afraid of the political costs of increased taxation before the forthcoming elections, since the majority of potential taxpayers, who had so far not paid any property taxes, would see it as an additional burden, especially as the potential benefits of increased taxation - such as improved municipal services - had yet to materialise. Some of the municipalities were, therefore, unwilling to push the progress of the new system. However, it was expected that this would change after the elections.

Furthermore, although the system is simple to use, the possibility remains that municipalities will not maintain and update their data base as regularly as they should. If this happens, then the whole exercise will be in vain.

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SOURCES OF INFORMATION AND TECHNICAL ADVICE

The staff of the multilateral technical co-operation project and the national institutions involved in the project are generally prepared to provide assistance and advice upon request.

The first step to regional exchange of information has already been taken in the form of a regional seminar attended by representatives from different Central American institutions involved in cadastral matters. In this seminar, the SIS-CAT experiences of Bolivia and Nicaragua were presented. As a result of the seminar, a fact-finding mission to Guatemala, Honduras and Costa Rica was organised to explore the possibility of adapting the Nicaraguan system to these countries.

More information on the system can be obtained from the handbooks prepared by the project:

- ***Manual y gúia para el operador del sistema gráfico***
  Handbook and guide for the graphic system operator

- ***Manual del encuestador***
  Handbook for the surveyor: a guide to cadastral survey

- Basic information on SIS-CAT: general information on the features of the system.

ADDRESSES OF LOCAL INSTITUTIONS AND EXPERTS

National Project Director:
Agustín Jarquín A.

National Cadastral Commission Coordinator:
Horacio Navas C.

UNCHS-HABITAT Project Coordinator:
Mario Cangiani B.

National Technical Coordinator:
Cesar Darce R.

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Proyecto NIC/92/002: "Sistema Unico de Catastro Apropiado al Nivel de las Alcaldías Municipales"

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E. URBAN LAND REGISTER AND ADDRESS SYSTEM - BENIN

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BACKGROUND TO SYSTEM DEVELOPMENT

Benin currently has a population of about 6 million people. While in 1980 only about 25% of the population lived in urban areas, today about 36% of the people dwell in towns and cities. With annual urban population growth rates of 5-7% in recent years (compared to only around 1% in rural areas), the urban population will probably double in 10-15 years, then accounting for 60% of the total population.

As a consequence of this rapid urban growth, towns and cities are afflicted by continuous urban sprawl and encroachment of informal settlements on the fringes of formal developments, and municipal services and utilities are being put under severe strain.

The municipal administrations are usually far too weak to cope with these increasing problems. As a legacy of the French colonial administration, the municipalities (*circonscriptions urbaines*) are still special territorial entities administered by the central government, and have all their personnel appointed by the central government. The municipalities themselves have very limited powers. Since Benin has a central treasury and budgeting system, municipal budgets also depend heavily on central transfers. Taxes and other revenues at all levels are paid into the central government treasury and redistributed to municipalities only upon submission of a municipal budget, which has to be approved by the central government.

The need for a reform of municipal finances and management first became apparent when, in the mid-1980s, urban development plans were drawn up for the five major cities of Benin with French technical assistance and most municipalities could not meet the investment needs identified by these plans. As a result of this, both the former socialist government and the subsequent democratic government realised that local revenues had to be raised in order to finance urban infrastructure development and to provide social services to fast-growing municipalities.

A study funded by French technical assistance identified that about 80% of total potential revenue was related to taxes and fees on land and properties. However, the study also revealed a number of problems for the levy of these taxes:

- the owners of land properties could not be traced because they were not registered
- taxes were usually fixed arbitrarily
- tax assessments and tax demands were prepared by hand and despatch was slow
- it was difficult to monitor payments since taxes were mostly paid in cash at post offices
- relationship and communication between different departments responsible for taxation were poor.

Against this background, it was decided in 1989 to establish an Urban Land Register (*Registre Foncier Urbain* - RFU). From the outset, the RFU, developed with French technical assistance, was designed as a multipurpose tool for urban land management, focusing first on the improvement of land-related revenues, but with a longer-term view to supporting other tasks in municipal land management. Accordingly, operations such as mail delivery and telephone connections were taken account of in system development, and the post office was enlisted to help with financing the development of the system.

MAIN AREAS OF APPLICATION

The *Registre Foncier Urbain* (RFU) was designed to support the following tasks:

To improve the **collection of**

- **taxes** on property purchases/sales and newly registered properties as the main source of municipal income
- **other municipal levies**:
  - fees for building permits
  - taxes on temporary occupation of municipal land
  - tax on the *permis d'habiter*, the customary substitute for land title
  - taxes on commercial activities.

To establish an **address system** for

- mail delivery and other postal operations
- handling applications for new telephone lines and managing telephone bills
- supporting emergency services, such as the fire brigade and ambulance, and the police.

To **support urban planning** by providing information on

- general demographic statistics
- land uses within the urban area
- levels of infrastructure and service provision at the household level
- housing conditions
- flooding levels
- municipal land available for settlement purposes or encroached upon by informal developments.

IMPROVEMENTS BROUGHT ABOUT BY THE SYSTEM

So far, the system has been introduced to two major cities, Parakou with 104,000 inhabitants and Cotonou with about 700,000 inhabitants. In Porto Novo, the capital city with 208,000 inhabitants, the introduction of the RFU was started in May 1994 and was due to be completed in December 1995.

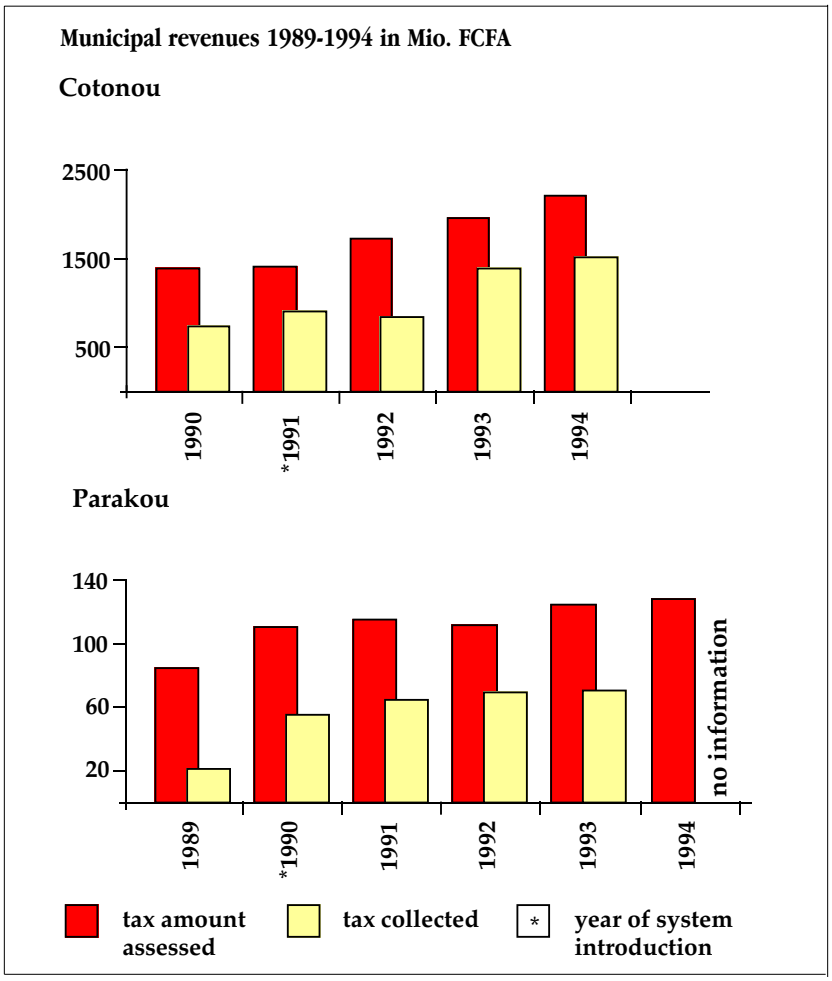
The RFU was established in Parakou in 1990 and in Cotonou in 1991. Within four and five years, their revenues increased by 227% and 100% respectively. The increases could have been as much as 225-500%, since only about 50% of potential revenues is currently raised, and many taxpayers are still trying to evade municipal charges. Furthermore, only those parts of the cities are currently covered by the system which have been surveyed by the central survey authorities, the *Institut Geographique National du Benin*.

