

ECE/HBP/96

**ECONOMIC COMMISSION FOR EUROPE
Geneva**

LAND ADMINISTRATION GUIDELINES

With Special Reference to Countries in Transition

**UNITED NATIONS
New York and Geneva, 1996**

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ECWHBP196 I

UNITED NATIONS PUBLICATION

Sales No E.96. II.E.7

ISBN 92-1-116644-6

PREFACE

In 1993 the United Nations Economic Commission for Europe (ECE) launched an initiative to strengthen land administration capabilities, mainly for countries in east and central Europe. The main purpose was to identify the current needs and problems related to land administration in these countries, and for experts both from countries in transition and from the west to share views and experiences. ECE also sought to assess the opportunities for applying methods, policies and procedures of land administration similar to those that evolved over a long period of time in the market economies of the ECE region.

In 1993 a seminar on reform of real property, land registration and cadastre took place in Copenhagen (Denmark). To follow up the seminar, workshops were organized in Austria, Croatia, Hungary, Latvia, the Netherlands and Romania. In parallel, and with input from these workshops, a task force was established by the ECE Committee on Human Settlements to prepare the present Guidelines on land administration. The task force consisted of Messrs. Friedrich HRBEK (Austria), Branimir GOJCETA (Croatia), GAbor REMETEY-FULOOPP (Hungary), Jan BROUWER (Netherlands), Helge ONSRUD (Norway), Virgil PAMFIL (Romania), Jim WIDMARK (Sweden) and Peter DALE (United Kingdom), Chairman of the task force.

These Guidelines define land administration as the process whereby land and the information about land may be effectively managed. They are mainly written for senior governmental staff and politicians engaged in land administration issues. The aim is to out-line the benefit of having a relevant and reliable land information system in place. The Guidelines are based on the assumptions that:

- (i) Access to food and shelter are fundamental human needs;
- (ii) Security of tenure is essential for an effective housing policy;
- (iii) Certainty in the legal status of land is essential for efficient agricultural production;
- (iv) Investors in a market economy require a formal structure of land and property rights;
- (v) Sustainable development is dependent on the State having overall responsibility for managing information about the ownership, value and use of land, even though the private sector may be extensively involved; and
- (vi) Both land and information about land are resources that must be husbanded in order to achieve economic growth.

The Guidelines are in accord with article I of the First Protocol to the European Convention on Human Rights signed in Rome on 4 November 1950. That article states: "Every natural or legal person is entitled to the peaceful enjoyment of his possessions. No one shall be deprived of his possessions except in the public interest and subject to the conditions provided for by law and by the general principles of international law."

The Guidelines identify the factors that should be taken into account in developing the legislation, organization, databases and maps, as well as the funding mechanisms, required to implement and maintain a solid land administration system, frequently referred to either as ;I cadastre or a land registration system.

The initial investment in a new land administration system may involve spending millions of dollars and the processes may take between 5 and 10 years. Such an investment and time-scale are however essential if economic development is to be sustainable.

The Guidelines draw primarily on experiences in eastern and western Europe. All western systems of cadastre and land registration have been established for a long time but many have been built on traditional skills that have in the past not necessarily focused on all the needs of users. They were based on manual, not digital, methods although most are now in the process of introducing computerization. Like their eastern European counterparts they are changing to meet the needs of a modern society.

Transition countries can learn much from western experiences. They need however to build their own systems within their own social, economic and cultural environments. These Guidelines should help them to consider alternative ways to meet modern requirements.

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EXECUTIVE SUMMARY

These Guidelines are based on the assumption that a formal system is necessary to register land and property and hence to provide secure ownership in land, investments and other private and public rights in real estate.

A system for recording land ownership, land values, land use and other land-related data is an indispensable tool for a market economy to work properly, as well as for sustainable management of land resources. All industrialized nations with a market economy maintain some sort of land register system that fulfils the above requirements.

These Guidelines use the term “land” to refer to the objects to which mortgages and other data are to be connected. “Real estate” is an alternative term. In practice a land administration system can incorporate various basic objects or units, land parcels being the most common.

Real estate can consist of one or several land parcels. Many countries also allow buildings or parts of buildings to be registered as separate real estates, as well as structures under or above the surface. The latter are referred to as properties in strata. Defining the basic units is a major element in the design of any land information system.

A good land administration system will:

- (i) Guarantee ownership and security of tenure;
- (ii) Support land and property taxation;
- (iii) Provide security for credit;
- (iv) Develop and monitor land markets;
- (v) Protect State lands;
- (vi) Reduce land disputes;
- (vii) Facilitate land reform;
- (viii) Improve urban planning and infrastructure development;
- (ix) Support environmental management;
- (x) Produce statistical data.

These Guidelines do not recommend one specific design of a land administration system to be implemented in countries in transition. Local traditions, existing infrastructure, etc. will require different solutions, especially in countries where cadastres have been in operation for many decades.

A good land information system includes textual files and maps that are closely linked to each other. The cadastral systems in the majority of west European countries contain different registers, each under a different administration, although the registers are operated partly or wholly by the Government in each case.

In some of the countries field surveys are undertaken by private surveyors, in other countries by governmental or local public agencies. The requirement for geometric precision varies considerably. Some countries require very precise surveying and mapping of boundaries, whilst others are far less demanding in this respect.

Most of the countries with a formal land information system in place have already computerized their systems, or are in the process of doing so. The existing manual systems frequently limit the opportunities for implementing optimal solutions. Furthermore, the conversion of existing files and survey data requires huge resources.

Countries building new land information systems from scratch-or almost-will have the benefit of not being restricted by existing systems, and should therefore have the possibility to implement optimal solutions from the very beginning. This should include the application of computer technology, both for textual data and for the maps.

Introducing a new land administration system, including the implementation of formal land information registers, is a huge and time-consuming process. The importance of solid investigations and thorough planning cannot be underestimated.

It is important to stress that the development of related legislation, an improved organizational structure, financial mechanisms, and technical issues are closely interconnected. Experiences indicate that issues related to legislation, organization and funding are frequently more complex to solve than technical issues.

These Guidelines recommend that countries in transition apply a step-by-step approach. Data content of the registers should initially be restricted to what is actually required to satisfy high-priority user needs. Demarcation and survey of boundaries are frequently a major element of the process. High geometric precision is often unnecessary for land administration. The possibility of applying low-cost surveying and mapping techniques should be investigated.

Countries in transition are recommended to investigate the possibility of implementing integrated land information systems, where the formal registration of legal information as well as technical information is supervised, controlled and operated by one public authority, and not split between two or more ministries and authorities. This does not exclude distributed solutions with practical activities being undertaken in regional or local offices.

Ways of involving the private sector should be evaluated. Many countries apply legislation under which field surveys are undertaken by private licensed surveyors. Databases can physically be operated by private data centres, under contract to the relevant public authority.

Establishing a new land administration system may be closely linked to land reform and the privatization of land. It is, however, difficult to identify mechanisms whereby the initial establishment of a land information system can be financed through user fees only. Countries should regard the initial establishment of their system as a long-term public investment in infrastructure, with user fees covering only a portion of the total costs of setting up the system. The costs of maintaining the system that result from land transactions, land subdivisions, etc. can however be fully recovered through fees.

It is recommended that a land administration coordination board be established with representatives of the relevant ministries, agencies and users to examine the needs for information and to coordinate land information management activities and projects.

The following series of operations must be addressed when introducing a new land administration system:

- (i) The determination of user needs;
- (ii) The creation of new administrative arrangements;
- (iii) The preparation of new legislation;
- (iv) The determination of what land and property rights already exist on the ground;
- (v) The demarcation and survey of new plots of land;
- (vi) The establishment of new registers and procedures for storing and retrieving land data;
- (vii) The setting in place of new financial management procedures;
- (viii) The development of public awareness as to how the system works.

I. LAND AND LAND ADMINISTRATION

A. Land as a resource

Land is the ultimate resource, for without it life on earth cannot be sustained. Land is both a physical commodity and an abstract concept in that the rights to own or use it are as much a part of the land as the objects rooted in its soil. Good stewardship of the land is essential for present and future generations.

These Guidelines are concerned with the administration of land as a natural resource to ensure its sustainable development. They address the social, legal, economic and technical framework within which land managers and administrators must operate.

From a legal perspective, land extends from the centre of the Earth to the infinite in the sky. In the present discussion, however, the focus will be on that volume of space that encompasses the surface of the Earth, all things that are attached to it, and the rocks and minerals that are just below it. Land includes areas covered by water such as seas and lakes, all building and construction, and all natural vegetation.

Objects that are not attached to the soil, such as motor cars, animals and human beings, are not part of the land, although they will be subject to the rights that control the use of the space that they occupy. “Air rights”, that is, rights to use space above the land, are in some jurisdictions treated as being part of the land, but will not be discussed here.

Land and its use may be examined from many different points of view. From an ecological perspective, land plays a vital role in the breeding and survival strategies of many living species. The history of human settlement has been dominated by national and international conflicts—men and women may kill or may be killed in fights over the boundaries of their nations or of their individual properties.

These Guidelines focus on land as something over which individuals or communities have rights of ownership and use, that can be bought and sold and be subject to tax, and that is the basis of economic production.

In many countries the term “real estate” is used to describe land. Some differentiate between the land and the buildings attached to it, referring to the latter as “property”. In these Guidelines, unless otherwise stated, the term “land” will be treated as embracing, while real property refers to man-made constructions.

The role of land in the economy of each nation is not always obvious, but is of great significance. Without secure land rights there can be no sustainable development, for there will be little willingness to make long-term investments. Countries in transition will, in particular, find it difficult to obtain some foreign investment.

There is a need to manage the wealth of every nation, at least 20% of whose gross domestic product (GDP) can come from land, property and construction. All countries

need to determine the ownership and value of land and property, and to monitor and manage their use so that the value of these assets may be enhanced.

B. Cadastres and land registration

The ownership, value and use of land, although independent in concept, are interdependent in practice. Each attribute of land needs to be carefully managed and to achieve this there must be good land records: of ownership to ensure security of tenure; of value to ensure fairness in land and property taxation and equity in the compulsory acquisition of land for State purposes; and of the use of land to ensure efficient resource management.

Every land administration system should include some form of land registration, which is a process for recording, and in some countries guaranteeing, information about the ownership of land. A right is something to which some person or group of persons is entitled. The function of land registration is to provide a safe and certain foundation for the acquisition, enjoyment and disposal of rights in land.

A land administration system should provide order and stability in society by creating security not only for landowners and their partners but also for national and international investors and moneylenders, for traders and dealers, and for Governments. Although systems of land registration are frequently directed at protecting the interests of individual landowners, they are also instruments of national land policy and mechanisms to support economic development.

A cadastre is similar to a land register in that it contains a set of records about land. Cadastres are based either on the proprietary land parcel, which is the area defined by ownership; or on the taxable area of land which may be different from the extent of what is owned; or on areas defined by land use rather than by land ownership. Cadastres may support either records of property rights, or the taxation of land, or the recording of land use.

Cadastres may also be used in a multi-purpose role to provide a wide range of land-related information. In such cases, it is best if they are constructed around the proprietary land parcel, as this is the legal basis for all dealings in land. Where ownership has not yet been proved, as may be the case where the land is being restored to former owners, such multi-purpose records can be built around the land parcel as defined by rights of use.

The cadastre is an information system consisting of two parts: a series of maps or plans showing the size and location of all land parcels together with text records that describe the attributes of the land. It is distinguished from a land registration system in that the latter is exclusively concerned with ownership.

Both a cadastre and a land register must operate within a strict legal framework, but a land register may not in practice record all land over a whole country since not all citizens may choose to register their lands. Furthermore, when introducing a new system

of land registration, selected areas may be given priority and other areas excluded for the meantime in order to maximize the best use of resources.

The cadastre however should be based on complete coverage of a country, since it may be used for the purposes of land taxation. Surveys for the cadastre can be used to support a land registration system and indeed in many countries the term “cadastral surveying” is used to describe the survey of land for the purposes of recording ownership.

In Finland and Sweden, for example, real property formation, mutation, land consolidation, cadastral mapping, registration of real properties, ownership and legal rights, real property valuation and taxation are all combined within one basic cadastral system. In many parts of Europe, however, the cadastre evolved as a support for land taxation, while the legal processes of land registration were dealt with separately by lawyers and the records entered in land books, for example the German *Grundbuch*.

Dual systems therefore emerged and these are being reintroduced in some eastern European countries as part of land reform programmes. Use rights are being recorded in the reformed cadastral system, while ownership rights are being treated under the traditional notary system. This is leading to duplication of effort and more complex processes of land administration than might otherwise be necessary. It will be important in the longer term for these separate systems to be brought into one unified system.

Different countries interpret the term “cadastre” in different ways and this can lead to great confusion when analysing systems. The common understanding is that a cadastre is a form of land information system. The term “land information system” is applied to a wide range of spatial information, including environmental and socio-economic data as well as data related to infrastructure systems and the cadastre.

A land information system is not necessarily land parcel-based, unlike a juridical, fiscal or multi-purpose cadastre. Instead it may be an inventory of forest resources, or of soils, or of geology and may incorporate a variety of types of data. A cadastre is more specifically focused on the ownership, value or use of land parcels.

Data that may appear in a cadastre include: geometric data (coordinates, maps); property addresses; land use; real property information; the nature and duration of the tenure; details about the construction of buildings and apartments; population; land taxation values. Data may relate to single plots of land or may cover many properties, as in land-use zoning. The data may be used to support private land transactions, to support land markets, or to assist in the administration of diverse sections of the economy such as: agriculture; environment protection; fishery; forestry; housing; land-use management and zoning; public utilities; transport.

C. Land management and land reform

Land management is the process by which the resources of land are put to good effect. It covers all activities concerned with the management of land as a resource both from an environmental and from an economic perspective. It can include farming, mineral extraction, property and estate management, and the physical planning of towns and the countryside. It embraces such matters as:

- Property conveyancing, including decisions on mortgages and investment;
- Property assessment and valuation;
- The development and management of utilities and services;
- The management of land resources such as forestry, soils, or agriculture;
- The formation and implementation of land-use policies;
- Environmental impact assessment; and
- The monitoring of all activities on land that affect the best use of that land.

One of the most important steps in the transition from a centrally planned to a market economy is the establishment of private ownership in land. For investment to take place, the investors must feel confident that the assets that they are developing will be built on land to which there is a secure title. There must be a clear and rigid framework of laws governing the ownership and rights to use the land.

Good land resource management will help to promote economic and social development in both urban and rural areas. For countries in transition, land reform is a key component in achieving these goals.

The term “land reform” has a variety of meanings. It may involve the restoration of land rights to previous owners, a process known as land restitution. This occurred in countries in transition when former private rights in land were restored. Land reform may involve the redistribution of land rights from one sector to another—for example by taking land from the State or from individual owners of large estates and giving it to people who have no land. Land reform may also involve land consolidation in which all landowners within an area surrender their land and are allocated new parcels of comparable value but in a pattern that encourages the more efficient and productive use of the land. Land reform may also involve changes in the tenure of the land, that is in the manner in which rights are held, thus abolishing complex traditional and customary rights and introducing more simple and streamlined mechanisms of land transfer. The impact on the land may be preplanned, but it may also result from property tax reforms that alter the value of land and in consequence its use.

Land reform programmes normally affect selected areas such as agricultural land or urban centres. In rural areas the programmes may be designed to facilitate changes in the technology of agriculture, the type of crops, the manner of husbanding the land, the financing of development or the marketing of products. In urban areas land reform programmes may involve major infrastructure development, the taxation of buildings as well as the land upon which they stand, or changes to the manner and use of land and properties.

Thus “land reform” covers a multitude of possible activities, not all of which may occur in any given reform programme.

D. Land administration

The term “land administration” is used in these Guidelines to refer to the processes of recording and disseminating information about the ownership, value and use of land and its associated resources. Such processes include the determination (sometimes known as the “adjudication”) of rights and other attributes of the land, the survey and description of these, their detailed documentation and the provision of relevant information in support of land markets.

In this context, land administration is only concerned with such matters as town and country planning or good agricultural practice in so far as such activities affect the compilation and maintenance of good land records. These Guidelines address only the supporting information infrastructure and are not directly concerned with physical planning, city centre redevelopment, agricultural reform, or improvements to agricultural productivity.

An understanding of the broader aspects of land management is essential to proper land information management but is not its essence. Land administration is concerned with three commodities—the ownership, value and use of the land—within the overall context of land resource management.

“Value” has several meanings. It may refer to the actual or assessed capital market value, i.e. the amount of money for which the land can be sold, or it may refer to the rental value, which is the amount for which the land can be hired out. Alternatively, “value” may be equated with construction costs, so that the value of a building for insurance purposes may be the cost of rebuilding if it were destroyed by fire.

The perceived value of land and property may also relate not to any present market price but to the potential to generate income. Thus vacant land would produce more income if it were fully developed and hence by taxing the potential value rather than the present actual value it may be possible to bring about changes in land use. The use of the land determines the wealth that it generates and hence its value.

In many of the countries in transition a free market in land has in the past been limited or non-existent. In some, such as Poland, a market in rural land remained throughout the communist period but urban land was subject to strict State control; in others, such as Bulgaria, urban property could be purchased (at a price dictated by the Government) but farm land was administered under a cooperative system with no individual person able to own land for agricultural use.

In such countries, the value of land has been taken to refer to its physical and environmental qualities. Land records have been compiled listing the soil characteristics, moisture content, slope and aspect of the land, all factors that would influence how the land could best be used. Data on such attributes underpinned various categories of cadastre which were in effect records of existing or potential land use.

In several countries in transition there have been different cadastres for agricultural land, forest land, viticulture, water resources, etc., as well as a general “unified” cadastre that attempted to integrate data on all of these. In many cases, the mapping in support of these cadastres was on a smaller scale than that now needed for fiscal or juridical purposes.

In most countries in transition, the cadastral data were further reduced to a generalized form and used to monitor agricultural production. Statistical data were compiled and sent to a higher authority to support the central planning system, but their use at the detailed level of individual farm management was almost non-existent.

Where generalized data are required, sampling may be a more cost-effective way to achieve the necessary support for decision-making. Comprehensive information at the individual farm level is necessary only when it directly affects the individual farmer. The European Union, for example, requires such data in order to calculate and pay subsidies to farmers under its Common Agricultural Policy. In most cases it is the farmer on the ground who knows best how to cultivate the land.

E. The benefits of a good land administration system

The modern cadastre is not primarily concerned with generalized data but rather with detailed information at the individual land parcel level. As such it should service the needs both of the individual and of the community at large. Benefits arise through its application to: asset management; conveyancing; credit security; demographic analysis; development control; emergency planning and management; environmental impact assessment; housing transactions and land market analysis; land and property ownership; land and property taxation; land reform; monitoring statistical data; physical planning; property portfolio management; public communication; site location; site management and protection. Although land records are expensive to compile and to keep up to date, a good land administration system should produce benefits, many of which cannot in practice be quantified in cash terms. These benefits are outlined below.

1. Guarantee of ownership and security of tenure

The compilation of land records and the judicial processes that must be gone through in order to bring land information onto the registers should provide formal identification and, in some systems, legal proof of ownership. The public registers should contain all essential juridical information allowing anyone viewing the system to identify third-party rights as well as the name of the landowner.

In some systems, such as the English registration of title to land, the State then guarantees the details recorded in the register, so that if a mistake were to occur, compensation would be paid. In others, the registers are treated as primary evidence rather than definitive proof. The Netherlands is an example of the latter, although any enquirer is protected against inaccurate or incomplete information either contained in

deeds entered in the public registers or caused by errors, omissions, delays or other irregularities. Thus, although there is technically no guarantee of ownership per se, the integrity of the system is sufficiently high for landowners to have full confidence in their rights.

2. Support for land and property taxation

Good land records will improve efficiency and effectiveness in collecting land and property taxes by identifying landowners and providing better information on the performance of the land market, for example by identifying the current prices being paid for property and the volume of sales. Since the cadastre should provide full cover of the land, all properties can be included and none should be omitted.

While not all countries seek to impose taxes on land or property, such fiscal measures are regarded by many as fair and just since they are perceived in effect as taxes upon wealth. They are relatively easy to collect in contrast for example to personal income taxes where earnings can be hidden. It is not possible to hide a piece of land or building although it is possible to conceal the records of such a property.

3. Provide security for credit

Certainty of ownership and knowledge of all the rights that exist in the land should provide confidence for banks and financial organizations to provide funds so that landowners can invest in their land. Mortgaging land is one way to acquire capital for investing in improvements. Landowners can then construct or improve buildings and infrastructure or improve their methods and management of the land, for example by introducing new farming techniques and technologies.

4. Develop and monitor land markets

The introduction of a cheap and secure way of transferring land rights means that those who wish to deal in land can do so with speed and certainty. Those who do not wish to sell their land can be protected-no persons need be dispossessed of land unless they so wish since their rights should be guaranteed.

The registers should be public so that at any time a landowner can confirm his or her rights. Those who wish to buy land can do so with confidence, knowing that the person who is trying to sell the land is the legally guaranteed owner. Those whose properties are subject to compulsory purchase-for instance where a new highway is to be built across their land-can be treated with fairness since the registers should provide information on current land prices, thus allowing better estimates of the market value of land to be made.

5. Protect State lands

In many countries the land that is held by the State for the benefit of the community is poorly documented. This is not a problem in countries where the State owns all land, but where there is private land ownership, that which remains in the possession of the State must be properly managed. In all societies the State is a major landowner and its property must be protected for example from encroachment by farmers onto land beside roads or from attempts by squatters to settle on vacant land that is being held for future use. The State needs to manage its property assets and to ensure their efficient use and upkeep every bit as much as does the private citizen. A system of registration of title to land will facilitate this.

6. Reduce land disputes

In many countries disputes over land and its boundaries give rise to expensive litigation and all too often lead to a breakdown in law and order. Much time is taken up by the courts in resolving these matters, leading to delays in other parts of the judicial system.

Land often cannot be put onto the market or put to better use without resolution of the disputes, since no potential investor is likely to wish to be committed to developing land where a lawsuit may be pending. The process of registering rights should prevent such disputes arising in the future, since at the time of first registration formal procedures should be followed that will resolve uncertainties.

7. Facilitate rural land reform

The distribution of land to the landless, and the consolidation and redistribution of land for more efficient use all require detailed records of the present ownership and use of the land. Compensation may need to be paid to those who lose out in such a process, or money may be taken from those who make special gains. The design of new patterns of land ownership to provide greater productivity from the land can be effective only if the existing pattern is well documented.

8. Improve urban planning and infrastructure development

As with rural land reform so urban centres need redevelopment and effective land-use planning and control. In many countries the control of development and the issuing of building permits are the responsibility of the local municipal authority.

A good land administration system should permit the integration of records of land ownership, land value and land use with sociological, economic and environmental data in support of physical planning. The availability of up-to-date large-scale cadastral plans of urban areas provides the basic framework within which development schemes can be planned and assessed and acceptable designs implemented.

9. Support environmental management

Multi-purpose cadastral records can be used to record conservation areas and give details of archaeological sites and other areas of scientific or cultural interest that may need to be protected. The cadastre can be used in the preparation of environmental impact assessments and in monitoring the consequences of development and construction projects. In the Netherlands, for example, there is a register of presently polluted sites and of formerly polluted sites that have been decontaminated.

10. Produce statistical data

By monitoring the ownership, value and use of the land, data can be assembled for those concerned on the one hand with resource allocation and on the other with measuring the performance of development programmes. Both long-term strategic planning and short-term operational management require data in support of decision-making.

F. Institutional issues

The success or otherwise of any broad-ranging land administration system requires a number of institutional issues to be addressed. It is essential to focus on the needs of the users of the proposed system. The customers of a land information system include most government departments and many sectors of the community, for instance:

- (a) *Government*: agriculture and forestry; defence education; environment; finance/economic affairs; health; highways and transport; housing; internal affairs/police; justice; lands and surveys; local government; natural resources; planning and development; power and electricity; public works; trade and industry; etc.;
- (b) *Private sector*: architects; banks and building societies; construction companies; economists; engineers; environmentalists; farmers and foresters; financial and insurance advisers; investors; land and property owners; lawyers and notaries; marketing specialists; planners; property developers; property managers; real-estate agents; surveyors and valuers; etc.

The products that are needed by each customer will differ, although a common theme is the ownership, value and use of the land. In many eastern European countries detailed land records have been compiled in most agricultural areas, providing data on soils, water resources, crop types, crop yields, etc. The classification for soils has been complex and detailed.

There is little evidence that the collection, storing and analysis of these data have been cost-effective or are needed in a modern market economy. There is an urgent need for

countries in transition to review their requirements for land information in the light of modern techniques of data gathering and processing and the changing needs of the economy. It is of course difficult to predict long-term **needs** for data that can be used to analyse changes over time. It is however essential at present to set priorities to match the resources presently available. Much money has in the past been spent on data that have been little **used**. Many costs can be recovered through the sale of land-related data, even though in a market economy it may be difficult to determine the right price. In many countries maps, for example, are marketable commodities but have traditionally either been unavailable because of the interests of national security or else have been on sale at highly subsidized prices.

Experience suggests that first registration of title to land must be subsidized, as must the creation of the base mapping that supports land registration and the cadastre. The legal and administrative costs of running a land registration system can and preferably should, however, be fully recovered from the users.

It is generally accepted that the State must have a dominant role in setting up and operating cadastre or land registration system. The influence and extent of involvement of the private sector differs between countries. In some countries, such as Sweden and Finland, the State operates a legal process of land management using governmental authorities with little input from the private sector.

In many countries, however, private licensed land surveyors undertake the field survey and measurement of individual property boundaries, while in some jurisdictions private lawyers are registered as State notaries. These notaries must check all relevant documents before they are registered and must endorse land transfer application forms to ensure that the persons concerned are the bona fide landowners.

Where data that have been collected by the State or by other governmental authorities are made available to the general public for possible commercial exploitation, the protection of the investment in data becomes important. The State needs to protect its investment in land information on behalf of the taxpayer just as much as the private sector needs to protect its interests. It is important to ensure that a fair reward goes to those who have incurred costs in collecting data or in creating products. Protection may be provided through pricing policies and the laws on intellectual property, especially copyright. In most countries international treaties on copyright exist especially as a result of the Bern Convention for the Protection of Literary and Artistic Works.

In moving towards a market-oriented approach to land-related information, managers should:

- Investigate who the customers are in the market for land-related data and what basic information they require;

- Direct existing data gathering and processing towards the ownership, value and use of land; and

-Provide a nationwide service, introducing cross-subsidies if necessary to ensure full cover of the country.

G. The role of computerization

One of the major catalysts for change has been computerization. The benefits of a land administration system can be enhanced by using computers to:

- Force standardization in the collection and processing of land information;
 - Speed up the processes of first registration of title;
 - Decrease the cost and space required for storing land records;
 - Prevent unnecessary duplication;
 - Simplify the preparation of “disaster” copies of registers;
 - Facilitate access to land-related data and improve their distribution;
 - Reduce the time and cost involved in transferring property rights and in processing mortgages;
 - Facilitate the monitoring and analysis of market and rental values of land and property;
- and
- Provide built-in mechanisms for quality control.

The conversion of data into computer-readable form is often an expensive and time-consuming task that can account for three quarters of the cost of setting up a computerized system. The quality of data may be poor and their conversion into digital form will not necessarily improve this. The introduction of computers is however more than a technical matter, since it introduces changes in the skills and responsibilities needed within an organization, its organizational structure, investment strategies and such like. Within a government-run cadastral system, computerization may involve changes in legislation.

In order to ensure that all land-related data can be treated as a corporate resource and shared between organizations, flexible and clearly defined data exchange standards will need to be introduced.

Given the present rapid rate of change in technology, investment in hardware and software will have to be renewed every three to five years. The major investment, however, is in data and although they too must be kept up to date, they should not need to be renewed along with the hardware and software.

H. Recommendations

Countries should establish or improve their land administration system to:

- Guarantee title and provide security for credit;
- Support land and property tax assessments;
- Provide data on the performance of land and property markets;
- Document the structure of land use and land-use restrictions;
- Monitor the environmental impact of development projects;

- Facilitate land reform;
- Subsidize the initial creation of ;I land administration system; but
- Recover fully their recurrent operating costs.

II. THE LEGAL FRAMEWORK

This chapter discusses aspects of the law as they affect land administration. In particular it focuses on the ownership of rights in land, the registration of deeds and title, the definition and survey of real property boundaries-what is sometimes known as real property formation or legal surveys-and the intellectual property rights in the information that is registered.

A. The legal status of land and real property

The law is a complex set of rules that have evolved within each society to ensure its orderly running and the peaceful behaviour of its members. The law may take several forms as is the case in Europe today where there are several different legal traditions. Looked at globally, there is for example statutory law in which all rules and regulations are written down and codified; there is customary law in which there is no written record but the code is assumed to be well known by all members of society; and in some jurisdictions there is the common law, which grew out of customary law but where over time the judgements of the courts have been written down to create precedents whereby new cases can be judged.

There are four main areas of the law that particularly affect the land administrator:

- (a) The law of “real” property that affects dealings in land;
- (b) The laws on land reform such as the privatization of State-owned land, the restitution of former private land, and land consolidation;
- (c) The laws that govern the conduct of land administration such as the regulations that control the operation of the cadastre; and
- (d) The laws on “intellectual” property that affect such matters as the ownership of information and ideas, the protection of data and personal privacy.

Other areas of the law, such as those relating to bankruptcy, inheritance and matrimony, also affect real property and thus the work of the land administrator.

The law of property deals with relations between people (“*in personam*”) and of persons to things (“*in rem*”). The following remarks deal with real property, by which is meant land, buildings and construction of works, and with intellectual property. The law recognizes different types of interest in all such things and makes a distinction between the physical object and the abstract rights associated with its use.

The law of real property is concerned with regulating what may be done with land. The definitions of “land” and “real property” vary between jurisdictions as to whether land includes mines and minerals below the surface, features attached to the surface such as buildings or parts of buildings, or natural objects grooving in the soil; and whether the definitions relate to the physical things or to abstract concepts such as rights in the land and real property.

In many countries there is a basic land code that includes special legislation governing the operation of the cadastre and any land registration system. In particular the code will define the nature of land and real property.

Unless otherwise stated in what follows it will be assumed that land extends from the centre of the Earth up into the sky, that it includes all things natural and man-made attached to or beneath the surface of the Earth, and that it also includes rights such as those of the ownership and use of the land.

Land may be owned by one person, in the possession of another and occupied by a third. “Ownership” means the right to enjoy the use of something, the ability to dispose of it and to benefit from the rights associated with it. With real property this is referred to as the “title”, which is the highest level of rights in the land. The title is held by the owner, who may not necessarily be in possession of the land.

Possession involves the ability to enjoy the use of the land and in some circumstances to exploit the products on or below its surface. Possession implies the physical power to control an object—a thief who steals a motor car may then be in possession of the car but is not its owner. In this respect, intellectual property is very different since information is unlike material goods—it can legitimately be sold to one person, given to another and retained by its originator all at the same time, something that cannot be done with a physical object such as a motor car. A possessor of land has the ability to make use of the land in some way or other. Possession may be legitimate or illegal. The legal possession of other people’s land takes place through formal agreements such as leases or rental agreements that protect the rights of the true owner.

Land may also be subject to “adverse possession”, when the occupation is contrary to the interests of the true owner. Adverse possession often takes place where the true owners cannot be traced—they may be absentee landowners, deceased, ignorant of their ownership (as is often the case with State land), or else unwilling to challenge the persons in occupation.

Those who are in ownership or legal possession of land may differ from those in occupation. The term “squatting” is often used to describe the illegal occupation of land; many landless people are forced to squat on land as they have nowhere else to go. Often this is on State land. Squatting is a major social and economic problem, which is all too often associated with poverty, crime and ill health. It is particularly prevalent in cities of less developed countries but also occurs in the most affluent societies. An effective and efficient land administration system is a prerequisite to the solution of the problems of squatting.

Ownership is a matter of “right”, while possession and occupation are matters of fact at any one time. The occupation and use of land may provide evidence of ownership but this is not proof. Where there is no evidence of title then, as the maxim goes, possession is nine tenths of the law.

In some countries there is a process whereby the peaceful adverse possession of land can, after a specified period, lead to the acquisition of full title to the land. Wrongly described by some as land stealing, the prescription of rights through adverse possession is a legitimate process for bringing security to those unable to prove original ownership. It is based on the rationale that land is a resource that should be used and that by allowing squatters to gain title, the society as a whole benefits.

Those who use the land and are therefore in possession of it may be tenants rather than owners. The user of land is not necessarily the owner and may not have exclusive rights.

In the land reform programmes of eastern Europe in the early 1990s, land was being restituted, that is it was being given back to those who originally owned it. The return of full ownership rights requires meticulous scrutiny of old land records and as a result the process has in many cases been slow. In order to expedite the change from collective to private enterprise farming, many landowners were allocated use rights. Agricultural production could then proceed without waiting for the restoration of full ownership rights. As a temporary measure the practice was successful, even though use rights are less secure than the full title to the land. Financial institutions such as banks are not keen to secure loans solely on the basis of use rights.

Countries introducing new land laws need to ensure that the law:

- Defines the nature of land, the form and nature of ownership and the legally recognized forms of tenure;
- Differentiates between real property and personal property;
- Distinguishes between the ownership, possession and use of land and protects the rights of landlords, tenants and third parties, including those of mortgagees;
- Indicates what rights less than full ownership, such as servitudes, should be recorded;
- Codifies all forms of statutory restriction that may apply to land.

In addition, the law needs to:

- Define the means and conditions whereby use rights can be changed to ownership rights, for example through the lapse of time;
- Prescribe rules for the initial determination of rights in land and property and how the ownership of these rights may be transferred.

B. Land tenure

The way in which rights in land are held is called "tenure". In many countries the absolute owner of all land is the State or Head of State but for all normal purposes two common forms of tenure can be identified: freehold and leasehold.

Freehold means that the owner can do what he or she likes with the land, for example in the way of disposal, subject to any restrictive covenants and the various planning regulations that are imposed by statute with regard to the use of the land. Freehold is not absolute since the State retains the right to acquire land in the public interest, for instance for building new housing or motorways.

Leasehold means that the freehold owner, who in some cases may be the State, has relinquished most of the rights in the land for a set period of time such as 99 years during which the leasehold owner has the use of the land or property but at the end of which the title returns to the freehold owner.

Many countries operate similar land tenure systems though some do not recognize leasehold and rely on rental agreements to control the short-term use of the land.

Not all rights are written down. A title is generally subject to statutory restrictions, such as development control regulations that are imposed by the local municipality but which do not appear on any certificate of title. The title may also be subject to customary laws and overriding interests that likewise are not written down.

C. Deeds registration and title registration

The three systems for recording rights in land are: (a) private conveyancing; (b) the registration of deeds; and (c) the registration of title.

In *private conveyancing*, documents agreeing to the transfer of ownership are passed between the seller (vendor) and purchaser (vendee), usually with the guidance of a lawyer. The State merely provides a legal framework within which this process takes place. Private conveyancing is generally regarded as inefficient and potentially dangerous since it can be subject to fraud as there is no easy proof that the vendor is the true owner.

Under a system of *registration of deeds*, a copy of the transfer document is deposited in a deeds registry. An entry in the registry then provides evidence of the vendor's right to sell. In parts of the United States of America, private registers are operated by insurance companies that underwrite any losses that may arise through defects in the title. This is known as title insurance. Under title insurance, the purchaser pays a premium to obtain the necessary guarantee. If fraud takes place and a purchaser of land finds that the title is invalid, the insurance company will pay compensation. The system does not however support general land management.

In countries where there is a national *deeds registration* system, the registry is under the control of the State. A copy of all agreements that affect the ownership and possession of the land must be registered at the registry offices and one copy of all documents is retained. Each document will normally have been checked by a notary or authorized lawyer and its validity ascertained. As a result, by searching the registry for the most recent document of transfer, any would-be purchaser should feel confident that the vendor has the right to sell. Inspection of the register will show how the vendor obtained the property and the conditions under which it was acquired. This of course provides no proof that the previous transaction was legitimate, hence the transaction before that should be inspected, and so on through a sequence of inspections until the purchaser is confident that there is a clear chain of title.

An ideal system would reflect perfectly the legal position on the ground (the mirror principle), draw a curtain over all previous dealings so that only the present entries on the register need be consulted (the curtain principle), and guarantee the accuracy of what is shown on the registers (the insurance principle). It is difficult for a deeds registration system to conform with all these principles.

On its own, the system gives no guarantee of title; it merely provides access to the history of transfers, some of which may in practice be missing depending on the history of the system; possible disasters may have occurred, for instance, during the Second World War when many records were destroyed.

A further objection to deeds registration is that it leads to the storage of vast quantities of ancient documents, creating what has been referred to as a “mausoleum of parchment”. Not only is this costly but the retrieval of data can also be difficult and time-consuming, depending on the volumes of documents stored. With computers it is of course possible to store and retrieve rapidly large amounts of data and although the conversion of old documents into digital form is potentially expensive, the costs are much less than in the past. By applying modern technology, such as the scanning and micro-filming of documents, and by adopting appropriate administrative routines, deeds registry systems can now offer an efficient and reliable service.

In some deeds registries, the management of the records is extremely efficient and as a result there is great confidence in the system. While such registries do not actually guarantee title, they provide the most important evidence of ownership that can be assumed to be correct unless proved otherwise in the courts. In many countries around the world, the deeds registries are not in this category and the systems owe more to the nineteenth century than to today. Documents are in poor physical state, difficult to retrieve and even more difficult to link into a chain of titles tracing the pattern of ownership over time.

An alternative to the registration of documents is the *registration -of title* to land. In this system each land parcel is identified on a map and the rights associated with it are recorded on the register. In addition, the name of the owner is recorded. When the whole of the land is subject to transfer, only the name of the owner need be changed. When part of the land is transferred, the plans must be amended and new documents issued. Although a copy of the certificate of title for each land parcel is held by the landowner or by the mortgagee in the case of land that has been used as collateral, the definitive record is that held by the titles registry.

Under such a system the ownership of land can be guaranteed. Anyone who is dispossessed of land through the functioning of the registers will be compensated even though the mistake was not made by the registry but rather was a case of fraud.

In Australia, registration of title to land is known as the Torrens system. Many other countries operate very similar and equally effective ways of registering title to land. The Torrens system is essentially simple and relatively cheap to operate. Transfers of whole

land parcels can take place without any lawyers being involved, although in practice many people choose to take professional advice when dealing in land.

Both systems of registration of title and registration of deeds evolved to meet the needs for improved conveyancing. Both were devised to provide greater security to the land market and both grew from a legal rather than a land management perspective.

A compromise between the two systems is possible, drawing on the strengths of each approach. A number of countries, for example, combine land ownership and mortgage data in one register, while other information such as that relating to property boundaries is recorded in separate documents. In some countries the data on mortgages or hypothecs are maintained in separate registers that have to be checked independently when transactions are taking place.

A system for recording land ownership should:

- Contain a legal definition of real property units that accurately reflects conditions on the ground;
- Facilitate land transfer through a system that is simple, secure, and cheap to operate;
- Eliminate the need for extensive searching for a chain of titles;
- Be supported by legislation that requires it to be kept up to date at all times, for example when mutations occur;
- Meet local needs;
- Record specific real property rights, ownership and restrictions on ownership that are not otherwise transparent;
- Cover all land, including that held by the State as well as by individual private citizens or institutions.

Neither deeds registration nor title registration systems are concerned directly with land use, though some indication of this may appear in the property description. Furthermore, neither system addresses all of the land rights. Rights restricted by municipalities under development control regulations are rarely incorporated. Similarly, the systems do not necessarily provide information about land values. In many cases, the price paid for properties as declared in transfer documents is used as a basis for charging for the service, and for government-imposed levies such as a land transfer tax or capital gains tax. The declared price may differ from the real price so that the vendors or purchasers can reduce or evade paying what may be seen as too high a tax.

In order to begin the compilation of a land register, whether it is under a deeds registration or a titles registration system, there needs to be some mechanism to bring land onto the registers. In both systems one trigger mechanism is a dealing in the land, for instance a sale or when a mortgage is taken out. For deeds registration that is all that is technically required, since the system merely records documents.

It is a prerequisite in either system that landowners and the general public understand the process sufficiently to have confidence in it. There is often a fear that a Government introducing a system may seek to take land away from people rather than confirm the rights that they have.

Once data are on the registers, the records must at all times be kept up to date. In some countries the system of inheritance makes this difficult, especially where ownership is shared between heirs. The relatives of a deceased landowner may also not record their inheritance, either through ignorance, a misunderstanding of the procedures, or a wish to avoid payment of death duties or taxes.

D. Adjudication of title to land

When title to land is brought onto the register for the first time, a special procedure may need to operate. This is known as adjudication, which is the process whereby existing rights in parcels of land are finally and authoritatively determined. Adjudication is the first stage in the registration of title to land in areas where the ownership of the land is not officially known.

Adjudication is a prerequisite for land consolidation and redistribution in order to ensure that each existing owner is identified and treated fairly. In theory, the land adjudication process neither alters existing rights in land, nor creates new ones; rather it establishes what rights exist, by whom they are exercised and to what limitations, if any, they are subject. As such, it should introduce certainty and finality into the land records, a process which frequently alters the status quo since all too often the existing ownership and rights in land are unclear.

Adjudication necessitates determining “who” owns “what”, that is the rights and ownership must be ascertained as well as the extent of the land affected. The latter means that the boundaries of each parcel must be agreed between the adjoining parties. The process may operate sporadically or systematically.

The word “sporadic” in this context means “here and there” or “now and then”. Thus adjudication takes place whenever or wherever there is a reason to determine the precise ownership and limits of individual parcels—for example when a dealing is about to take place or when an owner requests that the land be registered. The sequence whereby parcels are brought onto the register is piecemeal, haphazard and unpredictable.

Where systematic adjudication of title to land takes place there should be:

- A law that gives authority for the adjudication to take place;
- Selection of priority in accordance with need—for example areas that are to be subject to land reform, are under rapid development, have a high level of disputes, or where there is need for credit, etc.;
- Wide publicity concerning the areas and the dates on which the claimants must appear to give evidence;
- Procedures for the appointment of an adjudication team;
- The determination of the rights in accordance with prescribed procedures;
- The publication of the results and the hearing of appeals within a specified time-limit, such as 30 or 60 days;

-The formal entry of the results into the registers of title that should from then on be guaranteed.

The systematic approach implies a methodical and orderly sequence wherein, area by area, all parcels are brought onto the register. It is in the longer term less expensive because of economies of scale, safer because it gives maximum publicity to the determination of who owns what within an area, and more certain because detailed investigations take place on the ground with direct evidence from the owners of adjoining properties.

Sporadic adjudication can be used selectively to encourage specific categories of land ownership and is cheaper in the short term because adjudication of the rights to many parcels can be deferred. It also permits the cost of the whole operation to be passed directly to the beneficiaries, who can be charged an appropriate fee for having their land registered.

Sporadic adjudication can be applied voluntarily whereas the systematic approach must be compulsory since it is necessary to summon everyone who claims to own land within a designated area to give evidence. The process must therefore be subsidized by the State in order to ensure the cooperation of the people.

Experience has shown that without some degree of compulsion in adjudication, registration of title will almost certainly fail and complete registration of all important areas of land is never likely to be achieved. Furthermore, disputes over land are more difficult and expensive to resolve if the sporadic approach is adopted since economies of scale cannot apply.

Where a deeds registry is already in existence and the intention is to convert it into a titles registry, recourse to adjudication in the field may be avoided. If there is adequate mapping of the physical boundaries, then careful examination of the deeds should be sufficient to identify the parcels and their associated sets of property rights. If, however, the physical evidence is at variance with the documentary, then investigation on the ground may still be necessary. The problem is that it may not be easy to identify the changes that have taken place on the ground and the disparities that exist between what in theory was the ownership pattern and what in reality is the status of the land at the time of the change-over from deeds to title registration. Boundaries may have changed legitimately.

E. Boundaries

In a legal sense, a boundary is a surface which defines where one landowner's property ends and the next begins. Generally, this surface is vertical and may be likened to a bead curtain suspended from the sky so that anyone passing through it from one side to the other passes from one set of property rights into another. The boundary surface intersects the ground along the legal boundary line; stepping over this line is equivalent to passing through the bead curtain.

A legal boundary is an infinitesimally thin surface extending from the centre of the Earth to the infinite in the sky and is essentially an abstract concept. In the case of strata titles, such as in high-rise buildings, the boundary surface may be horizontal. In practice, most people mark the limits of their property on the surface of the Earth either with linear features, such as fences or hedges, or with point features, such as wooden pegs, iron bars or concrete markers. These physical objects may also be referred to as the boundary, though they may not follow the same line in space as the legal limit. In most legal systems, a fence is an item of defence, a guard against intrusion; it is not necessarily a property delimiter.

Within a registration system, boundaries are often referred to as either “fixed” or “general”. These terms are ambiguous for there are at least three concepts of a fixed boundary and three of a general boundary.