An important feature of the RFU is its transparency. Under the new system, taxes and rates are assessed according to clearly defined criteria and are calculated automatically, avoiding arbitrary assessments and corruption, which had been widespread before the introduction of the RFU.

Apart from the tangible improvement in tax collection, other public services - such as postal delivery, the fire brigade and the ambulance service - have also benefited from the new address system of the RFU.

In Cotonou, a major user of the information provided by the system is the telephone operations. The connection of new telephone lines used to take weeks or even months. Now, it is much faster because, with the help of the RFU, the telephone technicians can find the address of the applicant and locate the existing lines and junction boxes much more easily. Furthermore, using a program developed especially for this purpose, the required telephone equipment and materials can be calculated automatically, and a number assigned to the new applicant. Immediately after the receipt of the connection fee, which is also handled by the same computer program, the new line can be connected within a couple of days.

While the post office has participated in the development of the RFU from the very beginning and helped with financing its establishment, other potential users, such as the water and electricity utilities, are still on their conventional systems. Efforts are being made to include them in the RFU partnership.



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SYSTEM COMPONENTS

Due to the rapid urbanisation process in Benin and the lack of information on urban development, the RFU had to develop new instruments and procedures to establish its data base and process the collected information. All the system components were especially designed to meet the requirements of the municipalities in Benin after a careful assessment of the major weaknesses in their land management.

The RFU is consisted of the following components:

- A set of urban maps, in the scales of 1 : 2,000 and 1 : 10,000, prepared and kept either on the computer system or on sheets
- A newly designed address system, including the numbering of streets and plots on site
- A specially designed data base to process the information needed for the collection and management of land-related revenues.

In Cotonou, an additional software has been developed to process applications for new telephone lines and to manage telephone bills.

Cartography

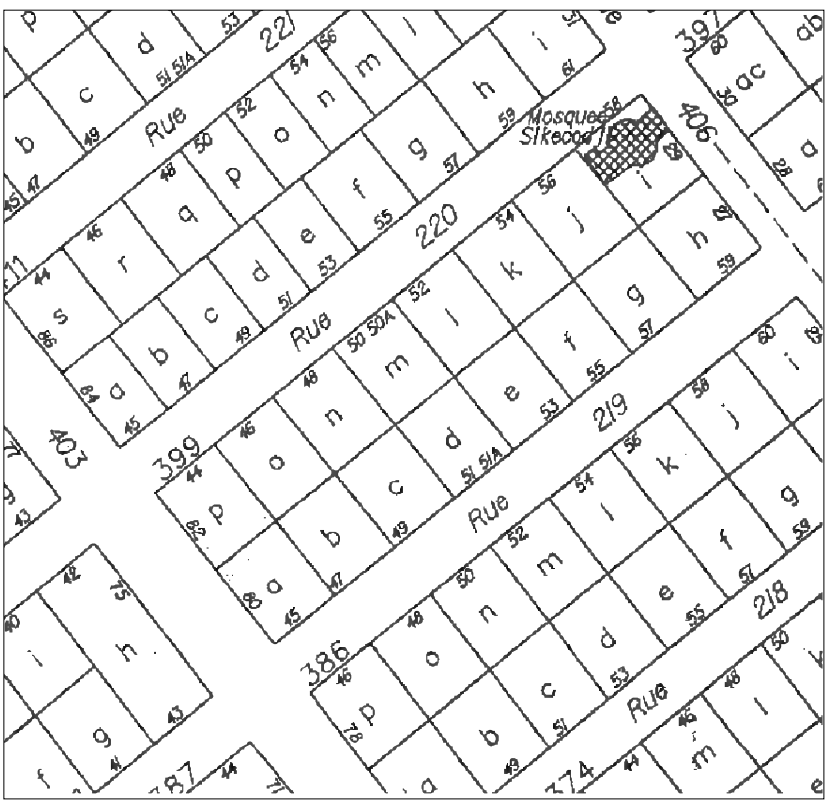
The system is able to produce maps, in the scale of 1 : 2,000, on a standardised sheet to facilitate orientation and filing. They contain the following information:

- names of zones (*communes*)
- boundaries and names of neighbourhoods (*quartiers*)
- numbers of streets and building blocks
- plot boundaries
- plot addresses according to the new address system (see illustration below)
- distinctive features, such as bridges, parks, public buildings, etc
- major hydrographic features, which are particularly important to Cotonou and Porto Novo, both of which suffer from flooding.

These maps are prepared and used in three different stages:

- Draft maps with provisional information are used and revised in preliminary field surveys.
- Revised outline maps are used as basis for the preparation of final maps.
- Final maps are produced based on photogrammetric evaluation of existing aerial photographs and detailed field surveys.

Detail of a block unit survey map (*plan parcellaire*) of Cotonou



The address system

While the initial map preparation is done by hand and on paper, the final map is digitised and linked to the alphanumeric data base of the system.

The digitised maps can be plotted by computer in different scales, and can incorporate other spatial information in different layers.

Apart from the standardised base maps (scaled at 1 : 2,000), overview maps (scaled at 1 : 10,000) are also prepared and used for system operation.

Closely related to the cartography is a completely new address system, which provides geographic references for the whole system. To support both cadastral registers and public services, such as post office operations, two different address systems were introduced:

- The QIP system (*Quartier-Ilot-Parcelle*) is divided into zones, building blocks and land parcels; and used for cadastral purposes. It uses a code letter for land parcels, a three-digit number for building blocks and a three-digit number for zones. The zone is either an administrative unit (*quartier*), or a part of the city that is unlikely to undergo administrative changes.

  In Cotonou, which is divided into 144 neighbourhoods (*quartiers*) in 24 zones (*communes*) and 6 districts, a QIP code "111.399.a" would mean: parcel "a" in block 399 in quartier 111.

- The REP system (*Rue et Entrée de Parcelle*) is based on street names and main entrances to land parcels. The code is consisted of the number of the street, which is unique within the boundaries of the city, and the number of the entry to the parcel. The few streets which already have names and house numbers are integrated into the system. A typical REP address would be: "34, rue 225" or "3, place de l'Etoile Rouge".

The postal address system is based on a few simple principles (e.g. north-south streets have even numbers, starting from the south; east-west streets have odd numbers, starting from the west).

The alphanumeric data base

The core of the RFU is the alphanumeric computer program which documents and processes all data stored on the system.

Although initially focused on the improvement of municipal revenues, the data base was designed, from the outset, with a longer-term perspective to include a wide range of information to carry out other urban management tasks. The structure and contents of the data base have been developed in such a way as to meet the requirements of potential users, including central and municipal tax offices, urban planners, statisticians and the post office. Accordingly, the information stored on the data base includes:

- cadastral and postal addresses of land parcels
- identity of occupant/owner, numbers of households and household members, rental/lease payment of individual properties
- land use, levels of development and service provision
- condition of building(s) and characteristics of neighbourhood
- locations and type of industrial/commercial activities.

These data can be presented in various formats to meet the needs of different users.

For the purposes of revenue collection, a unique identity number and address within the municipality is given to each individual or company liable to taxation, so that all taxable items (property, personal income, company profits, other assets) relating to a particular number and address can be identified on the data base.

The data base has been established on a PC system and can be used by itself or as part of a network.

Example of a property data sheet (*fiche*)

Code Quartier : _ _ _ **Z / Ilot : _ / _ _ _** **Parcelle : _ _** **Rue _ _ _ _ /EP _ _ _ _**

C01 Bâtiment N°: _ _ _ Obs : .....

C02 Surface au sol : _ _ _ _ _ m² C03 Nbre d'étages : _ _ _

C04 Fondation :
1 : légère
2 : maçonnée

C06 Eau SBEE :
1 : non
2 : collectif
3 : individuel
4 : confort

C07 Electricité :
1 : non
2 : collectif
3 : individuel
4 : confort

C05 Murs :
1 : végétal/récupération
2 : banco
3 : banco fini (crépi, peint)
4 : dur
5 : dur fini (crépi, peint)

C08 Toit :
1 : récupération / végétale
2 : tôle non plafonnée
3 : tôle plafonnée
4 : tuile/bac aluminium
5 : dalle.

C09 Nombre d'unités de logement. : _ _ _ _ C10 dont , en location : _ _

C11 Nombre d'activités : _ _ _ C12 Nombre de ménages : _ _ _

C13 Autres caractéristiques physiques : .....

C01 Bâtiment N°: _ _ _ Obs : .....

C02 Surface au sol : _ _ _ _ _ m² C03 Nbre d'étages : _ _ _

C04 Fondation :
: légère
: maçonnée

C06 Eau SBEE :
1 : non
2 : collectif
3 : individuel
4 : confort

C07 Electricité :
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C11 Nombre d'activités : _ _ _ C12 Nombre de ménage : _ _ _

C13 Autres caractéristiques physiques : .....

INTRODUCTION OF THE SYSTEM

The RFU was first developed in the city of Parakou. Following a decision of the municipal administration, the tasks of system development and introduction were entrusted to an urban planning consultancy firm, SERHAU-SEM (*Socíeťe d'Etudes Regionales d'Habitat et d'Aménagement Urbain, Socíeťe d'Economie Mixte*).

A similar process was followed in Cotonou and Porto Novo: based on a decision of the municipal administration to introduce the system, which also established the required legal framework for the operation of the system, development and introduction were also entrusted to SERHAU-SEM as general contractor. Due to a general lack of basic data, the development of the RFU included a large component of data collection and processing.

Producing survey maps and establishing the address system

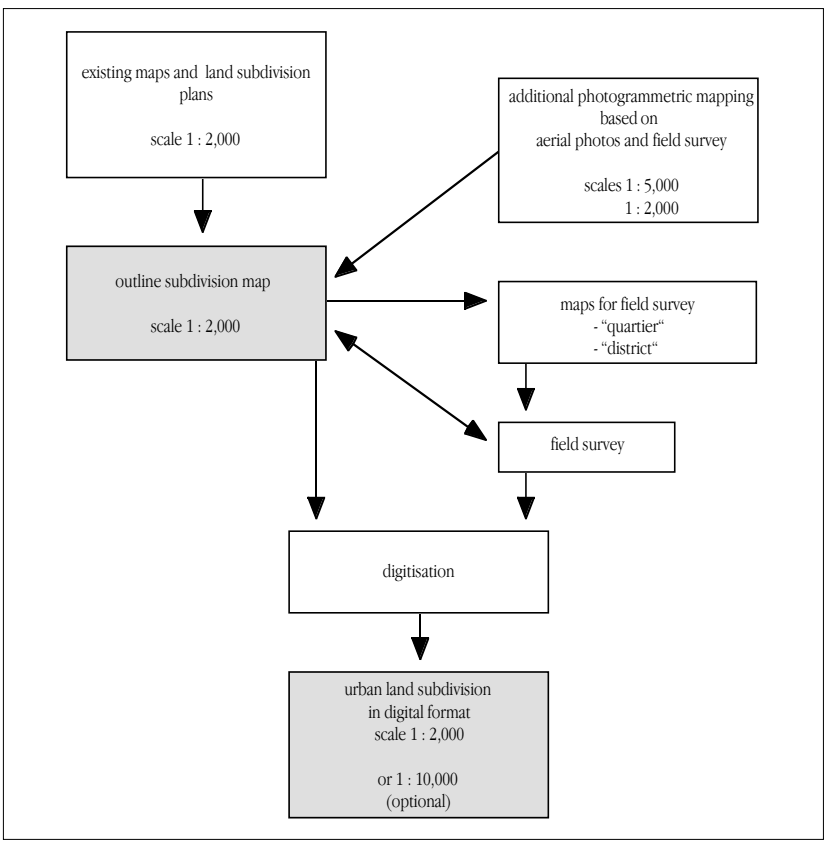
To produce appropriate survey maps, existing maps, usually incomplete, were first redrafted in the scale of 1 : 2,000 on a standard sheet to facilitate orientation in the field. For those areas for which base maps did not exist, aerial photographs were used to prepare draft maps. The second step in map production was to carry out a preliminary survey to ascertain property boundaries and to add this information to the base maps. The resulting maps were then used as the basis for the more comprehensive field surveys required to establish the data base, the results of which would in turn form the basis of the digital maps.

The addressing operations were carried out parallel to the preparation of basic maps. First, the municipality installed enamel street signs showing street names or numbers. House numbers are provisionally handwritten or stencilled on the walls, where possible. At a later stage, these painted numbers would be replaced by standardised number plates to be bought and displayed by the owners of the properties.

The four stages in the introduction of the RFU:

- Production of survey maps in parallel with the establishment of an address system.
- Data collection and processing.
- Application, consolidation and refinement of operation procedures, and establishment of an administrative unit.
- Handover of the RFU to the municipality.

Basic cartography



Data collection and processing

The main task of this stage was an exhaustive field survey to establish the data base for the system. This survey was carefully planned.