To some a fixed boundary (sometimes referred to as a specific boundary) is one which has been accurately surveyed so that any lost corner monument can be replaced precisely from the measurements.

To others, the term “fixed boundary” is used to describe a boundary corner point which becomes fixed in space when agreement is reached at the time of alienation of the land. The location of the legal boundary cannot then be changed without some document of transfer. The surveyor’s measurements may provide useful evidence of the boundary’s location but the boundary is fixed whether or not there has been a survey. This is the principle which is adopted under the so-called Torrens system.

Under both these definitions of a fixed boundary, evidence on the ground takes precedence over what is actually written down.

In some systems, however, a boundary is only fixed when agreement is reached between adjoining owners and the line of division between them is recorded as fixed in the register. From then on the evidence on the register normally overrides whatever is on the ground. The exact line of a boundary under dispute is then determined by reference to the documentary evidence in preference to long-term occupation and possession of the land or to the position of well-established physical features, such as hedges, which may be inconsistent with any registered plan.

An advantage of fixed boundaries is that landowners can have confidence in where their property limits lie since these are formally recognized within the system. Where boundaries cannot be referred to visible and permanent topographic features such as fences, walls, buildings or ditches, well surveyed fixed boundaries may have an impact in reducing future disputes. Precise surveys of all new boundaries will also reduce the amount of additional survey work required at a later stage if and when this is needed for particular projects such as the erection of buildings, expropriations, etc.

In the case of general boundaries, the precise line of the legal boundary between adjoining parcels is left undetermined as to whether it is one side of a hedge or fence or

the other or down the middle. The ownership of the land can be guaranteed up to the bounding feature, the ownership of which is left uncertain. There is no need for a precise survey, although a reasonably accurate topographic plan *is* needed. General boundaries are most appropriate where the development of the landscape is mature, for example in urban areas and in rural areas that have been cultivated for a long time so that the pattern of land use is well established.

Under the system of general boundaries, the ownership of a plot of land can be registered without the neighbours being consulted and having to agree the precise location of the legal boundary lines. This reduces the number of disputes in the short term but may give rise to problems in the longer term. The approach is often used where adjudication of title is undertaken sporadically with titles being brought onto the register only when dealings take place.

A general boundary may also be an indefinite boundary, such as one which is uncertain and variable like the edge of a forest or the line of high tide in coastal regions. In some registration systems, the law refers to “approximate boundaries” that are deliberately kept vague to prevent argument between neighbours.

Provided that there is good monumentation, for instance in the form of fences or iron stakes driven into the ground, then the parcels define themselves and all that is needed by the registrar of titles is a pointer to ensure that the correct parcel has been referred to. Inspection on the ground can reveal the precise alignment of the boundaries should that be needed and a surveyed plan is only necessary to identify the parcels.

The advantages of general boundaries lie primarily in the less demanding standards of survey and the manner in which the registrar of titles can ignore small changes in the position of a boundary agreed between two parties, whilst still guaranteeing the title of each. The cadastral records may therefore be compiled more cheaply and maintained within defined limits more accurately. If, for example, a fence between two properties falls down and is re-erected along a slightly different line, there would be no need to alter any cadastral map or filed plan. In the case of strata titles, for example where there is separate ownership of an apartment within a block of flats, the ownership of parts of buildings can be defined and guaranteed without the precise determination of where, within the walls and floors, one set of property rights changes into another. Depending on local conditions and demands, the requirement for precise surveys for fixed boundaries may also vary considerably.

Information about the location of parcels and their boundaries is an important part of a land information system (LIS). The data from either a general boundary or a fixed boundary system can be used in a LIS, the only differences being the precision with which the location of boundaries is recorded and the extent to which this information can be used as legal evidence.

It is necessary to maintain a public register of land and property in support of good land management but whether this is done through fixed or general boundaries is less important than how the registers are structured to meet the needs of the user community.

Different qualities of information may be needed for different types of environment-for example between urban and rural areas, or between mature landscapes and those undergoing rapid change. The precision with which boundaries are surveyed should depend on local conditions and requirements.

F. Cadastral surveying

In order to be able to guarantee the accuracy of boundary surveys and to apply quality controls to the work of the cadastral surveyor, it is common for survey regulations to be introduced. These often prescribe the manner in which surveys are to be carried out as well as the standards that must be reached. Survey regulations may also prescribe the necessary qualifications for grant of a licence to undertake cadastral surveys.

While in almost all other areas of land surveying it is not necessary to have a licence, in cadastral surveying it is common to find that before any persons in the private sector can conduct a survey they must be registered as competent to do so. The test of competence may be organized by a professional association of surveyors or by the State, depending on the traditions within any individual country. Regulations governing licensing normally apply to individual cadastral surveyors and not to survey companies.

Within the European Union there has been pressure for those who provide any form of service for official bodies within the Union to be registered under quality assurance. Such a process could be extended to license cadastral survey companies. Quality assurance requires all operational procedures to be documented so that at each stage in the preparation of a product or service, someone can be held responsible for the quality of the work. It is part of the overall process of total quality management that should ensure that what is done is fit for its purpose and meets the needs of clients.

Some techniques of surveying are discussed in chapter VI. In some countries survey regulations have not permitted the use of aerial survey techniques. The methods of survey are prescribed in regulations while the final standard of the product is not defined. Ideally, the law should interfere as little as possible in the choice of method of survey to be used. It should focus on the product rather than the process and should:

- Define the relationship between physical and legal boundaries;
- Permit flexibility in reconciling the possession of land with its ownership;
- Include legislation to protect officially emplaced survey monuments from damage and to provide rights of access to surveyors so that they can make full use of these monuments;
- Prescribe who may carry out cadastral surveys, prescribing qualifications for individual surveyors, for companies, and for institutions;
- Indicate acceptable survey standards without prescribing the methods whereby these must be achieved.

From a legal perspective it is necessary to prescribe the qualifications of those who may conduct cadastral surveys. It is also necessary to establish the legal liability of the surveyor for work undertaken and for the consequences in the short and the long term of

any errors in measurement. In many countries the State guarantees the quality of work as far as the general public is concerned but may reserve the right to sue the surveyor in cases of negligence. Sometimes the responsibility remains forever with the surveyor. In either case, the licensed surveyor should hold professional indemnity assurance to protect the ordinary landowner. Clear contractual relationships need to exist between the surveyors and their clients, whether the latter are private citizens or the State.

The definition of legal liability is important, since quality control is more cost-effective when it is undertaken by sampling. Since this implies the risk of missing incorrect data, the level of risk and consequences of mistakes must be clear in order to prevent expensive, unnecessary and time-consuming checking of surveys.

G. Land parcel information

Land registers have two main components: a textual description of each property; and a graphic representation or map often containing dimensional information. The latter is sometimes stored separately away from the text registers. The law should determine the extent to which information held on the registers is guaranteed.

The law should establish whether marks on the ground take precedence over measurements recorded in the registers in the re-establishment of boundaries or, if there is disagreement, whether the information shown on the plans must be followed.

The law should also establish the types of data that are held definitively on the registers and for which there is no need to look elsewhere. Thus the name of the owner, the type of tenure and the existence of mortgages should be guaranteed to prevent a purchaser from unknowingly buying a property that is already pledged as collateral.

Increasingly as registers are computerized and linked into wide area networks, the ownership and protection of the data within the registers become important. The law needs to lay down rights of access to the data, who is authorized to change entries on the registers, and who may use the information in ways or for purposes other than those for which it was provided. The law should define:

- The extent of legal liability for the accuracy of data;
- The extent of rights of privacy over land and property information;
- Who owns the copyright to data within the registers;
- Who may have access to data;
- Who may alter entries in the registers.

Many countries have laws on data protection while some have a freedom of information act. The balance between the rights of the citizen to privacy and the responsibilities of the State to manage land in the best interests of the community can be in conflict. In the Netherlands and Sweden the amount for which a property is mortgaged is treated as public information and can be seen by anyone who views the computerized registers. In England such information is regarded as private and is no more available to public

scrutiny than an individual's bank account. The law needs to give a clear lead on who can do what with information.

H. Recommendations

Countries introducing or revising their land administration system should ensure that there is a land code or a set of land laws that defines the nature of land and real property and the rights that are formally recognized. Legislation should control the processes whereby land rights are first recorded, the limitations on the use of land and real property, and the methods whereby land and property rights can be disposed of or otherwise transferred. The legislation should cover all land and property, including that in urban and rural areas and State land as well as that held by individual private citizens or institutions. The legislation should indicate who may conduct cadastral surveys and the quality of data that must be recorded. It should however avoid any detailed prescription of the methods and techniques that should be used. In addition to laws on real property there should be laws on intellectual property and the management of land information.

III. FINANCIAL MATTERS

This chapter examines the value of land, methods whereby value can be determined, and the nature of land and property markets. It stresses the importance of land and property in the national economy. It considers the costs and benefits of improving land administration systems and reviews the potential for recovering fully the costs of operating a land administration system.

A. Value and the valuation of land

Land is regarded as one of the basic elements from which a nation can derive wealth. Land is a natural thing that exists and is not created by humankind even though its use can be changed by human beings. Marsh land can, for example, be drained or land that was once covered by the sea can be reclaimed, thus creating more land for the construction of buildings.

All land and construction work may be considered to have a value. The value or worth of land depends on the purposes for which that value is determined—the value of a building for insurance purposes may not be the same as the price that it would fetch in an auction or on the open market. The estimation of the value or market price of a property is more an art than a science and depends on many external factors as well as the physical nature of the land or property.

In countries of east and central Europe that are currently in transition there was a cadastral system based on the Russian model. This cadastre focused on land use. Land was “valued” in terms of its agricultural potential based on soil types, climate, rainfall, etc. and the farmers were then instructed to grow appropriate crops. This concept of the term “value” is only indirectly connected with the sort of valuations that are needed to manage land in a market economy.

1. The distinction between price, market, cost and value

When estimating the value of land or property, appraisers make a careful distinction between the terms price, market, cost and value. The term price usually refers to a sale or transaction price and applies to an exchange: a price is an accomplished fact. A price represents the amount that a particular purchaser agrees to pay and a particular seller agrees to accept under the circumstances surrounding the transaction.

Generally the circumstances of a transaction reflect conditions within one or several markets. A market is a set of arrangements in which buyers and sellers are brought together through the price mechanism. A market may be defined in terms of geography, products or product features, the number of available buyers and sellers, or some other arrangement of circumstance.

A real-estate market is the interaction of individuals who exchange real-property rights for other assets, such as money. Specific real-estate markets are defined on the basis of property type, location, income-producing potential, typical investor characteristics, typical tenant characteristics, or other attributes recognized by those participating in the exchange of real property. The market for new, single-family residences selling for ECU 100,000 and the market for older apartment buildings located near the central business district and available for renovation are examples of specific real-estate markets.

The term cost is used by appraisers in relation to production, not exchange; cost may be either an accomplished fact or a current estimate. Appraisers distinguish among several types of costs: direct costs, indirect costs, construction costs, and development costs.

Direct costs include expenditure on labour and materials necessary to construct a new improvement. They are also called hard costs. The contractor's overheads and profit are generally considered to be direct costs.

Indirect costs incurred in construction refer to expenditure on items other than labour and materials. They include administrative costs; expenses incurred by the owner for professional fees, financing, taxes, and interest and insurance during construction; and lease-up costs, which are the net expenses of operating the project until it reaches a stable occupancy level. Indirect costs are sometimes referred to as soft costs.

Construction costs, or the contractor's bid price, normally include the direct costs of labour and materials plus the contractor's indirect costs.

Development costs are the costs involved in creating a property, including the land, and in bringing it to an efficient operating state. They are distinguished from the costs of constructing the improvements. Development costs include the profit of the developer or entrepreneur who brings the project into being.

These real estate-related expenditures are directly linked to the price of goods and services in competitive markets. For example, the costs of roofing materials, masonry, architectural plans, and rented scaffolding are determined by the interaction of supply and demand in specific areas and are subject to the influence of social, economic, governmental, and environmental forces.

Price, market, and cost relationships also incorporate concepts of value. Value can have many meanings in real-estate appraisal; the applicable definition depends on the context and usage. In the market-place, value is commonly perceived as the anticipation of benefits to be obtained in the future. Because value exists at a given moment, an appraisal reflects value at a particular point in time.

Value at a given time represents the monetary worth of property, goods, or services to buyers and sellers. To avoid confusion, appraisers do not use the word value alone; instead they refer to "market value", "use value", "investment value", "assessed value",

or other specific kinds of value. Market value is the focus of most real-property appraisal assignments and its estimation is the purpose of most appraisals.

2. Methods of valuation

The valuation process is applied to develop a well-supported estimate of the worth of a property, taking into account all pertinent data. Appraisers estimate property value with specific procedures that reflect three distinct methods of data analysis: cost, sales comparison, and income capitalization. One or more of these approaches are used in all estimations of value. The approaches employed depend on the type of property, the use of the appraisal, and the quality and quantity of data available for analysis.

All three approaches are applicable to many appraisal problems, but one or more of the approaches may have greater significance for a specific task. For example, the cost approach may be inappropriate in valuing properties with older improvements that suffer substantial depreciation due to physical deterioration or that have become functionally outdated, all of which are difficult to estimate. The sales comparison approach can not be applied to very specialized properties, such as refuse disposal plants, because comparable data may not be available. The income capitalization approach is rarely used to value owner-occupied residential properties, although it may be used in conjunction with other data. Income capitalization can be particularly unreliable for the commercial or industrial property market. Wherever possible, appraisers should apply at least two approaches. The different values derived can serve as useful checks on one another.

3. Cost approach

The cost approach is based on the understanding that the buyers and sellers relate value to cost. In this approach the value of a property is derived by adding the estimated value of the land to the current cost of constructing a reproduction or replacement for what is already on the land; from this the amount of depreciation, that is for deterioration and obsolescence, is subtracted to give a net value. This approach is particularly useful in valuing new or nearly new improvements and properties that are not frequently sold in the market. Cost-approach techniques can also be used to derive information needed in the sales comparison and income capitalization approaches.

The current costs to construct the improvements can be obtained from cost estimators such as quantity surveyors, cost estimating publications, builders, and contractors. Depreciation is measured through market research and the application of specific valuation procedures. Land value is estimated separately in the cost approach.

4. Sales comparison approach

The sales comparison approach is most useful when a number of similar properties have recently been sold or are currently up for sale. Using this approach, an appraiser produces an estimated value by comparing the property whose value is sought with similar properties, called comparable sales. The sales prices of the properties that are judged to be most comparable tend to indicate a range in which the estimated value for the target property will fall.

An appraiser estimates the degree of similarity or difference between the target property and the comparable sales by considering various elements of comparison such as: real property rights conveyed; financing terms; conditions of sale; market conditions; location; physical characteristics; economic characteristics; use; non-realty components of value. Monetary values or percentage adjustments are then applied to the sales price of each comparable property with consideration for the real property interest involved. Adjustments are made to the sales prices of the comparable properties because the prices of these properties are known, while the value of the subject property is not. Through this comparative procedure, the appraiser estimates the value for a specific date.

Data such as income multipliers and income rates may also be extracted through sales comparison analysis. In the sales comparison approach, appraisers consider these data, but do not regard them as elements of comparison. These data are however applied in the income capitalization approach.

In countries in transition where there has been no market there may be few or no comparable properties. In such cases a best estimate must be made taking into account such matters as:

- (a) *Site location*: topography, soil characteristics; usable land area; building setback requirements; end of road or corner location; view and landscaping; street and alley access; railroad and waterway access; available utilities; distance to shops, etc.; nearby nuisances (noise, pollutants); land-use zone;
- (b) *Building size*: ground floor area; total floor area; leasable area; volume; building height; ceiling height; clear span: number of storeys; number of apartments;
- (c) *Construction quality*: quality of materials; workmanship; architecture;
- (d) *Construction materials*: foundations; framing; floors; walls (exterior and interior); ceilings; roofs;
- (e) *Other building features*: number of rooms by type; heating, ventilation and air conditioning; plumbing facilities; fireplaces, etc.; additions and building extensions; porches and patios; swimming pools; shelters for motor cars; lifts;
- (f) *Design*: intended use; architectural style; shape of building; roof type; number of corners;
- (g) *Age/extent of appreciation*: chronological age; effective age; remaining economic life; condition; etc.

5. Income capitalization approach

In the income capitalization approach, the present value of the future benefits of property ownership is measured. A property's income streams and its resale value upon reversion may be capitalized into a present, lump-sum value. Two basic formulae are used in this approach:

$$\text{Income/Rate} = \text{Value} \quad \text{Income} \times \text{Factor} = \text{Value} \quad \text{where Factor} = 1/\text{Rate}$$

Like the cost and sales comparison approaches, the income capitalization approach requires extensive market research. Research and data analysis for this approach are conducted against a background of supply and demand relationships, which provide information about trends and market anticipation. An investor in an apartment building, for example, anticipates an acceptable return on the investment as well as a return of the invested funds. The level of return needed to attract investment capital is a function of the risk inherent in the property. Moreover, the level of return required by investors fluctuates with changes in money markets and the returns offered by alternative investments. Appraisers must be alert to the changes in investor requirements indicated by the current market for comparable investment properties and by changes in the more volatile money markets, which may suggest future trends.

The specific data that an appraiser investigates for this approach might include the property's gross income expectancy, the expected reduction in gross income caused by vacancy and collection loss, the anticipated annual operating expenses, the pattern and duration of the property's income stream, and the anticipated resale value or the value of other real-property interest reversions. After income and expenses are estimated, the income stream or streams are capitalized by applying an appropriate rate or factor, or converted into present value through discounting. In discounted cash-flow analysis, the quantity, variability, timing, and duration of a set of periodic incomes and the quantity and timing of the reversion are specified and discounted to a present value at a specified yield rate. The rates used for capitalization or discounting are derived from acceptable rates of return for similar properties.

B. Taxing land and property

Behind the systems of valuation outlined above is the objective of taxing either the land or the buildings attached to it. Any system of taxation should:

- Serve clearly defined social objectives;
- Raise significant amounts of revenue;
- Be exclusively under the control of the government authority;
- Be administered in a way that the public understands and sees as fair;
- Be relatively simple and cheap to collect;
- Be designed to make it difficult to avoid making payments;
- Distribute the tax burden equitably across the community;
- Encourage the good use of resources.

Ultimately, it is a matter of political judgement as to whether it is fair and equitable to tax land and property. In many countries there is a land transfer tax while in others there are direct taxes either on the land or on the buildings or on both.

The fiscal cadastre is an instrument for administering land tax policy. Although primarily a support for land value and property taxes, the data that are recorded within a fiscal cadastre can be used in the determination of other forms of tax, such as those imposed on personal wealth or on income derived from real estate. The latter include taxes on inheritance or what are sometimes called death duties.

A primary requirement for an efficient and effective fiscal cadastre is a set of current property maps that provide an index for compiling and maintaining valuation information. Such maps may be an integral part of the tax records or may be derived from data held in the land ownership registers. Property maps are necessary to ensure that all parcels are identified and that no parcel is taxed more than once. The approximate size, shape and location of the parcel, as depicted on the map, may be used in the actual valuation process.

The creation of a set of land and property tax records necessitates:

- The identification and mapping of all properties which are to be taxed;
- The classification of each property in accordance with an agreed set of characteristics relating to such matters as its use, size, type of construction and improvements;
- The collection and analysis of relevant market data including data on sales prices, rental charges or building maintenance costs, together with details of the dates when these applied;
- The determination of the value of each parcel in accordance with publicized procedures;
- The identification of the person or persons who will be responsible for paying the tax;
- The preparation of the valuation roll;
- The notification of the individual property taxpayer of what has to be paid;
- The collection of the appropriate taxes;
- Appeals procedures for taxpayers who dispute their assessment.

C. Central valuation agencies

In many countries there is a central valuation authority responsible for administering government valuations and, where such exists, the fiscal cadastre. Such an authority is usually under the control of the Ministry of Finance but has its own administrative structure and terms of reference. A central valuation authority should provide a comprehensive land valuation service both to departments of central Government and to local authorities and advise Government on matters affecting the value of land. It should carry out real-estate valuations where appropriate, for instance for:

- Land and property taxation;
- Calculating compensation to be paid where land is acquired for public purposes either by compulsory purchase or by agreement;
- Determining compensation for any adverse consequences of planning decisions; and

-Fixing the rent on government-owned property.

Most countries in transition have had cadastral systems that focused primarily on land-use data. Most do not yet have a central valuation authority, one reason having been the lack of qualified manpower capable of undertaking valuations. Initially, valuations were undertaken by people who were untrained or inexperienced in the workings of a land market. A number of bilateral aid programmes have addressed this problem and most countries are now developing the necessary skills in methods of valuation. Often however these skills are at present outside the cadastre, where the main focus has been towards computerization.

Computerization of the processes of valuation has many advantages, since much of the data tends to be uniform in character, requiring repetitive processing and often quite complex analysis. Computers may be used in the creation and maintenance of valuation databases, to analyse price and cost data, to determine general market trends, to carry out investment and statistical analysis and to maintain departmental accounts and other records. The use of computers should lead to improvements in the levels of performance and service provided by an assessing office, particularly with regard to the accuracy and speed with which valuations can be undertaken. They should reduce clerical costs and eventually reduce the unit cost of an appraisal or assessment. More efficient scheduling of the workload of each assessor should become possible and more and better information should be available for decision-making and overall administrative control.

There is some advantage in setting up a central valuation agency either within the cadastral authority or else in close cooperation with it in order to ensure:

- A uniform application of laws and standards;
- Greater economy, by the reduction in the duplication of records, staff and effort;
- Greater potential for individuals to develop skills in specialized areas such as valuing plant and machinery, agricultural land, or mining sites;
- The opportunity especially through computerization to coordinate large volumes of land sales data;
- The monitoring of land sales to detect land speculation or to identify social or economic changes that are reflected in the land market data.

D. Land and property markets

Land has also been regarded as the best kind of collateral in developed market economies. Systems for enabling land to be used for this purpose, and thereby laying the foundation for a well-functioning property market, are necessary ingredients in a functioning market economy. Real credits, that is loans based on real property as security, constitute a very large part of the credit market in most market economies. The property market is therefore also an important part of the economy as a whole, especially considering that a very large part of the household investments are made in this market.

With this in mind, necessary steps must be taken in order to create a reliable and efficient basis for a property market. This is of great importance both for the economic development of society as a whole and for the prosperity of individual property owners.

Understanding the property market involves understanding not only the financial actors but also the processes such as planning, construction, etc. on which economic decisions depend. The property market shows many similarities with the stock market. Investments in stocks or in property and the total sums involved are often of the same order. Recent developments in the countries in transition suggest that stock markets have been established quite rapidly, while the property markets lag far behind. Since major domestic investment often does not exist, foreign investments are more common. These are geared towards the stock market, mainly because of the lack of information about real estate such as annual reports from the cadastral or land registration authorities, in contrast to information more readily available on the stock exchange.