- The design of the questionnaire and survey forms had to be discussed with the main prospective users of the system, namely the tax office and the post office.
- The members of the survey team, mainly university students temporarily contracted to do the work, had to be trained in the use of the questionnaire and in survey techniques.
- A publicity campaign through the mass media (TV, radio, press) was launched to inform the community about the purpose of the forthcoming surveys.

Following these preparations, small teams of one to two surveyors identified the location of each plot of land on the base map, and then proceeded block by block with their investigations. Besides obtaining information for the land register, the survey also served as a final verification of the base maps.

The work of the survey teams was carefully supervised and evaluated throughout. To guarantee consistency of all data, all survey results were checked and, if necessary, revised by additional survey carried out by an auditing team.

The correct data were then entered into the computer in the format set for the system, thus establishing the data base of land information for taxation.

The revised survey maps were then used for preparing the final digital maps.

System application and consolidation

This stage involves the development and introduction of procedures to use the system for taxation purposes. As the first step to this end, a basis for land valuation has to be established, and this is done in the following way.

A small number of sample buildings were identified on the map, and their rental values assessed by independent chartered surveyors. Based on this information, a mathematical model was developed by SERHAU-SEM, to derive typical rental values for buildings of a certain quality, age and location. The model was then tested and checked by a special field survey, and revised to establish a reliable and accountable basis for taxation. Owing to the transparency of the valuation model, possibilities for manipulation or misuse have been greatly reduced. Furthermore, the model can easily be updated to take account of inflation or fluctuation in the land market.

The valuation program and its data base can help to automate many fiscal functions. Tedious tasks of aggregating and regrouping information, formerly carried out manually, have been replaced by standard routines for the calculation of different property taxes. Similarly, the

issuing of tax demands and the monitoring of tax payments can also be done automatically.

At this stage, an administrative unit should be created within the municipal administration and the staff assigned to this unit trained to operate and manage the system. Apart from system management and operation, this unit also has the task to put forward realistic fiscal strategies for the municipality, and to coordinate system operation with other agencies involved.

Furthermore, this stage also involves the definition and introduction of criteria and procedures for the updating of the data base and its further refinement.

Handover

While the first three stages were executed mainly by SERHAU-SEM as the agency contracted for the development of the system, the final stage involved the complete handover of the system to the municipality.

To do this, the technical assistance provided by the contractor was gradually reduced and more focused on ensuring the sustainability of the system. More specifically, these comprise:

- evaluation of the proficiency acquired by the system administrative unit
- production of handbooks for system operation
- clarification of the institutional and contractual framework for the partnership between the municipality and other agencies involved in system operation
- definition of a financial structure for system operation to help the municipality meet the costs of future operation and maintenance
- establishment of rules and procedures for the monitoring of revenue collection.

A possible alternative to the full handover of system operation to the municipal administration is to further subcontract SERHAU-SEM after the handover. In this case, as is the case in Parakou, SERHAU-SEM continues to provide personnel and services on an annual contract with the municipality.

ACCURACY OF DATA

At present, the municipal areas covered by the RFU are only those which had formally been parcelled by the Central Survey Authority (*Institut Geographique National du Benin* - IGNB), while informally developed, mostly suburban, areas - which in most municipalities account for about one third of total municipal areas - are not included. These will be included only when a development master plan for these areas is prepared, and when the land is redivided.

To save money and time, the RFU conceded to two compromises with regard to data accuracy:

- Plot boundaries on the maps were usually defined without a geodetic survey. The average error margin is +/- 50 cm. Furthermore, buildings shown on the 1 : 2,000 maps are only those identified on aerial photographs taken in 1989. All changes and structures built after 1989 were not included.
- The legal status of the ownership was usually based on declarations obtained during the field survey from the presumed owners or occupants, and generally assumed correct and not investigated further. In areas where land had been subdivided fairly recently, a special document called the *permis d'habiter* (permission to occupy) was accepted as a valid land title, as it was accepted by banks as a loan security. Moreover, the fact that a presumed owner pays tax on this land or its use is accepted as sufficient proof of ownership. Only in a few cases where the cartographic information was obviously wrong, or the ownership was in question, more detailed investigations were carried out.

The experience in both Parakou and Cotonou has proved that these compromises are no obstacles to the general acceptance of the RFU by land owners, or to the main objective of improving municipal reve-

SYSTEM OUTPUTS

nues. Indeed, this pragmatic approach has proved to be much more practical in implementing the system, facilitating operation and saving money.

In spite of a certain level of inaccuracy, the system generally works well, with only a small number of formal complaints against the basis of tax assessment, and these have been dealt with successfully at the individual level. Moreover, the regular updating of the cartographic information and the data base will further improve the RFU during operation.

The data base, in combination with the cartographic component, can provide various outputs to support urban and land management. These include:

- individual data sheets, e.g. all information on an individual plot of land
- lists of specific items, e.g. all owners of one block, QIP codes of vacant private land parcels in one district
- statistical charts, e.g. taxes on different taxable items over a period of time
- summary tables of aggregates, e.g. taxes due on commercial activities per district, forecasts of municipal revenues
- thematic maps, e.g. population densities per hectare, areas most often affected by flooding of more than 50 cm, neighbourhoods without water and electricity.

Many of the most common outputs can be readily displayed on the computer screen, while other, more complex outputs can only be obtained with the help of specialised computer tools.

At present, apart from supporting telephone office operations in Cotonou, only the fiscal aspect of the system is exploited to the full. The system carries out routine tasks for its main users, the municipal administration and the General Tax and Land Administration Office (*Direction Genérale des Impôts et des Domaines* - DGI) in the Ministry of Finance. For these tasks, the system can merge data files on plots, buildings and commercial activities with data files on owners and other taxpayers.

Furthermore, the system's analytical functions can reveal defaulters. Based on this information, special efforts can be made to track down those tax evaders who are most worthwhile to find. Additionally, the system can keep track of outstanding payments and interest from previous fiscal years.

Since the beginning of 1995, the previous, rather complicated municipal tax system has been simplified by the introduction of two taxes, the land tax (*Taxe Foncière Unique* - TFU) and the tax on the commercial activities carried out on that plot of land (*Taxe Professionnelle Unique* - TPU). The transition to the new system has been greatly helped by the computerised RFU system. Accordingly, the new law specifies that the TFU and TPU are only applicable in those municipalities where the RFU is already operational, thus acknowledging and promoting the advantages of the RFU: while taxes used to be arbitrarily fixed by tax agents, they are now calculated by a computer program, using very transparent criteria.

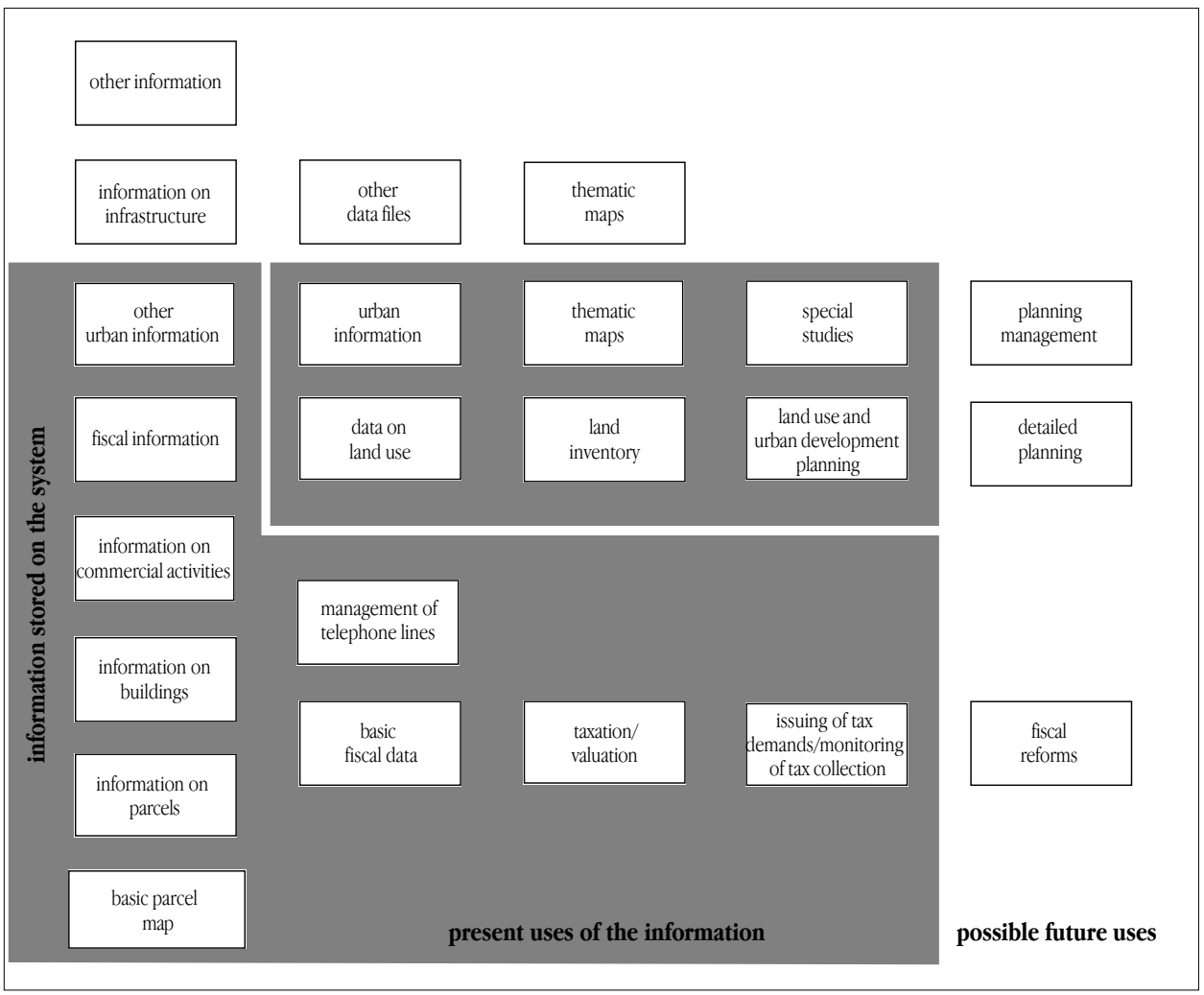
EXPANDABILITY OF THE SYSTEM

Since the RFU has been designed from the very beginning as a multipurpose land management tool, the data base includes more information than is needed for fiscal purposes. It can therefore be easily expanded to include other urban management tasks. Most of the information stored on the system and the digital cartographic component (e.g. services and utilities, numbers of households and inhabitants on individual plots, frequency of flooding) can be merged and overlaid for different purposes.

For the near future, the most important task to be supported by the system is urban development planning, which can be enhanced significantly by the information readily available on the RFU. According to the present plans for decentralisation and administrative reforms, it is expected that the municipalities will become autonomous entities, with more functions and responsibilities in planning and management, which will result in more extensive use of the system.

On parallel lines, efforts are being made to integrate the management of public utilities into the system. Although the state-owned water and electricity company still prefers to use its own information system and its own networks of agents for fee collection, it is expected that this attitude will change, since the RFU will be considerably more economic, as has already been demonstrated by its use by the telephone company.

Structure of the *Registre Foncier Urbain*



E BENIN

LEGAL AND POLITICAL FRAMEWORK

The legal and political conditions for the introduction of the RFU in Benin were basically determined by the particular position of the municipality as part of a central government structure, strongly reflecting the French colonial tradition. This highly centralised form of government continued during the 17 years of socialist regime from 1972 to 1989. Only since 1991, when a new Parliament and President were elected through democratic elections, have a few cautious steps been taken to reform the central and local governments in parallel with a general liberalisation of the economy.

Following these trends, it is expected that a new law on decentralisation and administrative reform will be introduced in the near future, which will establish the municipality (the present *circonscriptions urbaines*) as an autonomous administrative entity. The mayor will be elected locally instead of being appointed by the central government as it has been hitherto. It is further expected that the municipality will have its own revenue sources from local fees and taxes.

However, when the RFU was first conceived at the beginning of the 1990s, the local government had very little autonomy; and the management of all taxes and fees was still undertaken by the central government treasury. Since the aim of the RFU was to improve municipal income in order to invest locally, and yet taxes were still being collected by a central government agency (the *Direction Generale des Impôts et des Domaines*), special agreements had to be made between the municipality and the DGI to ensure that the increased revenues generated by the RFU were handed over to the municipality.

Another special condition for system development and introduction was the strong move towards privatisation of public services, which had already begun in the last years of the socialist government. This privatisation policy allowed a public-private partnership of the consulting firm SERHAU-SEM to be founded especially for the purposes of developing the RFU. It also supported the agreements between SERHAU-SEM and other agencies for their collaboration in the RFU.

Initially, the design of the RFU had to take into account a rather complex system of taxation, which had given rise to a large number of taxes and fees which were very difficult to administer. This experience helped to speed up a comprehensive reform of municipal taxes in 1995, which replaced all previous municipal taxes with a tax on real estate (the TFU) and a tax on all commercial activities (the TPU) in those municipalities where the RFU had been installed. In this way, the operation of the RFU has been greatly simplified. The current basis for taxation is the true rental value of a building. If the building is let, the landlord pays 26% of the rental value, regardless of how much rent is actually received; if the building is not rented, the landlord pays 13%.

The RFU is currently working in a situation where modern and traditional land ownership systems exist side by side. In terms of urban development, the ideal solution would be to subdivide and retitle land parcels. In reality, untitled plots are always almost sold to settlers by the traditional landowners (*chef de terres*) without a formal title. Only when roads or other infrastructure were urgently needed by the settlers would they call for a proper subdivision (*lotisement*). The IGNB would then come and survey the parcels, and subdivide them according to the municipal development plan. Only then would the settlers become the legal owners with a land title (*permis d'habiter*).

ORGANISATIONAL AND INSTITUTIONAL STRUCTURES

The institutional structure of the RFU system reflects the prevailing centralised political structure. While the municipality is the owner and main beneficiary of the system, two other important central government agencies are involved in its implementation:

- the *Direction Genérale des Impôts et des Domaines* (DGI), responsible for tax assessments and tax collection
- the *Institut Geographique National du Benin* (IGNB), responsible for map production and cadastres.