In a market economy it is the actors in the market that play the main role. The task of the public administration must, to a varying degree, be to take away the market imperfections, redistribute resources, and to put in place the legal framework to regulate the market's behaviour. This is done through rules and laws with different objectives. For both stock and property markets the public administration has taken a special role upon itself. These roles are different in different countries because of different needs to protect the "minor actors" such as the small-time investor or the family house owner. They differ in the ways in which they support the market and how they encourage investments and thereby also encourage economic growth. All this is expressed in the form of rules about the delivery of annual reports, insider trading, property formation, mortgaging real property, development permits, purchase of real property, etc.

Another important ingredient is the division of responsibilities between different players in the market. There is, or should be, a clear and distinct division of responsibilities between the different "traders" and the various service functions that are required. In nearly all aspects the stock market has developed further than the land market, perhaps due to the much larger international influence, the existence of very large players and the relatively large extent of speculation in the market.

The property market needs access to common basic information. This is of the utmost importance for the future. The property market crisis that both western European countries and the United States have gone through and in which many people have been left with negative equity illustrates the need for better land market information.

The land administrative activities such as planning, the issue of building and construction permits, and land registration are service functions that affect the land market and the economy as a whole.

E. Costs and benefits of land administration

In this section, consideration is given to assessing the costs and benefits of existing as well as new systems of land administration. Many countries in transition have been restoring many of the elements of the system that they operated half a century ago without assessing the opportunities for innovation in line with modern requirements. All too often there has been little or no analysis of the costs and benefits of the old system and no quantitative assessment of the costs and benefits of new approaches. In many cases, prejudice rather than careful assessment has indicated the way forward. Ultimately, decisions on investment may be made for political or social reasons and not solely on financial grounds, but this should not preclude careful analysis and evaluation of the options available.

Cost-benefit analysis is a support tool for making judgements and for setting priorities. It cannot provide definitive solutions, but, conversely, it is important to consider the costs and benefits, as an analysis of these will help to avoid wastage of resources and be a guide to those who must judge whether an investment should be made.

1. Investment appraisal and cost-benefit analysis

The implementation of a land administration system requires investment in hardware, software, data and most of all in people. This investment must be maintained over time because keeping the records up to date at all times is an essential element of any land registration system. There are thus both short-term and long-term costs. Similarly, there are short-term and long-term benefits, many of which are difficult to quantify. They are none the less real and need to be identified to ensure that financial and human resources are properly targeted.

Investment appraisal is a series of techniques that involves the analysis of all prospective tangible costs and benefits as a means of helping those responsible for deciding whether to make an investment.

Cost-benefit analysis is a technique that attempts to assess the economic and social costs of any project and to compare these with the financial and social benefits of the investment. It extends the processes of investment appraisal into wider considerations such as the creation of a ‘better’ environment.

Investment, as strictly defined by economists, is expenditure on capital goods. In general it is taken to include the acquisition of any asset that requires *some* sacrifice to be made in order to obtain a benefit including investment in people or training as well as the purchase of hardware or software. Gross investment is expenditure that includes the replacement of worn-out equipment, that is it includes the costs of depreciation; net investment ignores depreciation and the replacement of old equipment.

In some cases it is possible to measure activities in terms of the time that they take and the savings in time that would arise from using the system. It is however normal for the costs and benefits to be expressed in monetary terms, with time being equated with money on the basis of the wages that would be paid.

Because the costs and benefits will be spread over time, it is necessary to adjust any figures to a standard unit of currency. The process of relating future money values to those at a given moment such as the date of the proposed start of a project is known as discounting.

Money available today can be invested to produce interest so that numerically it is worth more tomorrow; on the other hand, a given numerical amount of money tomorrow would be worth less than it is today because of inflation.

In comparing costs and benefits over time, it is necessary to standardize the unit of measurement by applying a factor depending on the date at which the benefits or costs are calculated. On the basis of the discounted cash flow the true profitability of an investment can be assessed.

The essential difference between investment appraisal and cost-benefit analysis is that the latter incorporates an evaluation of intangible things that may be impossible to express in monetary terms.

2. Assessing costs

It might appear relatively straightforward to estimate the costs of setting up a land administration system. In practice this is often not so. While it may be easy to ascertain the purchase price of new equipment, the ongoing cost of its storage, running costs and maintenance may be unclear. Every square metre of floor space has an equivalent rental value and every piece of equipment represents a gross investment the value of which depreciates over time. Labour costs are often the most significant component of any organization's budget. In order to recover these costs, the time spent on a job by an individual worker must be charged at a rate that is higher than the actual amount paid in salary to that person. At least 25 per cent may need to be added for payments made for national insurance and towards the staff member's pension scheme. In addition, there are the costs of overheads such as the rent on office accommodation, heating, lighting, telephone and mail services, office support staff such as office cleaners, telephone operators and secretarial staff, and even senior management, a proportion of whose costs must be distributed between each project undertaken by the organization. These costs can add 150 per cent to 200 per cent on top of what is paid directly to those who do the work.

The average time that a worker spends productively per year is variously estimated at from 1,500 to 1,800 hours. This takes into account holiday time, sickness, absence for social reasons, periods for retraining, etc. Taking the lower figure and a 200 per cent overhead, the annual salary of a staff member needs to be divided by 500 in order to calculate the real cost per hour for his or her services. Thus the hourly costs for someone on an annual salary of ECU 20,000 would be ECU 40, or ECU 320 for an average working day. More highly skilled and highly paid staff would need to be costed at higher rates.

In addition to the labour costs, equipment costs must be considered. There are commercial rates for hiring equipment and although these rates contain a profit margin for the company undertaking the hiring, they provide a good measure of what equipment costs even if it is purchased in-house. The advantage of hiring is that there should be no amortization costs and equipment can be replaced when a newer and better item comes on the market. If it has only limited use then rather than purchase an item of equipment, it may be better for a government department to hire it or to put work out to the private sector. As an example, some government organizations only occasionally need to scan or print large maps and may find it cheaper to subcontract work than to buy the necessary equipment. If equipment is purchased then it must be amortized as an asset and money must be set aside for its maintenance and subsequent replacement. Maintenance contracts can be taken out but are expensive being between 10 per cent and 25 per cent of the purchase price. A judgement must be made of the financial consequences of any equipment breakdown. If the land registry is to provide data on-line to the public, then there would be need for immediate repair; but if the equipment were a personal computer that could be replaced easily and cheaply then a maintenance contract might not be cost-effective.

Frequently, data and equipment may be shared between different parts of an organization, each part having its own cost or budget centre. Thus digital maps may be purchased for one section of a municipal authority, for instance the highways department, that could be used by others, such as the planning or refuse collection departments.

Cost sharing arrangements may need to be worked out, but can prove difficult due to local internal politics and available budgets.

The assessment of intangible costs is also difficult. These will include worker resistance to new technology, traditional attitudes to job security, changes in work patterns and levels of responsibility within an organization. Some people may receive promotion but others may find their work less creative and more routine. In a full cost-benefit analysis all these factors must be taken into account.

Economists sometimes adopt the “Pareto” criterion, which states that in order for a change to be justified, at least one person should be better off and no person should be worse off. Thus, where possible losers are identified, action must be taken to ensure that they are compensated. This will add to the costs.

The Pareto criterion can take into account ethical issues. There is however a danger that it will be used as an argument against any form of change. By emphasizing the effects on people it can also overlook environmental impact. This is often difficult to measure but is none the less important to consider.

3. Calculating benefits

Calculating benefits is even more difficult than evaluating costs. A price can be put on some activities such as improved services, quicker and cheaper conveyancing or the more effective collection of taxes thus bringing in more revenue to Government. Some of these benefits will be “one-off”, while others will occur on a continual basis.

Some benefits are, however, not directly measurable in cash, such as a better environment or greater security of tenure. Some benefits will be relatively immediate in that they represent more cost-effective methods for doing what is already being done; others will be longer-term and may arise only some years after the system has been introduced.

The extent of benefits will depend very much on the type and number of users of the system. The needs of urban communities will, for example, be different from those in rural areas. Thus there is no point in a cadastral system holding records of soils data for city centres; conversely, recording of data on street lights is of less importance in most country areas. For each category of data there may be a different type of user and hence a different degree of benefit. f

In seeking to assess benefits and to determine “value for money” as a result of new investment in a land administrative system, it is useful to carry out a user requirements analysis. This should:

- Identify who the existing and potential users are;
- Document what information is already available;
- Identify potential new data sets that should be helpful to land managers, tax gatherers, the general public, etc.;
- Determine any legal requirements to provide data or that might restrict their use (this is especially so in the case of central and local government data sets where any data protection act may inhibit the use of data for purposes other than that for which they were collected);
- Evaluate each data set in terms of its costs to acquire, to store and to update; and
- Evaluate the benefits that should come from each data set.

The above list is simply cited as an example. Detailed interviews will need to be undertaken in order to establish the nature and extent of what people need and the savings that would be made from the proposed system.

Part of the benefit would then be the difference between the operational costs as at present and the operational costs using a new system. In some forms of analysis the capital investment costs are ignored and only the running costs are considered. The issue then becomes one of whether the new system will be cheaper to operate than the old.

Where the value of benefits is intangible, estimates can be made using the judgement of experts and experienced managers. They are asked to weight the benefits. Scores are then allocated for the importance of specific tasks-for instance with regard to the meeting of specific business goals. Based on these assignments possible savings calculated in monetary terms and hence a range of savings can be estimated for alternative strategies.

4. Comparing costs and benefits

When all the costs and benefits have been identified and if possible quantified, a balance sheet can be drawn up. The measurable, direct costs and benefits can be set beside a list of intangible, indirect costs and benefits. In the final balance sheet, all forms of cost and benefit should, however, be included. When all the data have been assembled, a judgement must be made as to whether a particular level of investment is justified. Often 90 per cent of the benefits can be obtained for 50 per cent of cost-increasing accuracy and precision in cadastral mapping may, for example, add significantly to its costs but add only marginal benefits. Ultimately, cost-benefit analysis is a tool to help in decision-making and is not a replacement for human judgement.

F Financing and sources of funding

There are in principle three different forms for financing a land administration system: financing by tax; financing by fees; financing by commission. Financing by tax means that there is no connection between the activity from which the tax is drawn and the grant that is given by the Government (national or local) to an agency in order to finance an activity. Financing by fees means that an applicant pays for a service and that there is a connection between the fee and the cost for the service. The tariff is decided by the Government. The fees can go directly or indirectly to the agency. Financing by commission means that an applicant pays for a service and that the agency that offers the service has the authority to decide about the tariff based on rules set by the Government.

These different forms of financing are often used in the same country, but in connection with different activities. This is the case in Sweden, where activities that have a direct applicant are generally subject to a fee or commission, while activities that are more connected to the rule of law or the overall public good are financed by grants. The fees charged are however often set at a level so that they contribute, indirectly, to the financing of the grants.

For the countries in transition it is often necessary to develop the fundamental organization and legislation for cadastral activities and land registration as well as the information infrastructure that have become part of more developed market economies. This requires funding that is not available domestically. For obvious reasons the various development banks, aid agencies, etc., are the most frequent funding sources used in such instances.

The introduction of a proper cadastral system and a reliable way of keeping records of land ownership are necessary, but the benefits of these systems (and the information that they produce) will have to be presented in more detail before any funding can be secured. These benefits are difficult to put in figures, but some examples can be of interest. The annual amount of stamp duty, paid by applicants to the land register agencies in Sweden is between 4 and 5 billion Swedish kronor (SKr). The total value of

real property units in Sweden that form the base for taxation is calculated at about SKr 1,372 billion. The total amount of real property tax levied is about SKr 16 billion per year. The total amount of mortgage bonds issued in Sweden as security is about SKr 1,600 billion. These figures show the great importance of the real property sector. The cost of running the cadastral organization, land registration and a land information system is a very small part of the total economy of the sector.

As a complement to foreign aid contributions there are other possibilities of financing the building-up of a register. In recent times big computer companies have made offers to finance the building-up of such registers. In return they want part of the future fees. This at least illustrates the vast potential that the use of basic land information, mainly in the form of details about land ownership, has in a market economy.

G. Marketing land registry and cadastral data

In recent years, there has been a major shift in the thinking of Governments about the costs and benefits of many of the services traditionally subsidized by the taxpayer. Many Governments have been seeking ways to both reduce the costs of land registration, especially surveying and mapping, and increase the revenue that can be generated from the products and services that are provided. Greater emphasis is now placed on making the user pay and on reducing general government expenditure. Increased cost recovery can however increase consumer resistance and there is no doubt that the community as a whole benefits from a sound land registration system as well as the individual landowner.

In almost every country, cadastral mapping for land titling and for land taxation has been prepared either with large State subsidies or has been totally underwritten by the State. Even where the private sector has been involved in surveys for land registration, the full costs of the system have not been passed on to the landowners. Frequently, the true costs have not even been calculated. Government departments have been run on annual allocations of funds that have rarely been tied to measures of productivity and many have had no accurate way of determining the unit cost of the products and services that they offer.

Today, in an increasing number of countries, policies are in place to encourage maximum efficiency and optimum income generation. The higher the level of cost recovery, the more an organization ought to be able to invest in the development of new products and services and invest in new technology. If the level of cost recovery is too low then there must be cross-subsidies from other parts of the organization which, in the case of government activities, means the general taxpayer.

Land registries store a wealth of information that can be used for many purposes other than to support conveyancing. Determining the optimum price that can be charged for cadastral data is often difficult especially where there is no market already established. Information as a commodity does not behave in the same way as physical products. For instance, someone who possesses information can sell the product to one person, give it

to another and still retain it for future use. Those who own a tangible object such as a computer cannot dispose of it and at the same time retain it. Information cannot be divided without significantly changing its nature, unlike, for example, electricity, to which a series of devices can be connected so that the product is divided but still operational. Furthermore, information increases through use, provided that it is kept up to date; material products in general wear out through use.

The price that should be charged for cadastral information can be established in a number of different ways. One is based on the production costs. In the case of a digital cadastral map, for example, the price can be set on the basis of the costs that were incurred in its production, to which could be added a margin for profit. This would then be divided by the estimated number of maps that would be expected to be sold to give a market price of, for example, ECU 200. However, the technology exists to store 3,000 such maps on one optical disk at marginal additional cost. Such a disk would almost certainly never sell if the price were ECU 600,000.

Production costs do not relate to the value of the product to a user—a US\$ 100 bill costs hardly anything to print but is still worth US\$ 100. An alternative way to establish the price is therefore to find out what the market will bear. If the price is too high, the products will not sell. If they sell very rapidly then it may be possible to increase the price.

A further strategy would be to find out what savings could be made through the use of the product in comparison to current practice. Thus if the possession of a paper map saves a motorist ECU 20 per year in fuel through more efficient selection of journey routes, and if the map is likely to last a year before becoming worn-out, then it would be worth the motorist paying ECU 19 for the map but not ECU 21 unless other factors came into play. Such calculations can, of course, become very complicated and presume that it is possible to establish the uses to which any cadastral information will be put. To do so necessitates carrying out a user requirements analysis.

In some countries it is not government policy to charge for the collection of data that are an essential part of a government department's work. In such cases a charge may be made for the cost of making the data available, for instance the cost of photocopying or the cost of providing computerized access, but without recovering any of the actual costs of acquiring the data.

A particular characteristic of many land administration systems is that the data are often guaranteed by the State. In some land ownership record systems the information is treated as the best evidence available, but is not necessarily definite proof of ownership and is not guaranteed. There is a cost to guaranteeing data and this is often absorbed by the State.

For private sector data, the relationship between the cadastral data provider and the data user should be subject to clear contractual arrangements setting out the extent of liability and guarantees on the quality of data. Protection for the consumer may be provided through indemnity insurance, whereby compensation is paid to the data user if there is

loss as a result of mistakes made. This cost must initially be borne by the data provider but will inevitably be passed on to the consumer in due course.

In order to protect the investment of the data provider, all copying of data should be protected through copyright laws. After some initial uncertainties over the status of data stored in electronic form, it is now possible in many legal systems to protect intellectual property rights and investment in data through copyright law. The price that is charged for cadastral data must be such as to give the data producer sufficient incentive and protection. Unauthorized copying of data, like stealing from other people, deprives those who have invested time, effort and capital of just reward. Although copyright is in part a moral issue, the primary objective of copyright protection is commercial.

H. Recommendations

In order to encourage investment within a market economy, the State should establish mechanisms whereby land markets can operate efficiently and effectively. The State needs to determine the value of real property when assessing land and property for taxation, when calculating the level of compensation for land that is compulsorily acquired for State purposes, and when fixing the rent of State-owned real property. An efficient land market requires skilled valuers, who can advise on the fair market price for land and property. The State should ensure that adequate educational facilities exist to train such valuers. The creation of a central valuation agency can ensure that the valuation of all land and real property meets the needs of the State. Since many valuations are based on comparisons between one property asset and other real estate, good land and property records must be maintained. The cost-effectiveness of new land administration systems or of improving existing systems should be assessed. Cost-benefit analysis is a useful tool for helping to determine better solutions to land administration problems. Strategies should be developed to increase cost recovery when operating a land administration system. Land information that is held by the State is an asset that can be used to generate revenue.

IV. LAND-USE PLANNING

This chapter examines the role of the cadastre in land-use planning. It places particular emphasis on urban land management and rural land reform. It also considers the impact of physical planning on the environment and the creation of optimum conditions for sustainable development and the protection of the environment. Finally, it considers the role that geographic information system technology can have in managing spatial data within a land information system.

A. The role of the cadastre in physical planning

In seeking to create a strong economy, every country must implement strategies for planning and development so as to improve the infrastructure and create a better environment. Physical planning is the process whereby changes to the environment can be brought about through formal procedures. It involves:

- Reviewing and understanding the existing environment;
- Defining the problems that need to be solved;
- Determining alternative courses of action;
- Evaluating the options for change;
- Selecting an appropriate strategy after consultation with those affected;
- Implementing that strategy and monitoring its consequences; and
- Operating within a formal legislative framework.

Physical planning is the process of allocating resources, particularly land, in order to achieve maximum efficiency while respecting the nature of the environment and the welfare of the community. The manner in which physical planning is conducted depends on the country's political system and on the division of responsibility between different parts of government. Some responsibilities will lie with the central Government while others may be devolved to the local level.

Physical planning must operate in conjunction with land registration, since it involves measures that create new subdivisions of the land and new patterns of land use. Failure to identify existing patterns and rights of ownership frequently leads to delays or even failure in development programmes, especially in urban areas.

There must be legally defined procedures for the compulsory acquisition and reallocation of rights in land and appeals mechanisms so that the confidence of the public in the security of their titles can be upheld.

Land policy and physical planning must provide compensation for owners of land whose rights are affected by any project. The powers vested in the public authorities under the planning system should permit settlements to be reached in the case of disputes over proposed developments, including the distribution of the costs-especially where there is land reallocation or land expropriation.

Physical planning is also concerned with the provision of any necessary infrastructure, and with appropriate legal regulations including by-laws relating to the quality of building and construction.

The first requirement in any development programme is an identification of the present pattern of ownership and use of the land. Difficulties will always be encountered in laying out new sites and in implementing development plans until detailed maps and knowledge about ownership rights and other rights in land become available. Planning activities require information related to land both at the stage of formulating policy and when carrying it out.

In order to manage land-related development projects, there must be an information system that is capable of meeting all the relevant needs. Cadastral maps can form the basis for such a system and they are increasingly being used for purposes other than land registration. Cadastral maps can serve as the basis for recording construction permits, for urban and rural planning, for environmental studies and other fields of activity required by the law.

To fulfil this multi-purpose function, a cadastral system can no longer concentrate only on the documentation of real property. Additional information about forests, buildings, roads and rivers not only helps landowners to define the extent of their properties but is also important for the management of construction, planning and environmental projects. Physical planners require geodetic information about land parcels including their identifier reference and other attributes in the same way as the cadastre and the land registry.

Political decisions based on statutory law often impact upon private rights—for example, in relation to the compulsory purchase of land for development. Such decisions must be taken in the full knowledge of the facts and this means that they must be based on complete and up-to-date information.

It is very important for physical planning to have a formal relationship with the land administration system because of the impact that development proposals will have on the land and the associated land rights. The executive authority responsible for planning and development must adopt administrative procedures that work closely with the cadastral system.

If the executive authority seeks to create new land-use patterns without integrating its work with the land administration system then the implementation of development programmes will almost certainly be delayed and may ultimately fail. Administrative procedures for matching cadastral and land registry data with planning data must be established especially at the local level. There are always inherent dangers that:

- Changes in the shape of land parcels may be recorded by the cadastral authorities and reported to the land registry, but not accepted by the latter since the appropriate legal procedures have not been followed;

- Subdivisions of the land brought about through inheritance may be legally documented in one way in the land registers but a different pattern of land use may be adopted by the

heirs; as a result, the cadastral records that are based on the land use may not conform with the records of ownership;

-Technical inconsistencies may occur whereby old measurement units and old parcel references appear in legal documents that do not accord with the planning and cadastral registers.

It is particularly important with the growth of computerized networked information systems that inconsistencies are eliminated. The records of permanent changes to the land that are held by both the cadastre and the land registry must be based on the juridical status of the land parcel and must be compatible with each other.

B. Land-use planning in urban centres

Changes in urban land use will take place as a result of the implementation of new urban plans. Such plans may be prepared either to accommodate urban expansion, or to create new towns in accordance with resettlement schemes, or to improve the existing environmental infrastructure. Redevelopment occurs where general improvements are needed to the urban environment, for example to alter traffic flows or to attract real property investments; or where urban centres need to be substantially rebuilt as a result of major social and political change.

Physical planning can result in value being added to real property through improvements to buildings and their associated infrastructure, or by permitting the change of land use for example from agriculture or forestry to residential or commercial purposes. Physical improvements to buildings make only small differences to the market price in comparison to changes in the permitted use. Sometimes referred to as betterment, the increase in value brought about by formally permitting the change in use of land is often proportionally very large and may be subject to specific taxes. Conversely, there is rarely compensation for “worsenment” when the characteristics of property are adversely affected, for instance by a decision to build a motorway or airport nearby.

Physical planning is primarily concerned with future land use. Land use is the interaction between land rights and land management. It includes the enjoyment of the land and the rights that are associated with it. A prerequisite for the preparation of a development plan is a land-use survey. This should:

- Define the present use of the land;
- Identify changes that are taking place and the rates of these changes, for example in urban expansion;
- Link land-use data to other physical and social data;
- Provide an analysis of areas by quantitative means using a variety of statistical measures;
- Prepare models of change over time and space; and
- Present the results of the survey in a manner that both decision makers and the public at large can understand.

A development plan should encompass the whole area of a community. It should identify the way that all the land should be used and be based on the predictable requirements of the community. The basic outline plan for a given area should then specify:

- Areas to be set aside for building and construction-such works must be in compliance with building regulations;
- Commercial areas for the supply and distribution of goods and services;
- Public areas with facilities for hospitals, schools, churches and cemeteries, serving the medical, educational, religious, social and cultural needs of the community;
- Routeways for local major and minor roads and for long-distance transport, and areas for parking lots;
- Areas for railway and tramway services;
- Areas for utility infrastructure, including the main networks for water, gas, electricity, and central heating;
- Areas for sewage, waste management and refuse disposal, and for waste-water purification;
- Parks and gardens, sports grounds, playgrounds, camping sites, and bathing places;
- Water areas, harbours, areas intended for water management, and areas for coastal and river protection against high waters;
- Landfill sites and mining areas;
- Agricultural and forest areas;
- Environmental protection areas, and sites of special scientific interest;
- Other areas to meet the needs of the community or town.

Once the outline development plan has been approved, a more detailed plan for each local area can be prepared. As with the outline plan, this local area plan should be legally binding. It will define in greater detail than the outline plan such matters as:

- The type of buildings that may be constructed;
- The manner of construction and the position of structures;
- The minimum permitted dimensions of any parcel (width, depth, area) and the maximum size of parcels for housing construction to ensure the economical use of the land;
- The maximum permissible number of flats in any housing unit;
- Areas for the construction of housing that will be completely or partially financed out of public funds to meet social needs;
- Areas for housing groups of persons with special housing requirements;
- The precise boundaries of commercial and industrial estates;
- Areas to remain uncultivated as a reserve for future development;
- Public and private green areas such as gardens, private permanent plots, sports grounds, playgrounds, camping sites, bathing places, cemeteries, etc.; and
- Areas with other purposes in accordance with development plans and other regulations.

C. Land consolidation and reallocation

Land consolidation is a process designed to improve land where the ownership has become uneconomic due to the small size of the holdings. This fragmentation is often

the consequence of a system of inheritance in which the land is divided between heirs. It can result either in many scattered parcels of land belonging to one person (multiplicity of parcels) or else many shares being held by different people in one piece of land (multiplicity of owners).

To manage the land more efficiently, land consolidation may need to be carried out. The owners surrender all their small parcels or shares in the land and are allocated one or more larger parcels that are approximately equivalent in value to their original holding but which can be used more economically.

Land reallocation may occur when the State decides to redevelop an area for the benefit of the wider community. To do so it will need to acquire land and pay compensation either in the form of money or new land given to those who have to be moved to facilitate the development.

Whatever the reasons for land consolidation or reallocation, the initial processes are the same and require the clear identification of all those landowners and occupiers who will be affected. The decision to carry out land reallocation must be published widely so that all who may be affected can be informed. Full publicity is essential and whatever means that are customary for notifying the local community must be used including local radio and advertisements in the local press.

The area to be subject to land reform must be formally defined and the procedures that are then followed must conform to the law. A cadastral plan showing the current state of ownership should be prepared together with a list of all the properties within the proposed development area. The plan showing the current state of ownership should comprise as a minimum the following data on each land parcel: the names of the landowners; the existing boundaries of all parcels; the size, shape and value of each parcel; in the case of urban properties, the street names and house numbers, and any encumbrances and other restrictions entered on the land register.

A basic condition for carrying out redevelopment is an orderly maintained cadastre. In the course of redeveloping a particular area it may be found that, in some cases, what has actually been constructed does not conform with the official cadastral plan of the area. In such cases it may be necessary to redesign the layout, especially in built-up areas, so that new construction can fit in with the position, shape and size of existing buildings. At the same time the cadastral records will have to be brought up to date and in harmony with the actual situation. The prime responsibility for designing the layout for new development areas should lie with the local authority who must at all times work closely with the cadastral service and land registry.

In the process of redevelopment there are the following participants:

- All owners of cadastral parcels in the development area;
- All holders of formal rights including use rights that are recorded in the land registers;
- Holders of rights that are not registered in the land registers, including any claimants to the land, for example claims to inheritance;
- The local authority;

-Contractors who provide public utility infrastructure.

Prior to designing the layout of individual land parcels, the local authority will need to set aside areas for: local traffic and highways, roads including pedestrian paths, access road units, squares and other traffic areas; surfaces for parking lots, green surfaces including playgrounds and environmental protection facilities. After land has been allocated to meet the needs of the local authority and the utility infrastructure contractors, the rest can be distributed either according to the value of the land or to the size of the plots.

Upon completing the discussion with owners and right holders, those responsible for re-parcelling the area should produce a map with textual annexes. The map should show the future layout of parcels in the area, indicating the boundaries and boundary marks for the new parcels and the area of each plot. The textual section should provide complete data on each new land parcel and identify its owner.

Details of the full project should be officially available to the local community, but in addition all the participants should be provided with a project extract relating to their rights. There should then be a designated period, for instance 60 days, during which participants can appeal against the proposed plans. Once this period has expired, and after having settled all possible complaints, the local authorities may then agree that the proposed layout can take legal effect so that construction work can begin.

D. Environmental monitoring and geographic information systems

Every development strategy must recognize that all nations have a responsibility not only for their own environment, but also for contributing to environmentally sound and sustainable development worldwide. Multi-purpose cadastral records can store much environmentally related information. At present, however, such records are rarely maintained within the cadastre and it is difficult to forecast the precise level of investment needed for environmental protection as a percentage of the total industrial investment. Many countries tend to direct their environmental policies at repairing past environmental damage rather than at anticipating and preventing future damage.

In the rural areas, the demand for land for infrastructure expansion often puts pressure on land currently used for agricultural production. Similarly, the need to increase agricultural productivity can also lead to land reforms, including the siting and servicing of new human settlements and the provision of new energy and transport systems. This can result in conflict between environmental and resource management though it can also provide opportunities for environmental improvement and the rational use of resources if there is wise planning.

The cadastre can be used in the preparation of environmental impact assessments and in monitoring the consequences of development and construction projects. All environmental data relate to some point or area of the Earth and can be spatially

referenced and linked to cadastral and topographic maps using geographic information system (GIS) technology.

A GIS is a computerized system for capturing, storing, checking, integrating, manipulating, analysing and displaying data which are spatially referenced to the Earth. Using GIS technology, planners can ask such questions as:

- What can be found at a particular point?
- What can be found within a predefined area?
- Where can a particular feature be found?
- Between two events, what has changed?
- Which is the best route through a network?
- Is there any particular pattern to a set of events?
- What will happen if plan A is adopted rather than plan B?

The quality of answers depends on the quality of the data and the quality of the processing. Some of these questions require factual answers that can be obtained by retrieving data from the database. Other questions can only be answered if there are models, especially mathematical models, to simulate what is required.

Many spatial statistics are as yet unrefined and although models exist, for example to predict the traffic flow along a proposed new road, many models used up until now have proved unreliable. This has in part been because of poor-quality data. Data must be fit for the purpose for which they were collected, both in terms of geometric accuracy and in terms of textual meaning. Experience shows that if the quality of the data is poor even good processing will not put that right. Similarly, good data that are processed badly will increase the risk of bad decisions being made.

The types of analysis and display that are built into a GIS are known as its functionality. The ways in which a GIS can capture, store, check, retrieve and integrate data are part of its functionality, as are its ability to query and analyse data. Examples of functionality include the ability of a GIS to display and analyse all data that fall within an area with a specified number of metres on either side of a proposed road alignment; or to show what area will be flooded and what the landscape will look like if a dam of a certain height were constructed at a specific location.

The applications of GIS technology are many and varied though they broadly fall into four categories:

- (a) Environment: soils and geology; watercourses; vegetation; wildlife;
- (b) Infrastructure: utilities; buildings; transport; communications;
- (c) Legal: tenure; valuation; land use; law and order;
- (d) Socio-economic: health; welfare; population census; marketing.

GIS is an integrating technology allowing value to be added to products and services by linking data from different sources. The solution to many environmental problems lies in stricter land-use control either through legal or financial restrictions on rights to use the land. Such restrictions affect the manner in which land is administered and hence affect the local cadastral system.

E Recommendations

Physical planning imposes restrictions on how the land may be used. The cadastre should be seen as a tool whereby information on the existing and permitted uses of the land can be recorded. A land administration system should ensure that there is easy access, possibly through linked computer networks, to all important data relating to the ownership, value and use of the land. Legislation to control the physical development of land and property should specify how development plans are created and how they are approved. When setting out new land parcels especially when subdividing plots of land and in programmes concerned with land consolidation and land reallocation, the new layout should conform to prescribed standards. The use of geographic information systems (GIS) should be considered when analysing data relevant to the preparation of development plans.

V. INSTITUTIONAL ARRANGEMENTS

This chapter discusses institutional arrangements in support of land administration. It focuses on how countries in transition can learn from the experiences of countries with long-established market economies but with different approaches to public and private sector involvement. It recognizes that organizational structures differ widely from country to country and hence only issues of broad policy are considered.

A. Land policy

Land management involves the implementation of fundamental policy decisions about the nature and extent of investments in the land. It thus involves routine operational decisions made each day by land administrators such as surveyors, valuers, and land registrars. From an institutional perspective, land management includes the formulation of land policy, the legal framework, resource management, land administration arrangements, and land information management. It entails both government and private initiatives.

Land policy consists of a whole complex of socio-economic and legal prescriptions that dictate how the land and the benefits from the land are to be allocated. A balance must be struck between the exploitation, utilization and conservation of the land as a resource in order to obtain the necessary level of sustainable development for the survival of humankind.

It is for this reason that political ideologies focus on land policy and the land administration process. Just as there are different ideologies, so there are different land policies; hence different approaches to land administration have evolved. Even between countries with market-oriented economies there are great differences, especially with regard to the institutional arrangements. The roles of the public and private sectors differ widely, as do the ways of organizing and managing the public sector.

B. Land administration activities

Land administration includes the functions involved in regulating the development and use of the land, gathering revenue from the land (through sale, lease, or taxation, etc.), and resolving conflicts concerning the ownership and use of the land. It is concerned both with private lands and public lands and involves: land settlement; land survey; land registration; land valuation and assessment; land-use control and management; infrastructure and utilities management. Land administration is the process of recording and distributing information about the ownership, value and the use of land and its associated resources. Such processes include the determination or adjudication of rights and other attributes of the land, the survey and description of these, their detailed documentation and the provision of relevant information in support of land markets.

C. Land information management

Land management must be based on knowledge, knowledge depends on information, and information depends on the methods of data collection and the manner in which their results are communicated. Land-related information is an important and expensive resource that must be managed efficiently in order to maximize its potential benefits.

Land information management entails:

- Determining the requirements of the State and of the general public for land-related information;
- Examining how the information is actually used in the decision-making process, how information flows from one producer or user to another, and what constraints there are upon that flow;
- Developing policies for determining priorities, allocating the necessary re-sources, assigning responsibilities for action, and setting standards of performance and methods for monitoring them;
- Improving existing land information systems or introducing new ones;
- Assessing and designing new tools and techniques; and
- Ensuring that matters of privacy and data security are respected.

The International Federation of Surveyors (FIG) has defined a land information system (LIS) as a tool for legal, administrative and economic decision-making and an aid for planning and development. A land information system consists, on the one hand, of a database containing spatially referenced land-related data for a defined area and, on the other, 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, which also simplifies the linking of data within the system with other land-related data.

Land information systems consist of human and technical resources which together with appropriate organizing procedures are applied to the collection, storage, retrieval, dissemination and use of land-related information. They may focus on environmental, infrastructure, cadastral or socio-economic information. They may be designed to serve one primary function, or they may be multi-functional.

Some of the most important systems relate to land, especially the more broad-based systems being developed around the land parcel as the basic spatial unit. The operation of such systems includes the acquisition and assembly of data; their processing, storage, and maintenance; and their retrieval, analysis, and dissemination. The usefulness of such a system depends upon being up to date, accurate, complete, and accessible, and upon the extent to which the system is designed for the benefit of the user rather than for the producer of the information.

D. Organization and management

Governments must play the major role in formulating the land policy and the principles of their land administration systems, including the land legislation and land-related regulations. In doing so they must address a number of major issues, including:

- Intergovernmental coordination;
- Centralization and decentralization;
- Status of the registration offices;
- The role of the public and private sectors;
- Mechanisms to ensure that user needs are met;
- Administration of cadastre data;
- Management of cadastral organizations;
- Management of human resources;
- Research;
- Education and training;
- Consultancies and technical aid;
- International cooperation.

1. Intergovernmental coordination

Every Government delegates the implementation of its land policy to its ministries and departments or to other governmental authorities. In addition it may receive appropriate levels of support from the private sector. The structure of most Governments includes a cabinet or central decision-making body, and a series of ministries. Since land policy concerns social, economic and legal disciplines, several ministries may have an interest in the implementation of land policy. In many countries in transition there are poor channels of communication and limited cooperation between these different ministries. Rarely do Governments have an integrated policy with regard to land or land information management. There is often a lack of guidelines for instance on how to handle copyright and the ownership of data, on pricing policies or who may have access to government-held data sets. Each ministry often makes up its own rules.

In developed market economies there is normally one governmental authority that has the main responsibility for land administration; in countries in transition there are often two, one concerned with agriculture and the rural sector, and the other with urban affairs and construction and development. Cooperation between such authorities depends more on personalities than on policies.

The detailed execution of a land administration system should preferably be supervised by one government department or ministry. The designation of one agency that will be responsible for policy formulation and for the overall control of the land administration system is often a controversial issue since the control of information provides a degree of power to those responsible for managing the system.

Lead agencies often have their own priorities and give less weight to other interested parties. Lawyers can give precedence to conveyancing and legal issues, while land

surveyors are often more concerned with the precision with which property boundaries are surveyed than with cost or delivery times. Tax authorities are concerned with value more than land-use management, while regional planners are concerned more with broad trends than individual technical details. Agriculturists concentrate on the interest of those in rural areas, and town planners on the urban environment. It is therefore important to undertake a thorough investigation of the needs of users and of their relative priorities.

In countries in transition, systems have been driven from the centre and not by the public. Those responsible for the cadastre have not been accustomed to responding to user needs, especially those of private individuals. A lead agency must be seen to be neutral and to take fair and balanced account of the interest of all parties.

Whereas a single organization has much merit, in many countries there are dual systems: the cadastre that records property boundaries and data for tax authorities and a separate legal registration system under the control of lawyers. Such an arrangement can lead to duplication of effort, additional costs, inconsistencies and, hence, inaccuracies in the data, and a danger of confusion resulting in wrong decisions being made.

In practice, evolving national land information systems have often been driven more by the strength of the personalities of those involved than by an objective assessment to determine the best institutional arrangements. In principle, however, the organization that is chosen to lead the land administration system must be able to:

- Meet the needs of all users in both the public and private sectors without bias or favour;
- Develop land information management policies in line with those of the national Government;
- Set and monitor technical standards, especially for data capture, including field survey, data processing and data exchange;
- Provide “methodological guidance” to ensure that all procedures are well understood and new opportunities for improvement are identified;
- Make recommendations for improving the efficiency of all land administration processes in the light of changing circumstances;
- Recommend changes to the law where these will improve the service to be provided;
- Archive data that are needed in the long-term national interest;
- Undertake production work where it is in the national interest for that work to be undertaken by Government, for example where military matters are involved;
- Address matters of personal privacy and the confidentiality of data in order to protect the interest of private citizens; and
- Define the legal liability of public sector and private sector data providers and ensure that title to land is guaranteed.

Provided that such activities are undertaken, it is then a matter of political judgement as to which ministry or institution can best fulfil the lead function. One mechanism for ensuring closer intra-governmental cooperation is to establish a land administration coordination board. The role of such a board would be to ensure coordination in the administration of land and the environment and to develop policies for handling land-related data so that these can be shared as a corporate national resource. Because of the

relationship between information and power, the land administration coordination board should have a strong position within the Government and should ensure that the designated lead agency cooperates with all interested parties. The coordination board should consult with representatives of the quasi-governmental bodies such as the public utilities, and with local governmental bodies, and with the private sector.

The coordination board may establish a technical support group to provide technical assistance for the coordination of spatial information. Such a group would, for example, prepare technical standards for data exchange. It should be multi-disciplinary, drawing on computer scientists, planners, environmentalists and others.

2. Centralization and decentralization

Land administration should ideally be under the supervision of a single authority referred to above as the lead agency. Such an arrangement will guarantee the best possible coordination between the various parts of the whole process.

Detailed administrative operations may be centralized or decentralized depending on the size of the country and the nature of communications. The day-to-day work may all be done centrally or may be delegated to the local authority level or to the private sector.

The lead agency should set and monitor standards and take care of national interests. Centralization can lead to economies in administrative procedures, standardization in documentation and the exchange of information between users, and economies of scale in which large and powerful systems can be used with mass production techniques. Decentralization offers advantages, especially in a country where distances are great or travel is inconvenient. From a political perspective, bringing government closer to the people through decentralization has considerable appeal. From a practical point of view, placing land administration offices at the district or local government level tends to ensure greater accuracy and effectiveness. If these offices are located a long way from the land for which they hold records, then landowners might not visit them. Transfers would then take place without notification to the land administration authorities.

The landowners should feel that the land office is there to serve them rather than to serve government bureaucrats in distant offices. Decentralization should allow the overall land administration process to proceed more quickly and should permit the system to respond more effectively to local community needs.

The greater the degree of decentralization, however, the greater is the need for good communications between the local offices and headquarters and for good management at all levels. If there is only a single central office, care must be taken to accommodate the needs of landowners in outlying areas by providing them with appropriate searching and registration services by mail or perhaps by telephone.

3. The role of the public and private sectors

There are different ways of organizing the administration of land and establishing the status of the offices responsible for the implementation and maintenance of registers. In western Europe, registration offices are in general under central or federal government control. In many cases, countries that maintain separate land registers organize these within the local or regional courts. Where a cadastre is set up separately from the land register, the cadastral organization is usually either a part of the national mapping and surveying authority, or is organized as a special agency.

In several European countries the technical, organizational and legal integration of registers is an emerging issue, as is the status of the organizations that are involved. Several countries have given or are currently discussing the possibility of giving the organizations a freer position within the Government. This development is frequently described as a transformation from authority to agency. The terms “agency” and “authority” have however different meanings under different national legislation. An agency normally has a separate board of directors, and is freer to do business than an authority. The Government’s guarantee and liability for the content of the registers is however not affected by the status of the organization, unless this is prescribed in the legislation. An agency can take advantage of the potential for developing value-added services on top of the basic land administration, for example by selling data to investors, developers, banks, etc. It may be difficult to maintain a neutral and objective role as a governmental agency or authority if it is much involved in competing with the private sector. It is therefore important that Governments define the rules under which such organizations operate and determine which activities should belong to the agency and which should be handled by the private sector.

A proper organizational framework is essential for coordination and cooperation between land administration agencies. To provide a framework for establishing a common approach, a unified land information system should be adopted. This will ensure the cooperation and commitment between agencies, determine the responsibilities for each agency and provide a focus for funding.

One role of the public sector may be to offer its customers a full service covering the entire land administration process, from boundary survey through adjudication and valuation to final registration. It could operate through a single decentralized cadastral authority with separate administrative units.

In practice, many western countries have a tradition of separate governmental institutions involved in the implementation work. This results, for example, in separate inquiries having to be made about rights in land before any transfer can take place. Thus the land registry may record ownership rights but the local authority controls land-use rights and the fiscal authorities control tax obligations that relate to the land.

These diverse administrative arrangements are normally well established politically and historically and hence it is difficult to alter them. Countries in transition have a better

opportunity to adopt a more efficient and customer-oriented approach and to focus on the longer-term developments of land markets once the short-term needs of the land reform programmes are met.

While the ultimate responsibility for the cadastral system must lie with the Government, the private sector may have a significant role to play in land policy implementation. The initial compilation of the registers may be undertaken under contract by the private sector. Technical work, for example, can be subcontracted, from base mapping and control surveys through to the detailed measurement and recording of property boundaries. In many countries private surveyors undertake subdivision surveys or the re-establishment of old boundaries while lawyers are involved in the land transfer process. In countries in transition there is often insufficient capacity left in the public sector for government staff to offer a complete cadastral service, while in many it is the official policy to encourage greater private sector involvement.

Since cadastral data produced by the private sector must stand the test of time, quality controls must be put in place. These may be the responsibility of the private sector itself or of the Government. Where responsibility stays with the private sector there must be a strong professional body that will enforce quality standards, supported by professional indemnity assurance so that in the case of error the customers will be recompensed. Where Government takes over full responsibility for the reliability of the data, checks will have to be applied to the work of the private sector. Depending on the manner in which this is undertaken, such checks can be expensive especially if attempts are made to check all aspects of each private sector task. Sample checks and a sensible understanding of risk management can overcome this difficulty.

In many countries, before private sector companies or individuals undertake work they must be licensed to do so. Legislation must be put in place laying down the procedures to obtain a licence and the parameters within which those who are licensed must operate. An alternative approach is to insist on quality assurance. This is a process whereby all companies undertaking work must be registered as quality assured. They submit details of their work procedures to an agency that will check each stage of the operation to ensure that there are clear directives as to who is responsible for the quality of the work. At present few countries in transition have mechanisms whereby companies can become quality assured and hence licensing is more likely to be adopted.

Private and government sectors can cooperate through joint ventures or undertakings to complete projects of social and economic benefit to the community. Such partnerships may involve some element of financial risk and a commitment to using valuable resources. The profit-sharing should be appropriate to both the level of resource input by each party and the measure of risk of the project. The balance of responsibilities between the public and private sectors ultimately depends upon:

- The political objectives with regard to privatization;
- The distinction between juridical and technical work;
- The nature and traditions of the particular jurisdiction;
- The available funding;
- Questions of access to certain types of data and the need for privacy; and

-The strengths of the private sector.

When deciding on the status of the various parts of the total land administration organization account should be taken of:

- The extent to which the organization should be allowed to influence its own income through active marketing of its services and be allowed to expand accordingly;
- The extent to which the organization should be allowed to borrow money in the regular market for investments;
- The manner in which the organization should implement an independent system of accounting;
- Whether the organization should be allowed to fix its own level of staff remuneration;
- Whether the organization should be authorized to decide on its own internal organization in divisions, etc., and where it should establish offices;
- Whether the organization should have an independent board of directors, or be controlled directly from the political level.