While the other institutions involved with the development of the RFU are public-sector agencies, SERHAU-SEM, the urban planning consultancy firm commissioned to develop and implement the system, is a joint-venture firm, of which 49% is owned by public institutions (the municipality, the central government and other governmental institutions) and 51% by private shareholders.

To give an overall framework to the inter-institutional collaboration in the establishment of the RFU, all parties involved entered into a general agreement, which defined the roles and duties of each institutional partner; the expected results; and the human, financial and technical resources to be contributed by each. A Steering Committee was then set up, consisting of representatives of all parties and headed by the Mayor of the respective municipality, to monitor progress. The agreement was to be revised annually in a meeting of all the parties involved.

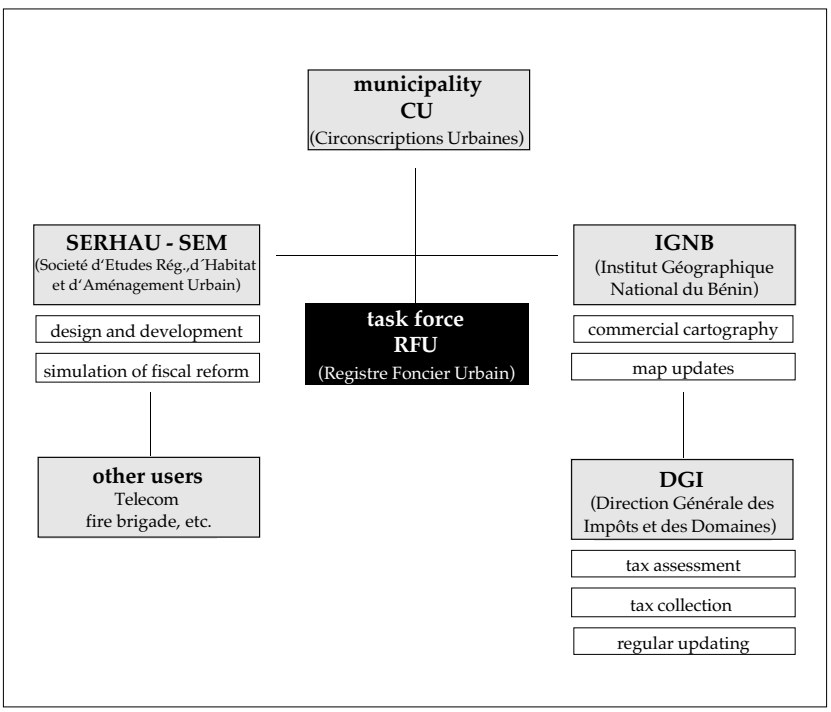
This agreement is supplemented by a contract between the municipality and SERHAU-SEM, which specifies the services to be rendered by SERHAU-SEM, as well as its fees.

SERHAU-SEM in turn subcontracts the DGI and the IGNB for special services, namely:

- preparation of tax assessments, issuing of tax demands and collection of taxes by the DGI
- preparation and updating of municipal maps by the IGNB.

Once the system is established and operational, the RFU is handed over to the municipality, which has to establish a special RFU unit within its administration even as the system is still being developed. Further assistance from SERHAU-SEM can be provided, if required, while the local offices of the DGI and the IGNB continue to render their services to the municipality.

Organisational structure



STAFFING AND TRAINING

The design of the RFU was done by the professional staff of SERHAU-SEM. The core design team comprised two local urban planners, one local computer specialist, one long-term French technical adviser and one French computer expert for 15 months during system development. This core team was complemented by the staff members of the other institutions involved, and by temporary staff employed for the field surveys.

To ensure that there would be enough qualified staff to set up the system and to operate it after it has been handed over to the municipalities, considerable training was necessary, both on the job and in special training courses.

- Training of staff for field surveys: University students from local universities were contracted temporarily to do the work. They underwent a one-week training by SERHAU-SEM's local experts. The number of staff required for these tasks ranged from 20 to 30 in the three cities covered by the RFU so far.

- Basic training for system operation: The operators were selected from the staff of local computer firms who already had a basic knowledge of electronic data processing. The staff were trained under a general training and maintenance contract by a local company, which also supplied the hardware and software to the project. The number of operators required during the phase of data collection and inputting ranged from 15 to 20 per municipality.

- Training of IGNB staff in photogrammetric mapping and digitisation: Since the IGNB staff assigned to these tasks had no experience in digital mapping, three of them were sent to France for three months to be trained in the use of the cartographic software. These three trained persons were employed on the RFU in all the municipalities covered so far.

- During the phase of data collection, an internal training course was carried out in the DGI to train the staff of the auditing team, who had to check the data before they were entered into the data base. In total, six members of staff were trained.

- A similar internal training course was provided, during the phase of system introduction, for the municipal staff assigned to the municipality's RFU unit, to enable them to operate the system independently after handover.

  After handover, further assistance and training were provided to further improve the level of proficiency of the RFU unit, and to enable them to keep the system regularly updated.

  The average number of staff for the RFU unit is three to four.

All local training was provided by SERHAU-SEM experts and supported by French technical advisers. The emphasis was generally on on-the-job training rather than on theory and special courses.

INVESTMENT AND RUNNING COSTS

The equipment necessary to implement the RFU consists of computers for the various agencies involved:

- General contractor SERHAU-SEM:
  one Pentium 90 MHz, 16 MB RAM, 50 MB HD; video accelerated, 20" screen; AO digitiser tablet; A4 scanner; A3 bubblejet colour printer; several 386/486 PCs.

- Municipal RFU unit:
  two 486 PCs; printer; UPS; software: MS-Office Professional, dBase 4, MAPINFO

- DGI team:
  one 386 PC; software: dBase, MS-Office Professional

- IGNB team:
  two ZEISS P33; one SUN-Workstation; three PCs with Microstation.

All of the equipment was provided by French technical assistance and supplied by a local computer firm.

Since the equipment provided to the general contractor, the DGI and the IGNB can be used for the installation of the system in other municipalities, only the equipment for the municipality itself has to be purchased each time, which costs about CFA 6 million.

The total cost for the establishment of the RFU in Cotonou, with a population of 700,000, was CFA 1,045.5 million, or CFA 1,500 per inhabitant. This figure included the purchase of equipment and the costs of subcontractors in the establishment of the data base, but not the salaries of the personnel of the public institutions involved.

Although the costs of equipment and operation were covered by French technical assistance, the financial viability of the RFU can be demonstrated by the example of Cotonou: within four years,

ADAPTABILITY OF THE SYSTEM

the RFU in Cotonou had recovered its investment costs and generated real profits for the municipality. The same return is highly likely in Porto Novo. Comparable figures for Parakou are not available, since the base maps there are still kept manually, the costs for which are not available as a separate item.

While the RFUs in Parakou, Cotonou and Porto Novo were almost fully financed by French technical assistance, a considerable contribution from the municipalities is expected in subsequent installations. Based on the financial feasibility of the RFU, as demonstrated by Cotonou, it is intended to invite private banks to finance further RFUs in Benin. One of the options currently under discussion is to take out bank loans for the necessary investment against a share in municipal revenues as a security.

The RFU developed for the major municipalities in Benin aims at building up a comprehensive land information system where existing cadastres are seriously out of date and incomplete; and where information on land is available only for small, formal parts of the cities, while large areas of urban settlement are not even recognised enough to be given addresses or basic services. It combines a simple, efficient address system with a property cadastre, and also provides comprehensive land information for other urban management tasks.

Although developed specifically for Benin, where municipal administrations are closely supervised and controlled by the central government, the system can be adapted to other countries where the local government has more autonomy. The current plans to decentralise and to give more autonomy to municipalities in Benin are at least partly based on the positive experience with the RFU in the major cities of the country. It is very likely that similar RFUs will be installed in all of the remaining seven municipalities in Benin. The city of Evreux in France has already financed an RFU for its twin city, Djougo, where the system has been installed but its operation is hampered by local political conflicts.

The Benin RFU provides a positive example of an efficient land information system, which can be replicated in other countries or regions. In particular in Western Africa, where many countries have similar development conditions, the Benin experience can be used as a guide for similar approaches. Of particular interest is the public-private partnership formed for the purposes of its development, which helped to overcome the initial weaknesses of the public institutions involved.

Some international donors, like the World Bank, have already expressed interest in the system, while a number of other West African countries have already embarked on similar address systems, one of which is described in more detail below.

Return on RFU investment, Cotonou

Year	**Increase of real tax revenue** (M CFA)	**Write-off of investment and operating costs** (M CFA)	**Balance** (M CFA)
1991	121.2	267.4	-146.1
1992	32.5	262.1	-375.6
1993	522.8	291.5	-144.3
1994	611.8	296.8	+170.7

notes:
At present, only 52% of potential tax revenue is collected, the potential increases in revenues are not shown in the above figures.

Maintenance and updating costs of the RFU are estimated to represent about 6% of the increased revenues as a result of introducing the RFU.

A SIMILAR APPROACH: THE ADDRESS SYSTEM IN BURKINA FASO

As a first step to bring land information up to date and to improve urban services, address systems similar to the RFU in Benin have been developed, and almost completed, for the cities of Ouagadougou and Bobo-Diulasso in Burkina Faso.

Like in Benin, the need to establish a new address system originated from the fact that urban cadastres maintained by central government institutions were largely incomplete and out of date; and from the fact that cities have been growing fast, with the majority of recent settlements generally having no formal addresses. Furthermore, the existing cadastral codes used for property registers proved impractical for identifying properties and owners on site or on maps.

In the new address systems in both cities, all streets are numbered according to the new, standardised scheme, even if street names already existed. The numbering of plot entrance, though, is different from the system in Benin, as follows.

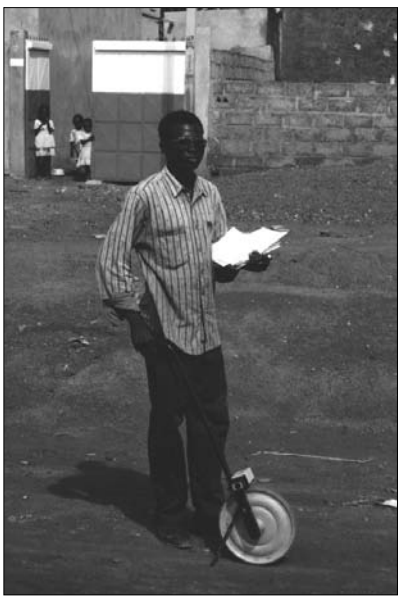
On a base map, in the scale of 1 : 10,000, each street within a section is numbered, with the beginning and end of each street being defined as the boundaries for the numbering of plots. The field survey consists of simply measuring the distance between the beginning of the street and the entrance to each plot, or house, with a measuring wheel. The left side, looking from the beginning of the street, gets only odd numbers, while the right side gets only even numbers. Thus, an address shown as 03.427.1277 would mean: section 3, street 427, on the left side looking from the beginning of the street, 1277 metres from the beginning of the street.

This system has the advantage that vacant plots which have no identifiably entrance, or which are subdivided later, can be numbered later to fit into the system. This method is particularly practical for suburban areas which are developing rapidly, because it allows the records to be updated easily. The disadvantage is that in long avenues, house numbers will be rather long.

Street numbers and their names, if they exist, are shown on enamel plates fixed to walls or poles erected specially for that purpose. The entrance (house) number is painted next to each entrance. If a plot has more than one entrance, e.g. three adjoining shops in one building, then there will be three different numbers.

So far, the system is used mainly to support the management of urban services, such as the post office, police, fire brigade and ambulance. However, it is intended to extend it to other uses, such as fiscal management, at later stages.

The cost of the complete address system for 6,500 streets and about 1 million inhabitants in the two cities is estimated at US$ 540,000, or US$ 0.50 per inhabitant.



CONDITIONS FOR ADOPTION

- Problems of land management and municipal finance are similar to those in Benin.
- Local government institutions and central government agencies are willing to improve property registers and increase municipal revenues.
- Public institutions to be involved are willing to cooperate.
- Private firms can legally be contracted to develop and establish the system.
- Adequate financial resources can be mobilised to cover the initial costs of the system (equipment and data collection).
- Technical assistance and training are available for system development.
- Executing public agencies, especially the municipalities, have sufficient qualified staff to participate in system development and operation.

SOURCES OF INFORMATION AND TECHNICAL ADVICE

Further information on the RFU in Benin can be obtained from the different public bodies involved in the establishment of the RFU. Most of them are prepared to offer technical assistance or on-the-job training in their own work places.

As a profit-making consultancy, SERHAU-SEM is interested in expanding and benefiting from its own experience. Its subcontractor, BIFED, and itself would therefore welcome domestic or international consultancy work.

The municipality of Parakou is also offering hospitality to visitors who want to observe the RFU in operation, or to be trained on the job. Similar opportunities will also be offered in future by the municipalities of Cotonou and Porto Novo through the intermediary of SERHAU-SEM.

ADDRESSES OF LOCAL INSTITUTIONS AND EXPERTS

SERHAU-SEM
(Societé d'Etudes Régionales, d'Habitat et d'Aménagement Urbain, Societé d'Economie Mixte)
Directeur Général: B. Oloude
Conseiller Technique: B. Daly
- 32-34, Rue 390 (Route de Lomé)
- BP 2338 -
Cotonou / Benin

Tel.: +229 - 3 - 00209
Fax : +229 - 3 - 00626

IGNB
(Institut Géographique National du Bénin)
Directeur Général: M. Dikou
- 16, Rue 312 (Avenue Delorme) - BP 360 -
Cotonou / Benin

Tel.: +229 - 3 - 12441
12978
13266

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ANNEX

GLOSSARY

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This short glossary provides brief explanations to some of the technical terms as they are used in this report. Where available, the source of information is indicated to facilitate further investigation.

Aerial Photography
Photographs taken from aircrafts showing the surface of the earth with topographic features and information depending on the scale and resolution of the photograph. Scales of aerial photos for urban purpose usually range from 1 : 5.000 - 1 : 20.000.

Arial photographs are frequently used for map production through photogrammetric methods.