4. Administration of cadastral data

In the society of today great demands are being placed on rapid access to relevant and correct information. The computerized multi-purpose cadastre is a useful tool for the efficient handling of land and property-related data. These data should be looked upon as a strategic resource for development and business. The computerized multi-purpose cadastre is a relatively new concept. It has the potential to provide many benefits across all sections of the community. Therefore it is important that the benefits are widely promoted both to leaders of Government who are responsible for the allocation of resources and to the users of land and property-related information.

In order to ensure the efficient production and use of cadastral data suitable techniques and organizational arrangements for data exchange must be put in place. There needs to be a “market-place” where data of interest can be checked for content, quality, price and conditions of delivery, and where it is possible to order data via an effective communications network.

The data must be collected, stored, maintained and updated economically and efficiently. Data should be registered only once, kept up to date in one place (the most suitable institution) and offered for public use. This will, however, require several separate technical, organizational, and financial measures, which are outlined below.

(a) Data standards and data exchange

Although administrative mechanisms may exist for the exchange of land information between government departments, they may not operate effectively. At a technical level, national standards for the exchange of data will almost certainly need to be established. These should cover the definition of terms used, data transfer formats, data classification, and accuracy standards. Although such standards may be directed towards

the exchange of data rather than towards internal operational procedures, they inevitably change the way that things are done.

There is a need for cooperation between all producers and users of land information. Unfortunately, interdepartmental rivalry occurs in almost every country. Even within a land survey department the cadastral staff may not know or cooperate with the topographic branch. There can be a conflict of interest and lack of cooperation between those maintaining land records, such as a register of titles, those keeping assessment records and those involved in land surveying. Each department has a role to play in the team of land information managers. The institutions that are responsible for the supply of land and property-related data must cooperate both among themselves and with the users in order to produce databases that will suit the needs of each organization.

The management of the cadastre and the effective networking of that system with other organizations depend both on national policies and on continuing resource allocations. An individual department is unlikely to be able to develop a computerized multi-purpose cadastre on its own. None the less, no single Government can operate a land administration system without considering its national implications.

To make it possible for many institutions to use the same data, wherever the data are produced, it is necessary that the meaning of data delivered from one institution to another is clear. For that reason there need to be:

- Methods to describe cadastral data in a precise way;
- Data dictionaries that provide meta-data, that is information about data (what kind of data, background, format and relations to other data);
- Standards for describing the quality of data and its terminology;
- Standards for transferring data from one system to another;
- Tools to store, send and remove data messages.

Although technical standards are very important they are not the only prerequisite for the efficient handling of cadastral data. To facilitate the use of databases for different land management applications, it is necessary to address a variety of administrative, juridical and organizational issues. These concern pricing and copyright, and the security and safety of databases, and the legal liability for data.

(b) Pricing and copyright

Those who bear the cost of producing data should receive appropriate reward. While this obviously applies to the private sector there is a growing recognition that even the public sector should consider charging for some of its services. In many countries, national mapping agencies are being encouraged to increase their revenue through sales and services. Similarly, land registries are being asked to cover their expenses, apart from the costs of the initial compilation of the registers, by charging their clients for the cost of providing the service.

What is an appropriate rate of return is a matter of political judgement but in general the trend is to recover most if not all costs with the aim of making a small profit. Some activities may be deemed to be in the public interest and are therefore a direct charge on the taxpayer. The level of payment made from the public purse should be clearly defined and declared in annual balance sheets and an annual report should be prepared by agencies and made available to the public.

If land information is to be treated as a resource, then there must be access to it by interested parties. In addition to the price charged there are two factors that may prevent the open exchange of data-copyright and security. All land and property-related information, both in text and in map form, may be subject to copyright; hence communicating land-related data to the public may cause legal or financial problems if the copyright laws are to be enforced. In the case of maps printed on paper, some measure of control can be exercised in the same manner as it is with books and other published material. In the case of digital maps, extracts can be made more easily and transferred between systems electronically, for example over telephone lines. It is much more difficult to enforce the copyright law for digital maps than for paper copies. If government policy is to distribute land information freely, then it will be missing an opportunity to recover its costs. If it charges for the data, then it will need to establish mechanisms to control its copyright.

(c) Security and privacy

In some countries, paper maps and aerial photographs carry security classification and may in consequence be unavailable even to other government departments. Difficulties with the exchange of spatial data exist where the ready availability of certain types of land information such as maps and aerial photographs may have military implications.

There may be implicit or explicit regulations governing the access to government-held land-related data by other State authorities and by the public. Data protection acts may also impose constraints on what information may be held or divulged. In some countries, the public may have a degree of protection against the divulgence of personal information, while in others there may be no right to privacy. Some countries have a freedom of information act that allows access to much government-held data. Even in such cases, protection is needed for the land administration system itself.

Those seeking illegal access to databases must be prevented from tampering with the system and, for example, changing the name of the registered owner of a property. Although the problems are technical and differ more in kind than in principle from what has been the case in the past, they are more urgent because of the volumes of data that can be interfered with or destroyed.

The creation and management of land-related databases also raise a number of legal and institutional concerns, few of which have been dealt with in a fully satisfactory way. Intellectual property laws traditionally focused on the medium rather than on the message. In the past it was not possible to copyright or patent data as such; only the

records of those data could be protected. Similarly, legislation tended to govern access to documents, including microfilm and electronic records, rather than to information itself. Recent legal cases have however suggested that this is no longer the case.

(d) Legal liability

As increasing volumes of data become available and are used by both the public and private sectors in support of decision-making, liability for the accuracy of the data may arise. In some countries the State gives an unequivocal guarantee about the data held in the land registry so that if a mistake occurs those who suffer in consequence will be paid compensation. The degree to which civil servants can be sued for negligence depends upon the jurisdiction.

5. Management of land administration systems

The management of a land administration organization includes the establishment and maintenance of good contacts with not only the primary users of a land administration system, but also with the growing group of secondary users and clients. The function of the land administration coordination board referred to above is not only to avoid the development of duplicate systems, creating double work and extra costs but also to be able to realize the potential benefits of any cadastral reform.

Another aspect of management is the creation of good conditions in which staff can develop their skills in line with the rapid technological developments. A third major aspect is the creation of financing facilities that will allow the organization to invest in and develop new technology and new applications as the number of customers increases.

Computer technology today offers excellent opportunities for the automation of the cadastre and the creation of cost-effective land administration systems. The introduction of computers is, however, more than a technical matter since it implies changes in the necessary skills and responsibilities within an organization, the organizational structure, investment strategies and such like. Overall, with the introduction of modern technology, the manager needs to:

- Identify the human factors involved in the transition;
- Define new levels of skill and responsibility for each and every task;
- Consult the staff involved to obtain their confidence and awareness of what is going on;
- Involve any trade unions that will be affected as their opposition can seriously delay progress;
- Plan for a more rapid turn-round of staff who may not wish to stay in the same job for any length of time;
- Revise training programmes in the light of changing needs and the consequences of this more rapid turn-round of staff;
- Avoid recruiting staff who are overqualified, for their frustration adversely affects others;

- Upgrade the education of supervisors, who may have management skills but little understanding of modern technology in comparison with younger and more junior staff;
- Reassess the relationship between what is done in the field and what is done in the office and the linkages between them;
- Check on ergonomic factors to reconcile efficiency with comfort; and
- Monitor the health and safety of the staff involved.

Of all these elements, the provision of adequate training and the development of motivation in the staff are by far the most important.

(a) Staff training

The success of any cadastral or land administration system is dependent on the availability of skilled staff at all levels. Governments must provide the facilities for both formal and in-house training. Training courses must be practical in their orientation, available to all who require training, and range from university-level courses for comprehensive professional training to short-term courses for the introduction of new techniques.

Government policies must ensure that there is an adequate pool of qualified teaching staff who are well skilled in the latest land information management techniques. Attention should also be given to:

- Providing on-the-job training, particularly at the lower skilled end of the industry;
- Providing written information and technical manuals for all levels of operation;
- Promoting national and international exchanges of experts.

Education and training are ongoing processes. Government departments need to bring continuing education into their offices, setting aside time for staff training and development. All too often, promotion to higher positions is based on length of service rather than knowledge and ability. At present, in many countries, staff training is an ad hoc process that is not structured in terms of each individual's career development.

In many countries in transition the previous education in schools and universities, when it comes to surveying and cadastral topics, has been aimed at a situation quite different from what exists in a free land market. Although it might affect the total skills on the market only in a long-term perspective it is very important to review the curricula of schools of surveying. From the point of view of countries in transition, training especially in land and real property valuation should be given new direction. The education at universities and at other levels including technician training should be restructured. A rapid rise in competence inside the university system could also be the best way to create training centres for people already in the profession.

(b) Management training

The single most important factor in the success or failure of land administration systems has been the quality of their management. Management is concerned with organization and methods, with policy and planning, with monitoring, modelling and motivating. It is concerned with listening, with analysing, with decision-making and with communicating. Managers must address matters of policy, of institutional arrangements and the consequences of reorganization and change that are inevitable in the implementation of cadastral reform.

Managers must set reasonable targets for the performance of their staff and be able to monitor their success. They must understand the processes of marketing so that they can persuade their political and financial masters of the need to invest in and sustain the new techniques and technologies that are available. They must further recognize that personal power and status result from the control of information.

Managers must understand that management is not only how to do the job but, more importantly, about how to get the job done.

Management training, especially for top managers, is common in western countries. Most large organizations insist that their senior staff and executives are properly trained in the skills of management. Similar training is needed for staff in transition countries-at all levels of management from senior, through middle to junior. Management training should be an integral part of continuing professional development.

Whereas some people may never make good managers, many can improve their performance, and hence the performance of those whom they in turn manage, through greater awareness of the issues. All too often, management skills are treated like parent-hood as if by instinct and observation anyone of calibre can become a manager without training.

If land administration systems are to be improved then the first place to start is by improving the management training of those whose responsibility it is to run such systems.

6. Research

Research must encompass all facets of land management, ranging from the purely technical to legal, social and economic issues. It also requires close coordination across the varying professional disciplines and needs to be directed towards affordable and appropriate technological solutions. It is essential that society should allocate resources to this end.

In countries in transition the current research efforts are often not focused on critical issues facing land reform. As the computerized multi-purpose cadastre introduces new techniques it is important that the universities update their education systems. Within

the field of cadastral data maintenance there is a great need for research and development.

7. Consultancy and technical assistance

In many cases, the development of an appropriate land administration system for a transition country may require assistance from international experts. Bilateral long-term institutional cooperation between sister organizations in west and east is recommended. Surveying consultants can provide technical assistance, advise on appropriate technologies and implement training programmes for local staff. Technical assistance may take the form of providing hardware and software as well as advising on strategic planning and the development of a proper land information management framework. In a similar way, legal consultants can provide assistance and advice on appropriate legislation and other legal matters.

E. Recommendations

Every Government must show a commitment to ensuring the provision of an adequate supply of land by enacting and implementing a comprehensive land policy. Transition countries looking for solutions to institutional problems should study, compare and analyse different approaches to land administration and identify the best elements that are relevant to their own unique circumstances. Key politicians must be involved in selecting the best system for their country as their support is essential to the establishment of sound land policies and the creation of an appropriate land administration system. Each Government should ensure that there is inter-ministerial coordination of land information. It should define a lead agency responsible for policy formulation and for the overall control of the cadastral and land administration systems. Governments should organize the implementation of land policy in a cost-effective way, focusing particularly on the needs of landowners. In many countries a single decentralized authority will be the best solution. The amount of cadastral work that the Government contracts out to the private sector is a matter of political will and the strength of the private sector. The resources of the private sector can be used both in the introduction and in the updating and maintenance of a land information system. Where the private sector is involved, mechanisms must be put in place to ensure the competence of private practitioners and to assure the quality of their work. There should be a clear definition of those parts of the total land administration that must be undertaken by governmental offices, and those activities that should be left to the private sector. The land administration system should be developed in a way that will be compatible with the technology of tomorrow. Managers and staff are the key to successful land administration. They must be well motivated and well trained. Governments in transition countries should undertake research in support of land reforms. They should review educational programmes to ensure that they meet the needs of land reform and cadastral development.

VI. TECHNICAL MATTERS

This chapter provides an overview of the relationship between modern geodetic control networks and the cadastre. Even for cadastral purposes an integrated network covering the whole of the country is needed. This should preferably be linked to a global referencing system. Within that framework a variety of procedures may be adopted to survey the boundaries of properties. The records of the surveys together with data about the ownership, value and use of the land can then be entered into computers. This chapter examines aspects of surveying and mapping and of electronic data processing.

A. Control surveys

The classic approach to land surveying and mapping begins with the establishment of a geodetic control framework. Geodetic control measurements make an efficient and effective basis for cadastral surveying and land registration. They also support other surveying and mapping activities including geodesy, cartography, engineering surveying, geophysics and the measurement of tectonic movements, and navigation.

The establishment of a geodetic reference system guarantees the geometrical consistency of all surveying activities within a well-defined coordinate system. Such a geodetic reference frame should consist of both horizontal and vertical control points, although for most cadastral purposes a two-dimensional representation of these points is all that is necessary.

If possible, the network should be connected to a global geodetic reference frame. It should be highly accurate and reliable with points sited in areas that are free from slope instability and tectonic movements. Finally, it should be based on an appropriate map projection system together with a suitably defined reference surface such as a reference ellipsoid.

The establishment of a geodetic framework is generally regarded as the responsibility of a national survey organization. Recommendations and guidelines for the establishment or the updating of an existing national reference frame have been provided by several international geodetic and cartographic organizations, for example the European Reference Frame (EUREF); and the Unified European Levelling Network (UELN), both of which are commissions of the International Association of Geodesy (IAG). Additional work has been undertaken by the Comité Européen des Responsables de la Cartographie Officielle (CERCO). On the basis of these recommendations all European nations should be able to establish an international three-dimensional reference frame. EUREF has been extended to most parts of eastern Europe and provides a base for further economic and scientific developments.

A great number of international projects depend on cooperation in surveying and mapping, for example navigation, traffic, common border crossings, technical projects

and so on. EUREF provides a link between existing national control networks and the rest of the continent.

In most European countries the national reference frame is characterized by a datum that was defined a long time ago, together with a network of control points the locations of which were selected to provide a strong geometrical framework with good inter-visibility between neighbouring points. As such the networks did not necessarily provide points that were convenient for surveying cadastral parcels.

In most cases the old geodetic control will not be accurate enough to meet modern needs. In some cases it is possible to upgrade the old system by making some additional measurements and by using modern computers to carry out the necessary readjustment. This will often meet the needs of cadastral surveying and of future geographic information systems and may well be the most economical way to proceed.

For modern purposes, the local national reference frame should be compatible with the international network. The high accuracy of modern geodetic measurement equipment using electronic distance measuring devices or the global positioning system (GPS) can be lost if measurements are connected to old networks. The global positioning system is a satellite-based system for determining position and for navigation. Part of the system is controlled by the United States Department of Defense, whose main function is to support the military. As a result, there are restrictions for non-authorized users. An alternative system, GLONASS, has been established in the former USSR and is based on similar principles.

In order to improve the quality of old survey networks, the original observations may need to be recalculated. After the readjustment, unacceptable discrepancies of some decimetres or even metres between the old and the new solutions may appear. It must then be decided whether a recalculation of the whole of the network, including all the cadastral points, is necessary. This decision is a very important one and should not be taken without considering the costs and benefits.

The international trend is towards solutions of high accuracy, approaching one centimetre, in order to take advantage of new measuring equipment and techniques, and for scientific reasons. The alternative is to accept lower accuracy and precision and to use more sophisticated algorithms and less economical procedures. The manpower and investment costs of a full recalculation have to be set against the uneconomical consequences of continuing to work with the old data.

Although global positioning systems are able to give reliable position information without delay, it is generally accepted within the international geodetic community that physical monuments are still necessary as these can be seen and understood by landowners and ensure that cadastral surveys can still be undertaken even when GPSs are not available.

The most important application of GPS in geodesy and surveying is in determining the relative positions of points. An overview of the system follows below.

1. GPS technology

The global positioning system consists of 21 satellites plus 3 active spares. These 24 satellites circumnavigate the Earth in six orbital planes, each containing four satellites. The signals from these satellites are then picked up on the ground by mobile receivers whose positions can then be calculated.

There are five worldwide ground control stations that are responsible for determining the orbits of the satellites. They can also introduce signal degradation and code encryption, both of which affect the accuracy that is obtainable by non-military personnel. Signal degradation can be produced by manipulating the satellite clocks or by truncating the transmitted messages. This procedure is called “selective availability” (SA). When selective availability is introduced, the point positioning accuracy decreases from 15 to 120 metres or more. This may happen during times of international conflict when the military want to restrict access to the determination of precise positions. The implementation of code encryption is called “anti-spoofing” (AS) and has been developed to prevent adversaries from sending out false signals with those coming from the GPS satellites, thus confusing combat troops fighting on the ground. Anti-spoofing only affects high-precision measurements.

There are many different types of GPS receiver, each serving a particular function and producing a particular level of accuracy-receivers for navigating boats, for example, are less sophisticated than those needed to establish geodetic control points. Using two receivers simultaneously on different sites results in a higher relative accuracy than using a single instrument, because of the influence of the satellite clock and the effects of the atmosphere. A pair of instruments will both be affected by the same amount but the relative difference between them should be free of errors. The use of two or more instruments can provide relative coordinate differences with an accuracy of a few centimetres within only a few minutes. For high-precision applications, the techniques can be refined to produce accuracies of some centimetres or even millimetres. To achieve this, two or more receivers are kept stationary while observations are taken over a period of half an hour to several hours.

The data collected have to be post-processed, that is they are subject to later analysis and computation. The application of this technique is widespread and has been used for continental and national horizontal control networks as well as for geodynamic investigations.

Although relative positioning is the best method for geodetic applications of GPS, the choice of an optimal hardware configuration is strongly correlated with the size and the accuracy of the geodetic project.

2. GPS and cadastral surveys

GPS techniques are excellent for nearly all types of geodesy and surveying. The available hardware is supported by highly sophisticated forms of software that can be extended by scientific computer programs for special tasks.

Through the use of baseline, multi-station and network adjustment procedures it is possible to combine GPS with conventional measurements providing a more flexible solution to a variety of survey problems including the cadastre. The results are highly accurate as well as highly consistent and, provided that a sufficiently large number of points are to be observed, the techniques become cost-effective.

In Hungary, for example, GPS was used to establish a new network of control points that would be suitable for cadastral surveys and base mapping. Prior to the commencement of the work, a manual was compiled giving guidance on GPS operational procedures. Regulations were laid down for: planning the network; reconnaissance and selection of sites; planning the field observations; performing the calibration of satellite receivers; performing the field observations and field check computations; handling and archiving the measurements; final network adjustment and analysis; requirements for configuration of sites and satellites; length and timing of observation periods; values of deviations and errors permitted at different levels of the observation and computation phases. The estimated cost, time and effectiveness for increasing the number of control points showed savings of up to 50 per cent when using GPS as compared with traditional techniques. The accuracy was no worse than that obtained by traditional Hungarian methods and it was possible to use the system in all weathers, unlike traditional methods that are fully dependent on the weather.

Thus although there is a significant capital outlay for both equipment and data processing systems, the Hungarian study shows that GPS can be applied directly to cadastral problems and can produce high-quality coordinate values for property boundary beacons.

B. Cadastral surveying and mapping

At their simplest level, cadastral surveys are concerned with setting out and recording the turning-points or corners along property boundaries. A variety of techniques may be used, each having its own inherent accuracy and cost. Many cadastral surveyors are accustomed to thinking in terms of precision when doing their job and in many countries have been less concerned about the cost or the time that it takes to achieve the standards that they perceive as necessary. The necessary and sufficient accuracy that is needed for any survey depends on the purposes for which that survey is conducted. When the accuracy is defined, different methods of achieving it can be considered. If the cadastre is to achieve its aim of being a support for land management and possibly land taxation, it should be established according to the same general principles throughout the whole country. This does not however mean that all areas must be surveyed to the same precision, since the requirements will be different in different areas of the country. In

cities a precision of between 0.1 and 0.3 metres may be required while in rural areas 1 to 3 metres may be sufficient. In some areas, for instance where the land must be registered as speedily as possible in order to meet social and economic objectives, lower precision may be required in order to permit the use of more rapid survey techniques. If the monuments that delimit the boundaries are suitable and relatively permanent, the need for precision in the survey is also low. Relative accuracy matters more than absolute accuracy. It is more important to know where a boundary beacon is in relation to other nearby boundary beacons than it is to know the precise scientific location of points relative to the other side of the country.

Almost all generally known techniques in surveying can be employed for the purpose of cadastral renewal. These include both field survey techniques (using steel tapes, theodolites, total stations, GPS, etc.) and air survey methods. Photogrammetric techniques are a powerful set of tools for documenting, interpreting and surveying large areas. The advantage of using such techniques instead of ground surveying is that they save time and money. They can be used to increase the density of control points as well as to measure property boundaries, provided that whatever is to be recorded can be seen on aerial photographs. While it is self-evident that such techniques cannot be used for setting out points on the ground, they can record the physical evidence of what has been set out, for example the lines of hedges and fences or the location of points that have been 'pre-marked', that is marked on the ground in such a way as to make them visible from the air. They can also be used to determine land use and to collect topographic data.

In Austria, for example, there are three main applications of photogrammetry. Firstly, it is used in the preparation of land-use maps in areas of agricultural land where the soil quality needs to be determined. This is important information for the Ministry of Finance. Secondly, it supports the digital cadastre since high accuracy and completeness are easily attainable. Thirdly, it is used to measure new buildings or buildings which have changed. In Sweden extensive use is made of orthophotography for base mapping. Orthophotomaps have similar measurement characteristics to topographic maps but have the appearance of an aerial photograph. Such maps can be used both as index maps for a whole area and as detailed diagrams for particular land parcels provided that the boundaries are visible from the air, such as hedges or ditches.

Photogrammetry should be regarded as just another set of tools in the surveyor's trade. The choice of the most appropriate survey technique should be determined by the basic objectives, economic matters, the available resources and by the urgency of the demand.

The overall quality required for cadastral surveys should be laid down by the central surveying authority, which should determine the rules, standards and basic principles for:

- Examination and evaluation of basic material;
- Quality improvement of the available maps;
- Bringing together the available basic material;
- Acquisition of the current data;
- Connection of the current data with the existing data.

The central authority should also lay down standards and procedures for the allocation of land parcel references. The design of the system of land parcel identifiers is an important part of the overall system design. A country is not always free in designing these identifiers, as they may be limited by previous or existing systems. Renumbering may be cost-effective in the long run if existing identifiers do not meet present requirements.