Cadastre
The cadastre is a methodically arranged public inventory of data on the properties within a certain country or district based on a survey of their boundaries; such properties are systematically identified by means of some separate designation. The outlines of the property and the parcel identifier are normally shown on large scale maps.
The UN Ad Hoc Group of Experts on Cadastral Surveying and Land Information Systems (1985)

A cadastre is thus a systematic description of the land units within an area. The description is made by maps that identify the location and boundaries of every unit, and by records.
G. Larsson: Land Registration and Cadastral Systems; Burnt Mill 1991

Cadastral Map
A cadastral map shows the real estate properties for a selected area. It usually includes property boundaries, administrative boundaries, road corridors, parcel identifier codes, and, eventually, indicates the size of parcels, street names and names of administrative zones.
The use of satellite images for urban planning; a case study from Karachi, Pakistan (page 101); by Marie-Agnes Bertaud, World Bank, Washington 1989

Cadastral Survey
The cadastral survey is defined as a survey of boundaries of land units. A cadastral survey may be carried out both for the initial formation of the parcel as well as for any subsequent changes of the boundaries. A cadastral survey may also be conducted in order to re-establish missing boundaries.
G. Larsson: Land Registration and Cadastral Systems; Burnt Mill 1991

The information collected through the cadastral survey usually forms the basis of land taxation and the description of property parcels in the land register.

Fiscal Cadastre
A fiscal cadastre is an up-to-date official record for a jurisdiction, state or country showing the taxable and or ratable proprietor, the address of such a proprietor, a legal description of the parcel concerned and address of the parcel, the improvement on the land, the assessment of the land and improvements together with the associated date of the assessment, the parcels current and planned land use.
Land management information for urban development. needs, issues and options (glossary page 2) World Bank, Washington 1989

Legal Cadastre
A legal cadastre is an official legal record for a jurisdicition, state, country showing the legal parcels. The record may consist of some or all of the following elements:
- documentary records of ownership in the form of register of certificates of land title or registers of dees,
- maps and survey plans of the land, the subject of the documentary registers, and
- indexes linking the documentary records and maps.

In developing countries, the majority of parcels are not registered or cadastrally mapped.
Land management information for urban development. needs, issues and options (glossary page 5); World Bank, Washington 1989

Geodetic Network
A nationwide grid forming the bases of official mapping and cadastres, usually based on a triangular network of surveying points.

There are three different possibilities for the establishment of the triangular networks: Triangulation, trilateration or by satellite navigation systems with time and ranging-global position system.

The grid provides a unified system of coordinates to be used in the collection and processing of all spatial data.

Geographic Information System (GIS)
The GIS is a system for collecting, data input, checking, processing, integrating, analyzing, modeling and reporting on information relating to locations on earth. They may be established and used for many functions some of which are forecasting potential commercial areas, analyzing factors contributing to seismic hazard levels, determining high risk erosion areas, or used to assist in the determination of the optimum use of land.

The term GIS is applied to systems containing spatial units as soil zones, statistical districts and water catchment areas. The data held in GIS tend to be natural resource and environmentally based.
Land management information for urban development. needs, issues and options (page 5); by Lynn Holstein, World Bank, Washington 1989

In a technical sense, GIS is used in the computer industry as a product comprising hardware and software components to be used as tools or instruments to support GIS and LIS applications.

Land Information System (LIS)
A Land Information System is a tool for legal, administrative and economic decision-making and an aid for planning and development, which consist on the one hand of a database containing spatially referenced land-related data for a defined area, on the other hand, of procedures and techniques for the systematic collection, updating, processing and distribution of the data.

The base of a Land Information System is a uniform spatial referencing system for the data in the system, which also facilitates the linking of data within the system with other land-related data.
Resolution 301 of the XVI. FIG-congress 1981, Montreux, CH

In contrast to GIS, the term „land information system" is being applied to systems which are focussed on land parcels as their unit of information or are land administration based.
Land management information for urban development. needs, issues and options (page 2); World Bank, Washington 1989

Land Management
It involves all the traditional functions of land administration being, the formulation and administration of policies for land development and housing provision; the facilitation and support of the land market; the legal and fiscal systems for land conveyancing and taxation; the formulation and administration of land use policies; as well as natural resource planning; putting land to its best use; and environmental policy, assessment and monitoring.
Land management information for urban development. needs, issues and options (page 2); World Bank, Washington 1989

Land Market
Encloses all those activities dealing with the purchase, sale and transfer of properties of land.

Functioning and transparent land markets are an important precondition for an efficient management of urban development.

Land Office Operations
The entirety of institutional set-ups, procedures and measures, which deal with the administration, management, and regulation land.

Land Tax (Real estate tax)
One of the oldest ways of direct taxation, often at municipal leve,l based on real estate properties. The level of taxation usually is determined based on the size, the quality (the use) and the value of the land.

Parcel
A parcel is a real property land unit which is distinguishable from neighboring land units. It is capable of being separately described say by a label number, identifier, or by a written description and is therefore able to be sold, mortgaged as a separate land unit.

A parcel maybe private or public land; maybe formal or non formal; and be held under any tenure system and rights and title proved under any system of land registration system.
Land management information for urban development. Needs, issues and options (glossary page 6); World Bank, Washington 1989

For the cadastre the basic spatial unit is known as the parcel. A land parcel, known in some countries as alot, plot or even a plat, is an area of land whose separate identity may be defined by the limit of legal rights, by responsibility for taxation payments, or by use.
The UN Ad Hoc Group of Experts on Cadastral Surveying and Land Information Systems (1985)

In common practice the parcel designation consists of a name or number of the section / block and a unique number within in for the parcel in question.
G. Larsson: Land Registration and Cadastral Systems; Burnt Mill 1991

Program
A sequence of coded instructions fed into a computer, enabling it to perform specified logical and arithmetical operations on data.

Property register (land register)
A legal land register is a public register of deeds and rights concerning real property. Depending on the legal system, there may be a register of deeds or a register of titles. Under the system absed on the registration of deeds, it is the deed itself which is registered.

A deed is a record of a particular transaction and serves as evidence of this specific agreement, but it is not itself a proof of the legal right of the transacting parties to enter into and consummate the agreement.

Under the alternative system based on the registration of titles, this process of tracing the chain of deeds is unnecessary . Title registration is itself a proof of ownership and its correctness is usually guaranteed and insured by the State.
The UN Ad Hoc Group of Experts on Cadastral Surveying and Land Information Systems (1985)

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Thematic Map
It presents information on special topics in form of a map. Thematic maps often aggragate information that is not visible on the ground (in the real world), like population data, soil qualities, level of services provision, etc.

Topographic Map
It shows the physical features (natural and artificial) visible on the surface of the earth, portrayed in two-dimensional form.

Topographic maps are prepared in different scales, depending on the cartographic system of the country.

Topography
Is the science of describing or presenting the character and physical features of a particular site in detail, especially with regard to the presentation of information on physical shape and height of lands, by maps

Topographic Survey
Is the basis for the preparation and production of official topographic maps.

The topographic survey considers all the important details of the earth's surface, e.g. topography, built-up areas, networks of communication, waters, frontiers, etc.

Due to the permanent change of landscape and uses, a regular updating of the information base through topographic surveys is necessary

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CASE STUDIES

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