For cultural reasons, some countries assign priority to protecting existing names as part of their system of land identifiers, even when this is clearly not the optimal solution. Identifiers should clearly identify the relevant land parcels or other real-estate units. Identifiers should be unique, stable over time, and practical to handle both in analogue form and in digital form. They should, if possible, be easy to remember for persons directly affected such as landowners, but this may be in conflict with the other requirements. To be stable, identifiers should not contain information which can change over time, such as the type of land tenure, land use, etc. Even reference to a local administrative unit (municipality, etc.) may require renumbering if district boundaries are moved. Street addresses should not be used to identify properties, as street names can be changed. If the legislation allows strata titles so that structures above or under the surface can be registered as separate properties, such properties should be assigned unique identifiers that will not be altered even if the surface land is subdivided. It is preferable to implement pure numeric identifiers linked to district numbers that should also be unique. Districts which are too small can be in conflict with the requirement for stable identifiers. When applying computerized registration systems, numeric identifiers may contain a control digit which automatically checks that numbers are correctly entered into the system.

C. Electronic data processing for land administration

A land administration system provides important information for government, for the economy and for every single citizen of a country. Both semantic information as well as graphic information are required. The creation and maintenance of an automated cadastre is both time-consuming and costly. It requires attention not only to technical details, but also to legal, organizational and economic matters.

1. Determining the objectives

In each country, the type and the extent of electronic data processing employed will depend upon how the maintenance of the cadastre is organized. There will be different solutions depending on whether there is a cadastral organization already in existence or whether a new one is to be created. It also makes a significant difference whether the cadastre is a comprehensive public register rather than a collection of certain documents such as contracts and plans with other material stored in separate archives. If the cadastral data are linked, for example, to the land registers, then computerized systems can provide highly efficient ways of accessing and integrating the data.

In setting up a computerized system it is necessary to determine:

- Which conventional records, registers and plans are to be included;
- How these relate to other applications such as land registration, taxation, area planning, community tasks, etc.;
- Where, how and by whom the maintenance of the data will be done;
- What conditions of access will be needed by different users, such as the office hours for clients, standardized and specific inquiry forms, delivery of data carriers, delivery of update material, direct access, etc.

Certain legal, organizational, and financial limitations may occur or there may be technical impediments, for example the lack of an overall supply network. These may necessitate the development of the system in a series of stages or phases in order to achieve the defined objectives. It is however recommended that the final form of the computerized cadastre should be defined at the start, even though at first only a partial implementation can be achieved.

The common methods that are used for the systematic development of information systems should also be applied when setting up a computerized cadastre. A detailed strategy for electronic data processing should cover: the systems design; the creation of digital data sets; the provision of equipment for the data processing centre; the determination of forms of access to the data.

2. The systems design

The performance of the computerized system and its conceptual realization will be dependent on its design. In practice, not all theoretical solutions will prove to be useful or successful for a cadastre that contains numerical as well as semantic and graphic data. Even with the current state of technology, it will be necessary to compromise between what is desirable and what is practical.

The use of geographic information systems (GISs) that link attribute data to the graphic data, may be advantageous for small areas. Experience indicates, however, that the employment of traditional hierarchic and relational database systems will often be better for:

- Storing and maintaining non-graphic data;
- Large regions;
- Frequent access to defined attribute data such as standard inquiries;
- Competing and fast update operations; and
- Nationwide direct access.

3. The creation of digital data sets

After identifying all the available conventional records, registers and plans that are to be incorporated into the system, and after determining what data must be made available for other applications, the data elements to be collected will have to be determined. There are different methods for the actual digitizing when:

- Filling in forms for data typists or machine reading;
- Entering data on-line;
- Undertaking machine digitizing (scanning, pattern recognition);
- Using available digital data.

4. Procurement of hardware and software

At the heart of the computerized land administration system there will be a processing centre that must be equipped to meet the requirements of the systems design in the most efficient way. The range of systems may extend from a single personal computer (PC) or a multi-PC system through to a series of interconnected processors on different systems levels. The hardware, the software including the database software, and the communication equipment all have to be evaluated and the optimum configuration selected. Furthermore, the procedures to be adopted and the requirements for data security and data protection must be defined.

It is important to employ qualified personnel who have been adequately trained. Operating the processing centre, or in the case of “small solutions” the local computer network, could be carried out separately at a different place.

5. Forms of access to the data

Up until now, within existing manual systems, data have been maintained in analogue form, usually at administrative offices where there is some degree of public access. The clients' access during office hours has been limited to a visual inspection of the registers with copying in longhand or by photocopying. Computerized data processing creates a number of opportunities to improve access to data by providing, for example more convenient times at which to access the data. The facility can provide considerably faster and better defined access to data. It is also possible to deliver and distribute the data via printers and plotters, perhaps also via data carriers. Access to large quantities of data allows different forms of data evaluation. A cadastre supplies many systems with basic data.

For certain groups of users, a computerized land administration system offers the opportunity for direct and immediate consultation with official personnel. The quality of what the user receives is then improved.

The forms of access that are provided must be oriented towards existing needs. This demand must be met with regard to the contents as well as in technological respects (transfer medium, data networks). It should however be borne in mind that the users

benefiting from such optimum systems will have to contribute to pay for the increased costs.

6. Cost-benefit analysis

It is known from experience that the process of digitizing the data for a nationwide digital cadastre is expensive and takes a long time. The investment costs and the costs of running the system should not be underestimated. Therefore, it is important to draw up a cost-benefit comparison before embarking on computerization.

The employment of information technology should not be restricted to using the data elements for a single application or only one sphere of work. They should be used to achieve an optimum benefit through interdisciplinary employment and the solution of a wide range of problems.

In view of the benefits of introducing information technology to the land administration system, the aim should be not merely more economical maintenance, but also to create greater use for the important stock of real-estate data. Databases that have been created under these conditions and that are called real-estate databases, show excellent cost-benefit ratios.

D. Recommendations

The establishment or upgrading of a geodetic control network is necessary to ensure that all land and property-related data can be spatially referenced. In central and eastern Europe, survey authorities are encouraged to link their data to the European Reference Framework. A uniform and unique spatial referencing system for the identification of all land parcels and other real-estate units should be introduced. Modern techniques of surveying are often capital rather than labour-intensive. The methods used to survey land parcels and other real-property units should be cost-effective and depend on local circumstances. High-precision surveys are often unnecessary provided that there is suitable monumentation of real-property boundaries. Photogrammetric techniques including the use of orthophotography are suitable for the compilation of many cadastral index maps. They can also be used for detailed property surveys provided that the features to be mapped are clearly visible on the aerial photographs. The computerization of land and property records poses institutional as well as technical problems. Governments must address the institutional every bit as much as the technical. In setting up a computerized system it is necessary to determine what records should be included within the system, how they relate to other records, how access to the records will be provided, and how the records will be kept up to date. The cost and time involved in building a computerized land administration system is considerable and its full implementation may take many years. Data conversion alone is relatively expensive. The costs should not be underestimated.

VII. PROCEDURES FOR INTRODUCING A LAND ADMINISTRATION SYSTEM

A land administration system involves the determination and recording of up-to-date information about rights in land. It must operate within both a technical and institutional framework and address not only the mechanics of setting out, surveying and recording land parcels but also the legal, financial, administrative, social and political issues that are associated with the management of land.

A land administration system does not necessarily have to be computerized. Many such systems are increasingly making use of computer technology but the fundamental problems are of an institutional rather than a technical nature. This chapter suggests a methodology whereby an efficient and effective system can be established. It lists a series of operations which, although they may not be carried out precisely in the sequence suggested, must all be addressed at one time or other.

A. The determination of user needs

A land administration system is in part an administrative system that must meet the needs of good government. It must also address the requirements of non-governmental institutions and the general public. Before altering an existing system or introducing a new one, it is essential that the requirements of those who will use or benefit from the system are clearly identified. This means that a wide variety of user communities will need to be consulted in order to understand their requirements and the constraints under which they currently operate. In many cadastral systems that have been based on the old Russian model, a great variety of data was collected, much of which is no longer needed for a market-driven economy. Farmers, for example, are often the best people to determine on the ground the optimum use of their land rather than administrators who dictate what is best from a central government office, remote from the fields concerned.

The assessment of user needs should be made not only at the outset of the development of a new land administration system but also throughout its lifetime. In many countries in transition, land reform and the introduction of new land administrative procedures were devised for the benefit of agricultural communities without their impact on the urban environment being considered. Yet legislation that is prepared for rural land will inevitably have an impact on urban and peri-urban areas.

Part of the process of determining user needs should involve a review of the procedures whereby land policy is formed and how land as a resource is managed. It should examine present management structures and their supportin,0 management information systems, making inquiries at all those ministries and departments that deal with land. A number of questions need to be asked on matters of policy, including:

- Which ministries are responsible for formulating land policies?
- Which ministries and departments are concerned with implementing land policies especially those that relate to land reform?

- What policies currently exist and are they in practice being implemented?
- What mechanisms exist for monitoring the implementation and consequences of land policies?
- Are urban policies integrated with rural policies?
- Which ministries are currently responsible for recording land ownership and which for recording and controlling land-use rights?

In addition, a number of questions need to be asked about the categories of data that will in future be required such as:

- What information do planners and land managers require?
- Which government ministries and departments use land-related data? Which of these are providers of data and which are data users?
- Are any taxes based on the value of the land owned or is any tax imposed when a property is sold? If so, on what basis is the value of the land or property assessed?
- Who in central and local government will require access to land-related data? What types of data will they require?
- What quasi-government and private sector institutions such as banks, finance companies, surveyors and valuers will require access to land-related data? What types of data will they require?
- What members of the general public-private citizens, farmers, property developers, etc.-will require access to land-related data? What types of data will they require? How much are they willing or able to pay for the data?

From the analysis of needs it should be possible to determine priorities. While it may seem desirable to acquire some types of data for instance for the benefit of historical research that may be conducted at some time in the future, every single data item is expensive to capture and to store and its collection adds to the delay before the national archive is complete. It may be an attractive idea to collect some types of data for some possible use in the future but if it is not necessary to do so at present, then few resources should be allocated for that purpose. A step-by-step approach may be more cost-effective.

B. The creation of new administrative and organizational structures

The introduction of a new land administration system often necessitates internal reorganization within specific departments or units. A balance must be struck between central control and decentralization of the service to the public.

In countries in transition it has been usual for a new department to be created, often within the Ministry of Agriculture since the priority has been the restitution of agricultural land. There are several other possible ministries that could take on the role of lead agency, given the importance of accommodating both urban and rural interests. The selection of a lead agency is a contentious and difficult task involving inter-ministerial rivalry. It is often resolved more by the quality of the senior managers than by issues of principle. The analysis of user requirements should indicate the most sensible choice.

While it may seem obvious to involve those responsible for the old cadastre this is not necessarily the best solution in countries in transition, since the old system usually contains data that are no longer required within a market-driven economy. In many old cadastral systems, productivity was low and the system was under-resourced and unresponsive to user needs. Although significant improvements to old cadastres are often possible through improved management and administration, the organization that has managed the cadastre in the past is not necessarily the best candidate for managing the new system.

It is essential to choose an agency that can work with other ministries at both the technical and political level. There will be a need for cooperation over who collects and coordinates data, what technology should be acquired so that all components of the system are compatible, how common standards and procedures can be developed, and other system-related decisions. To achieve this, the agency must operate at a high political level, preferably close to the chief minister's office.

Those who ultimately are given responsibility for running the land administration system will need to communicate both vertically (to higher management and political levels and to staff) and horizontally (to other departments, organizations and users). This will be especially important during the initial stages of developing the system. Only through communication will voluntary cooperation be achieved, although cooperation may be enforced to a limited extent through legislation or policy. The lead agency will also need to work with a variety of professionals and associations who will be directly involved in the collection and use of the land and property-related data including lawyers, land surveyors, planners, and valuers. Efficient and cost-effective methods for the maintenance and updating of the system are essential. As the land administration system develops, there will probably be changes in standards and procedures that closely affect these groups.

Since the new system will entail extensive changes in land tenure, conveyancing, and land registration procedures, it is essential that the legal profession, in particular, understands the benefits that the system can offer and supports the initiatives. Thus in setting up new organizational arrangements it is essential to:

- Select a lead agent that can work across existing ministerial boundaries;
- Ensure ongoing political support from both senior managers and members of the legislature;
- Recruit new staff into the organization with skills appropriate to its new technical, legal and administrative tasks.

The last point is important since the present levels and skills of manpower involved in any one agency may be insufficient. Existing government policies with regard to manpower and the balance between capital and labour must be respected. It may be necessary to create new opportunities for staff development and to allocate resources for retraining all staff including managers. It is, for example, unlikely that in the early stages countries in transition will have sufficient skills in market valuation. Furthermore, the change to a market-driven economy requires significant changes in management style.

Similarly, many people trained in land management may feel uncomfortable with modern technology. Conversely, many systems analysts and computer technicians do not have an in-depth understanding of land tenure.

The new agency must work within a business framework, setting annual targets for its performance so that it can meet the objectives of land reform in a timely manner. It will need to establish new cost-management procedures to ensure that it can meet these objectives and adopt cost-recovery procedures that will ensure its continuing support by the Government and any funding agencies. It will also need to set in place mechanisms for monitoring the impact of land reform, by providing information on such matters as: the performance of the real estate market; fluctuations in land and property prices; the extent to which land-use controls are being enforced; the availability of land for development; and the environmental impact of the land reform programme.

C. The preparation of new legislation

A land administration system must operate within a legislative framework that covers:

- Basic land laws defining what rights and tenures exist including easements and overriding interests, and how these rights are transmitted through sale, gift or inheritance;
- Land registration and what rights are to be included, for instance short-term leases;
- Procedures for the initial creation and determination of rights in land, for real estate formation, re-allotment etc.;
- Laws regarding transition arrangements including compensation where cannot be fully restituted;
- Mortgaging of land and property;
- The conduct of surveys and the regulation of surveyors;
- The use of land including controls stemming from physical planning;
- The status of evidence produced by electronic media; and
- Data protection.

Since legal reforms often take years to accomplish, the land administration system should as far as possible be designed to be independent of legislative changes once the initial legal framework has been put in place. The United Nations Economic Commission for Europe has already prepared a “Guide on the adaptation of property laws in the countries of central and eastern Europe including questions of ownership, valuation, security and restitution” (TRADE/WP.YR.13). In addition to the issues raised therein, consideration should be given to:

- What constitutes the root of any title?
- Under what circumstances can new land parcels be created?
- Will leaseholds be registered and if so what short-term leases will be included?
- Will the State guarantee title to land?
- Should there be a legal requirement to register any sale, gift or other transfer of rights in land, in whole or in part?
- Will there be a central register or will there be local court registers of deeds and other documents that relate to the ownership of rights in land?

- Is there a system of local land charges covering such matters as: planning restrictions imposed by local municipalities; orders designating specific types of land use; and compulsory purchase orders?
- Are strata titles (relating to the ownership of apartments, etc.) to be recognized?
- What rights exist below ground level such as mineral rights?
- Is there to be a formal procedure for the adverse possession of land?
- Is there a statute of limitations, that is a law that limits the time during which claims can be made, and if so how does it affect land rights?
- What procedures are to be followed when a landowner cannot be traced?
- Will there be a formal requirement to monument property boundaries?
- What procedures will there be for resolving disputes over land or boundaries'?

Most of the answers to these questions need to be brought together within a single clear and simple code of land law together with a set of rules that cover procedural matters.

D. The adjudication and determination of rights in land

Laws and procedures must be put in place to determine who owns or will own what areas of land. The first registration of rights in land starts with an analysis of old records, though these may not reflect what is now on the ground. In such cases it may, therefore, be necessary to hold public hearings and to take evidence from occupiers and other interested parties on the ground before agreeing to restore old rights.

Where land cannot be restored then either an alternative site will need to be identified or else compensation may be offered. In either case there must be clear laws that lay down what procedures are to be followed. Similarly, where land that was formally held by the State and is alienated, that is, it is taken away from State ownership and given or sold into the private sector, then formal procedures for demarcating the land and for allocating new land rights must be followed.

Two approaches may be adopted: a systematic approach in which all the land within a designated area is brought onto the land register at the same time; or a sporadic approach in which registration takes place on demand. The former is more cost-effective when carrying out initial registration but it requires powers of compulsion to bring land onto the register. The latter can be used selectively but in the long run it is more expensive. When the registers are complete, their maintenance will inevitably be done on a sporadic basis since the system will be driven by the land market.

E. The surveying of land and property boundaries

The surveying and mapping of property boundaries will normally be linked to a network of geodetic control points. Although this is not essential in the short term, the long-term advantages of such an arrangement are considerable. The geodetic network must be able to support base mapping and serve as a framework for referencing spatial data. Additional survey control points may be required at the local level in order to integrate

surveys and to improve and provide coordinate references for parcel information. The application of new technologies, such as GPS, should be assessed from an economic rather than a technical perspective. Provisions must also be made to accommodate future changes in the network that may occur as a result of technical improvements. These may affect all coordinate based systems, including parcel references where coordinates are used.

Appropriate methods for surveying property boundaries should be chosen provided that they are consistent with the methods whereby existing land parcels are described and referenced. Thus if coordinates are an essential component of the cadastral system then the survey technique must be capable of producing these either directly or indirectly. The survey of property boundaries is essentially a long-term investment since once the land has been registered the measurements of the boundaries are only likely to be used in cases where there are disputes over the land. The legal position as shown in the records must be related to the evidence on the ground. In many systems the evidence on the ground is considered paramount.

A key component in any land administration system is the parcel identifier or unique parcel reference number. This acts as a link between the parcel itself and all records related to it such as legal documents, valuation or assessment rolls. It facilitates data input and data exchange. The choice of a suitable referencing system should be based on such considerations as user familiarity, simplicity, flexibility, suitability for data storage, uniqueness and ability to be updated. The parcel reference number should appear on base or index maps that will help the public identify their land in relation to their neighbours. Index maps should be compiled both as reference for cadastral information and for efficiently integrating environmental and other information.

The base maps must be at scales large enough to depict property information, with displays at 1:1,000 or 1:2,000 often being required where parcel sizes are small and the amount of detail is large. Orthophotomaps, rectified photomaps, or planimetric maps may be used depending on the user requirements, cost, and timing among other factors. These maps will be in addition to any cadastral data that may be held in digital form. In designing an appropriate cadastral survey and mapping system consideration should be given to:

- The way that boundaries are marked on the ground and whether they are always marked out, for instance in residential “open-planned” estates;
- Whether boundaries are visible from the air so that photogrammetric methods can be used, assuming that photographic evidence is acceptable in a court of law and there are no military restrictions on the use of aerial photography;
- What social attitudes to boundaries exist and who is responsible for the preservation of boundary marks;
- What penalties exist if boundary marks are disturbed;
- Whether there is any legal requirement for land parcels to be surveyed and if so, who and what determines whether a survey is to an acceptable standard;
- What accuracy standards are to be laid down and how are they to be monitored;
- How survey data should be stored and retrieved and whether the field notes of surveyors are to be treated as legal evidence;

- Whether microfilm copies of survey records will be maintained along with back-up copies of the evidence of title to land;
- The average overhead costs in money and time of different techniques of cadastral surveys;
- The educational and training levels and skills that are available;
- The scales and content of cadastral maps and plans that are to be produced either as index diagrams or for the precise record of parcel boundaries;
- The legal status of maps and plans kept within the land registration system;
- Restrictions governing the maximum and minimum sizes of land parcels, and details such as road reserve widths and plot frontages that must conform with building and development control regulations;
- How complete and up-to-date is present land-use mapping;
- The present state of public utility mapping both under and above the ground, including the records of easements for pipelines;
- The procedures and standards for digital data exchange, including those for graphic and alphanumeric data.

F. The management of land information

The management of an up-to-date land administration system inevitably involves the use of modern information technology. Conventional solutions may no longer apply and the new system may involve the fundamental restructuring of the existing cadastral services and the scrutiny and analysis of every part of the system. The result of this process will be the first step towards a national land information system. Since the system will take several years to develop, it is susceptible to political and institutional change. It must be able to accommodate new user demands and to take advantage of new technologies as they become available. On the other hand, it must continue to provide guarantees and to have the confidence of those who may have registered their land many generations ago.

The technology adopted should be chosen to meet the needs of the present multi-user community, but it should also be sufficiently flexible to meet anticipated future needs and to permit system growth and change. It must, however, always provide reliable legal evidence of land ownership.

The United Nations Economic Commission for Europe held a workshop in Vienna in September 1994 which produced a number of recommendations concerning the introduction of data into a cadastral system that are relevant to land administration including:

- (a) Data capture is the most expensive part of building up cadastral information systems. To avoid redundancies and inappropriate data it is important to set up a pilot project to examine standards for quality, data exchange, data classes, attributes, updating routines, etc. It is necessary also to consider how the use and value of land will influence data accuracy;
- (b) Data concerning real property are used by a great many people and organizations. To avoid double registration it is essential that regulations are set up for cooperation

- between public authorities on different levels and private companies. The public authority should be responsible for the necessary control of data;
- (c) To secure an optimum use of data, it is necessary to define a minimum core of common data. It is better to have a limited number of essential common data for a whole region or country than sophisticated data collections for minor areas. The different users can then supply the common data with specific data to meet their own specific needs;
 - (d) To avoid double registrations of basic common data it is important to meet the expectations of users. In this connection time is a crucial parameter. The authority responsible must consider the involvement of external producers in the conversion process from analogue to digital form to implement the process in a shorter time;
 - (e) When data collection starts it is important that an updating process should be installed at the same time.

The workshop also made a number of recommendations concerning the quality of data in cadastral databases. It concluded that:

- (a) The quality of data in a cadastre should be defined and measured on the basis of user needs. The quality is good when the users are satisfied. Thus user needs should be identified and taken into account when building or reforming a cadastre. *Inter alia*, pilot studies can be used to identify user needs;
- (b) Whilst surveyors traditionally have been occupied with and assigned priority to geometrical accuracy, less attention has been paid to the quality of the descriptive data;
- (c) When defining the quality of data, the following aspects should be taken into account: completeness; coverage; frequency of updating; attribute reliability and accuracy; geometrical accuracy;
- (d) The quality requirements differ considerably with different categories of data. These differences should be identified and taken into account;
- (e) The requirement for accuracy in the determination of boundaries varies considerably from area to area. Several countries expressed the view that completeness and real-time updating were more important than high geometrical accuracy;
- (f) Data quality should always be documented. *Inter alia*, quality parameters are important to avoid misuse or misinterpretation of cadastral information. Quality parameters should be attached to all data elements or groups and categories of data, and included when data are exchanged. The quality parameters should be shown to the users. The main quality parameters are the data source, the time of the last update, and the accuracy of the data;
- (g) Ensuring quality in descriptive data is a matter of organization. Quality management should be introduced in particular to identify critical points in the establishment as well as in the updating of databases. Quality checking routines should be established. Instruments like ISO 9000-90004 should be considered;
- (h) Whilst more and more users require cadastral information that is frequently and quickly updated in real-time, the need to secure data quality should not be underestimated;
- (i) The related costs should be identified and taken into account when deciding the levels of quality. Costs related to the possible misuse, misinterpretation or wrong decision-making that may result from defects in the data should also be evaluated.

Documentation of the quality is very important when the quality is lower than the users might expect.

G. The establishment of financial management procedures

The creation of a new land administration system provides an opportunity for developing new financial arrangements. From the outset there needs to be tight control on expenditure and an efficient management information system put in place to ensure resources are properly and fully utilized. Under many existing systems there are global budgets but little detailed accounting to determine current costs of each individual part of the overall operation. As a result, there is much inefficiency and both time and money are wasted. Better financial accounting systems need to be put in place.

The level, scope, timing, and source of financing and expenditure should be reconsidered. There are opportunities for greater cost-effectiveness in areas such as subcontracting work to the private sector; increasing cost recovery through higher fees, sales of information, and taxes; and by linking the existing land administration records with a wider range of land information. The market for real-estate data should create substantial opportunities for cost recovery. The potential for profit lies more in selling data about ownership, title and mortgages, rather than in graphic data concerning boundaries and parcels.

While the first registration of land may have to be subsidized, much if not all of the costs related to subsequent dealings in land can be passed on to the landowners. Nevertheless, the costs related to the basic maintenance of the land administration system can be regarded as a public responsibility. It should also be regarded as part of the vital infrastructure for the development and maintenance of sustainable societies. This should be taken into account when deciding on the financial mechanisms for charging for products and services. The major users of land-related data are in general public bodies which may be unable to adapt to market-based pricing. Prices should not prevent the optimal flow and utilization of such data. Hence in some circumstances, prices should be differentiated, based on the individual user's benefit or profit from having access to the data.

Overall, those who invest in the new system as well as the external users, in both the public and private sectors, should be able to gain monetary benefit from the service provided. The new system should improve access to data, reduce or eliminate unnecessary activities and expenditure, improve data quality and enhance the quality of decision-making.

H. Developing awareness in the user community

A land administration system should benefit both the general public and all those in authority who are responsible for managing land-related resources. Frequently the public are unclear about how the system works. In many areas of the world informal systems of

land administration have developed so that what in reality occurs on the ground differs from that recorded in the registers.

It is essential that the public become well informed about the operation of their land administration system. When land parcels are legally subdivided or when transfers of land or property take place, the authorities must be informed and the registers amended accordingly. This applies in the case of both sales and inheritance. In many countries the passing of laws to this effect is insufficient. The system must have the active support of the public.

When land reform is taking place, especially in land restitution and in land consolidation, those affected must be actively involved. Public meetings need to be held to explain what is going on and the media such as radio and television may be used to broadcast details of the reform programmes. When such programmes are complete, however, there is still a need to inform the public of their rights and obligations.

The growth of land information systems and the dissemination of information held in the land and property registers threatens the privacy of individuals. The public must understand and accept the level of information that is placed in the public domain or else people will find ways to avoid information appearing in the registers. This will then destroy the confidence that others have in the system and hence significantly reduce the benefits of secure land titles.

One mechanism for keeping the public informed is the distribution of leaflets explaining the system, how it works and how the public should use it. More detailed “practice leaflets” may be issued for the benefit of lawyers who are unfamiliar with any new legislation so that they understand the procedures that they must operate.

It is essential that all parties concerned are aware of the costs, benefits and procedures to be followed in a land administration system. Promotion of the system requires careful planning. A land administration system requires marketing if its full benefits are to be realized.

I. Recommendations

Determine what the State and the general public need. Create new administrative structures so that the system can respond to market needs. Prepare new legislation that covers the management of land and of land information. Make sure what exists on the ground so that the registers reflect the facts. Ensure that land and property boundaries are clearly identifiable and surveyed to appropriate standards. Provide easy and cost-effective access to the data within the system. Publicize the way the system works and its benefits.

ANNEX

THE EXPERIENCE OF HUNGARY IN MODERNIZING A LAND REGISTRATION SYSTEM

Introduction

This annex describes the Hungarian experience in modernizing a land registration system. It does not start from the position of trying to create a new land administration system, rather it seeks to maximize the potential of the existing system through a modernization programme-one that is broadly in line with the United Nations recommendations. It was prepared by the Hungarian experts Messrs L. Niklasz, A. Podolcsak, G. Remetey-Fulopp, and by Mr. R. Baldwin (United Kingdom).

The aim of the modernization programme in Hungary is to support the creation of a market economy by easing the transfer of property ownership and by supporting reforms while guaranteeing title to land and property as a sovereign act of the State. This annex shows how Hungary has been able to identify its requirements, and then move forward in a planned modernization programme which has not only produced direct and immediate benefits to the land registration sector, but also provided support for wider aims.

The transition to a market-driven economy is the greatest challenge facing Hungary at the present time. Hungary has clearly signalled its intention to move from a centrally planned, command-based economy to an economic structure similar to that of the European Union member countries. The command economy was characterized by:

- (a) A legal framework which executed administrative procedures through a regulatory framework which had the full support of the legal process. The result was that low-level activities of the administrative system were defined by law, placing severe restrictions on the activities, and also on the methods that could be used to support these statutory obligations. Consequently, even minor changes in procedures required an amendment to the relevant act;
- (b) A reliance on centralized budgeting and planning, which reduced the opportunity for local innovation and placed the emphasis of responsibility upon compliance with ministerial level directives, rather than encouraging the administration officers to assume localized responsibility, where relevant;
- (c) A lack of knowledge of the true costs of operations undertaken by the administrative sector. At worst, this led to a perpetuation of activities that were unnecessary, or at best activities were undertaken without due regard for the costs/benefits of those activities and of their financial implications;
- (d) A vertically oriented command structure, with few direct lines of communication for technical staff, other than through the administrative management process, which created bureaucratic difficulties in the execution of the day-to-day activities. The horizontal communication lines were weak;

- (e) An abrogation of the decision-making process, whereby decisions were undertaken at a centralized senior level, with the consequent risk that the decision makers could appear remote from the real problems;
- (f) A philosophy which depended upon State budget allocation for the execution of activities, rather than seeking an understanding of user needs (public and private sector) and then seeking means of cost recovery;
- (g) The maintenance of large sectors of the economy under direct government control, which reduced the involvement of the private sector and small and medium-sized enterprises in particular.

While the government is now taking steps to overcome these problems, the transition process cannot take place overnight. The social and political implications of the restructuring are severe, and the well publicized route of mass privatization of State industry does not always appear to benefit the people themselves.

The accurate and up-to-date maintenance of land ownership records is fundamental to the efficient and legal transfer of land within a free market economy and is the responsibility of the State in Hungary, as in most other European countries. This responsibility is carried out through the act of land registration, which thereby guarantees the legal title to land and property.

Land registration in Hungary is based upon a multi-purpose cadastral system which consists of an accurate cadastral map and a set of legal and administrative records (property sheets) which record property description, ownership and financial obligations or other restrictions applying to the property. Land use, valuation, land classification and land protection are also recorded.

The land registration system is the responsibility of the Ministry of Agriculture, which administers a hierarchy of 19 county land offices, 115 district land offices and a separate capital land office and Budapest district land office for the 23 districts of Budapest. With the exception of Budapest, the system is able to provide a register of property ownership that is reasonably up to date. However, the system is unable to respond to the changing demands of a market-based economy.

A key component in the modernization of the land registration system is the “computerization of land offices” project. The specific aim of this project is to modernize the existing paper-based records system by introducing modern management methods and computerized information systems into the land offices. This will transform the land offices from a bureaucratic organization with a slow response and a restricted range of services into an organization able to provide:

- (i) Rapid and secure processing of land registration applications;
- (ii) Security of credit through title guarantee and loan registration;
- (iii) Stimulation of the land market by easing the conveyancing of properties;
- (iv) On-line electronic query services.

The modernization of the cadastral mapping will provide:

- (i) Computerized digital mapping for the recording of property boundaries;

- (ii) Accurate large-scale data sets suitable for use as base mapping by other users;
- (iii) A single unified mapping base which can be rapidly updated and maintained.

These specific aims will support the establishment of national decentralized sets of computerized land information (land administrative and legal records, as well as large-scale digital base maps). This has wider implications for land administration and economic development.

The nature of land information is such that it is of immense importance to many different government sectors, both at a national, strategic level, and also at a local government level. Agriculture, environment, health, security, local authorities, as well as non-governmental organizations (NGOs) and large public and private sector groups such as utilities, marketing, construction, retailing and distribution, are all key users of geographic information.

The information services of the land registry are currently focused purely on the interests of the land registration sector itself; however, the opportunity exists for making these data available to other groups with consequent quality of life and economic benefit to all.

At an international level, the European Union (EU) model shows the importance of being able to present up-to-date information for regional planning and economic development. The Ministry of Agriculture has already begun to examine the implications of future EU membership and the key to all of these activities is in supplying accurate statistical data to support senior decision-making. The implications for land administration and economic development are that the project will provide support for:

- The market reform process;
- The EU harmonization process;
- The production of agrostistics and spatial reporting units;
- Land and property valuation and the development of land markets;
- The economic viability of agriculture.

The implementation of these wider aims are downstream issues.

I. Key issues and the identification of user needs

The following are the perceived key issues which confront the land registration sector at the present time. The listing is not exhaustive, but does characterize the current Hungarian situation.

A. Registration of title

The absolute guarantee of legal entitlement to property in Hungary is achieved through the process of registration of title, whereby the State maintains legal and administrative

records and cadastral maps which unequivocally define the property units, their ownership, and record any financial or other encumbrances placed on them. A feature of the Hungarian system is the unique property identifier, which unifies the cadastral mapping and the legal and administrative records.

Registration of title, the maintenance of the large-scale base maps, the multi-purpose nature of the information recorded, and the maintenance of the whole by a single organizational structure are great strengths of the Hungarian system. This must be protected as a fundamental priority. *It is necessary to promote awareness of the strength of the Hungarian system, and the unique advantages that accrue from a single integrated land management sector, in order to protect a unique national asset.*

B. Land compensation and privatization activity

The land compensation and privatization programme has involved the redistribution of almost 5 million hectares and the creation of almost 2 million new property units. Former owners and other individuals entitled to compensation are issued with gold crown vouchers, which are then used in an auction system to subdivide allocated areas into smaller individual units, based upon the land classification (i.e. nominal value), area available, and the number of bids. The former members of agricultural cooperatives also receive gold crown vouchers.

The process is managed by the National Compensation Office, in partnership with the land offices, and the results have yet to be incorporated into the land registration records. According to Ministry of Agriculture figures, it is estimated that by April 1995, the auctioning process was approximately 90 per cent complete, and an estimated 55 per cent of these property units were physically marked out in the field. When the process is completed, the results are stored in digital computer-readable form.

One side-effect of this compensation process is the fragmentation of land units, often into thin strips which are not viable for individual agricultural purposes. This programme needs immediate support for the assimilation of the new ownership records into the land registration system; completion of the physical marking-out of the properties; and the consolidation of the fragmented land units. *The modernization programme must provide the technical systems at the land offices to support the assimilation of these data as a priority.*

C. Completeness and computerization of legal and administrative records

Outside Budapest, the existing paper-based property sheets which record the legal and administrative records are largely complete and up to date. The EU PHARE computerization of land offices project has introduced personal computers and databases into the district land offices in order to provide a computerized inventory of the contents of the 6.5 million property sheets.

The first page of each property sheet contains the primary descriptive information, and all of these pages have now been computerized. The second and third pages contain ancillary information and these are being entered by the district land offices. It is estimated that 35 per cent (June 1995) of pages 2 and 3 have been entered since the second half of 1993, and more than 800 of the approximately 3,200 municipalities are now completely loaded, and considered to be legally in force. *The significant benefits of computerization will become apparent only when a significant proportion of the records are available in computer-readable form.*

D. Completeness and computerization of cadastral maps

There are an estimated 60,000 cadastral maps at a variety of scales (varying from 1:1,000 - 1:4,000) and in different projection systems. The maps are maintained by the district land office (by law) and copies are provided to other users. The maps vary in their completeness and currency of content. It is estimated that 4 per cent of the maps are already digitized.

Digital map information also exists from the 1980s in Budapest and the quality of this data has been studied by a Swiss aid project. In the urban areas there are different demands for digital large-scale spatial data compared to those rural authorities located on the Great Plain. *It is necessary to have accurate data concerning the exact status of the cadastral mapping on a national basis. A priority basis has to be established for deciding which maps are to be computerized first, as land registration purposes alone will not justify the investment.*

E. Budapest situation

The capital and district land offices of Budapest are unable to keep up with the flood of applications dealing with changes to the property sheets. It is estimated that a backlog of over 200,000 has built up (June 1995) and an application can take over a year to process. By comparison there are only some 2,000 changes per year made to the cadastral maps and this is not a problem. *The extraordinary situation in Budapest requires an immediate response. This solution should concentrate on the land registration records.*

F. National standards

The introduction of digital technology for the management of cadastral map standards requires new and appropriate standards to be created for the definition of content, data acceptance and quality control, and also the digital exchange of information. Under the guidance of the National Committee for Technological Development (OMFB) and with the involvement of the Institute for Geodesy, Cartography and Remote Sensing (FOMI) and also representatives from the private sector and other interested parties, initiatives

have been created to address these problems. *The development of national standards for digital cadastral mapping and data exchange standards must be supported.*

G. Ownership and copyright

The situation concerning the ownership and copyright of the land registration data and the cadastral map data is not clear. For example, while the district land offices are responsible for the updating and maintenance of these records, the information is provided to FOMI, which then is able to sell these data to users. There are regulations concerning pricing policy, however the situation concerning who has ownership, copyright, and is entitled to the income thereof needs to be examined and clarified. *The issues of copyright and legal ownership of data must be clearly addressed and precise guidelines set as to how they may or may not be used.*

H. Cost recovery

It is estimated that only 4 per cent of the total budget for the maintenance of the land registration sector comes from revenue generation. This compares unfavourably with the Netherlands, which has complete cost recovery, and the United Kingdom, which has 66 per cent for its mapping activities, and has total cost recovery for its land registry. A move to significant cost recovery by the land registration sector of Hungary is clearly possible, if the land offices can supply the right products. There needs to be an awareness of marketing, product development, and the definition of products and services. *It is necessary to investigate cost recovery mechanisms, and then establish targets for achieving cost recovery over a period of time.*

I. Institutional issues

The current organization of the land registration sector consists of a network of 115 district land offices, 19 county land offices, FOMI, and the main Department of Lands and Mapping located within the Ministry of Agriculture headquarters in Budapest. There are over 4,000 employees, and the organization also places significant contracts outside this sector, in particular with the three former State-owned surveying enterprises. However, it is appropriate to question if this is the optimum institutional organization. Two recent EU PHARE studies have advocated moving to a separate agency status with full budgetary and regulatory authority, and with an emphasis on cost recovery and local accountability. *It is necessary to conduct a review of the current institutional framework, and examine alternative models for organizational structure and seek to investigate the advantages and disadvantages of such change.*

J. Market opportunities

The original purpose of the cadastral map was to provide a record of property boundaries. Other government sector (and private sector) users are now emerging who have requirements to use these data as a base map for other purposes. The Ministry of Agriculture is now in a position to identify products based upon the land registration records and cadastral map resources and make these available as marketable products. *The potential income from the marketing of digital products needs to be investigated. This may provide sufficient financial justification for carrying out the digitizing of cadastral maps in certain cases.*

K. On-line electronic access to data

The market transition in Hungary will significantly increase the volume of transactions to be processed by the land offices. This is especially significant in Budapest, where there are more than 200,000 outstanding applications for change of ownership, mortgage entry, or some other change to the land registration records. The provision of on-line computerized access to land registration data is at an early stage, but this may provide in early opportunity for providing a client 'self-service' for routine activities such as requests for copies of property sheets. *There are issues concerned with the identification of services, the security of the records, and the scope and visibility of the data. The provision of on-line access will change the nature of the services requested from the land offices.*

L. Land consolidation

The land compensation programme has reduced the average size of agricultural land units by a factor of 10, and has resulted in many land units which are clearly unviable for economic use. There is an urgent need to support the consolidation of these land units through land exchange at a local level, based on voluntary initiatives of the interested parties. There is also a need to support this consolidation on a national basis. A German-Hungarian bilateral project has been launched with the objective of testing appropriate technical procedures and methodologies in selected pilot areas. This will produce recommendations which will support the consolidation process, and thereby support the generation of agriculturally viable units. *It is necessary to urgently develop a programme to support land consolidation through appropriate legal, organizational and technical measures.*

M. Legal issues

There have been a number of changes in the law relating to land issues in Hungary which have provided a framework for the compensation programme, supporting the computerization of land records and the adoption of digital technology. The opportunity now exists for examining the existing legal framework in terms of potential restrictive practices; simplifying the regulatory framework and reviewing the legal code; reviewing the credit arrangements and resolving the issues concerning copyright and ownership.

There is an opportunity to review the legal framework and identify areas where changes can benefit society and the operation of the land registration sector.

N. Education and training

The existing training and education in land surveying and land registration is of a high standard at university and college level. However, in view of the increased demands for the combination of information technology (IT) and land registration skills, there is a requirement to review the existing education and training programmes, and to ensure that they are correctly targeted. There are both short-term aims and long-term aims. The development of a highly trained workforce, with high ethical standards, good technical and technological skills, and with high professional standards, and a clear professional development path is essential to support the long-term aims of the modernization of the land registration sector. *A review body should be appointed to examine the whole question of professional development (i.e. educational requirements, recruitment, training, promotional paths), in consultation with professional bodies and universities and colleges.*

There are a number of wider issues that assume importance in the national and international use of information resources which form an essential part of a land registration system. These are concerned with:

- Land information services;
- Supporting the safe and secure transfer of title, ensuring the security of credit against property assets;
- Stimulation of land markets and development of a valuation sector;
- Developing the role of the private sector and the participation of the local authorities, utilities and other NGOs;
- Agricultural land use and classification assessment/monitoring;
- Support environmental protection and sustainable agriculture;
- Supporting the economic viability of agriculture;
- Generating agro-statistics in line with national and international requirements and supporting the move to EU harmonization, in terms of compliance with EU directives and the establishment of the required reporting units for demographic, agricultural and other purposes.

II. The modernization of land registration in Hungary

The land registration sector is currently facing challenges from a number of sources:

- (a) The market transition which was introduced in 1989 has stimulated the land and property sector. It is estimated that as much as 20 per cent of the national GDP comes from the land and property and construction sectors of the economy. The transition process has introduced mass privatization, increased individual home ownership, and increased demand for land registration information;

- (b) The land compensation programme has created two million new land parcels, involving more than five million hectares. All of this has to be managed, auctioned, divided, set out, and the results assimilated into the land registration sector;
- (c) Privatization of State farms, cooperatives and State industry all place demands on land registration records;
- (d) Increased conveyancing has resulted from significantly increased home ownership through a programme of subsidized purchases, the compensation programme, and increased commercial development. These problems are particularly acute in the large urban centres;
- (e) Large-scale establishment of housing associations. The large-scale establishment of housing associations, and the resulting change of registration entries has produced a situation where district land offices can suddenly receive a request for the wholesale transfer of assets, which may involve several hundreds or even thousands of property units;
- (f) Wider economic issues. There are wider economic issues concerned with the development of land markets, valuation, land use, land classification and land protection, as well as downstream issues concerned with EU harmonization, problems concerning reporting units, agro-statistics and the economic viability of agriculture.

The Ministry of Agriculture recognized these problems at an early stage and put into effect the “computerization of land offices” project, financed by PHARE (Poland-Hungary Assistance for Reconstruction of the Economy), with counterpart funding from the Government of Hungary. This project is aimed at providing the technical facilities to allow the land offices to computerize the records; assimilate the new compensation data units; and support the wider long-term aims of support for the economic reform.

The computerization of land offices project involves of a technical assistance team and a full-time Hungarian Ministry of Agriculture project manager. The technical assistance team consists of an international and a Hungarian technical adviser, and a bilingual programme assistant.

The overall strategy of the long-term technical assistance team has been to develop a fundamental strategic approach for land registration which is technically, organizationally and financially sound. Such an undertaking requires many different aspects of the problem to be investigated. The approach is to use the technical assistance team to help develop a strategy and the long-term components of the problem, and to identify specific tasks that are consistent with the overall aims of the project and are then undertaken by short-term consultants, both international and Hungarian. These short-term consultants have specialist knowledge of the task area. The overall aim is to integrate the results of the consultancies into a final approach.

The technical assistance team has reviewed the earlier six-stage strategy of the Ministry of Agriculture and then developed the TAKAROS information systems strategy, which supports the cadastral mapping and land registration data updating and management at the district land offices. It also provides geographical information services and technical

support for the county land offices. A second priority has been to support the modernization of the Budapest district land offices.

III. Progress in the modernization (1992-1995)

The first phase of the project (stage A, March 1992-September 1993) followed the initial Ministry plan, that is, it retained the existing institutional structure and legal framework, and concentrated on providing a fast and interim solution for the modernization of the management of the land registration's legal and administrative records. This allowed the district land offices to respond to the increased demand for services and also to support the compensation programme.

The first phase of the project called for the installation of personal computer-based local area networks (PC LAN) and property sheet management software (CDPRS) at all of the 115 district land offices. By the end of 1993, all district land offices were equipped with the hardware and software for property sheet management. The page one data (location, description) was transferred to the district land office systems from the national database of page one data maintained by FOMI, and a start was made on the data loading of the ownership and financial data (pages two and three of the property sheets).

An extensive analysis of the management and IT requirements of Budapest land offices was carried out. This project identified activities and functions to be supported by the modernization programme and demonstrated that the CDPRS approach could not meet the functional and performance requirements. Three alternative information systems strategies were examined, and one of the strategies was adopted after careful review and debate.

This second phase of the project (stage B, September 1993-May 1995) was characterized by a careful examination of the user needs for the support of land registration and cadastral mapping. A number of studies were carried out, including:

- A study of the large-scale cadastral mapping requirements of Hungary, involving a team of four international and Hungarian experts, who submitted a final report in July 1994, prepared under the coordination of a United Nations regional adviser;
- A study of the role of the county land offices, which examined the information requirements and activities currently carried out at the county land offices;
- A review of the first part of the modernization. The implementation of the PC LAN equipment and the adoption of the CDPRS software within the district land offices were examined;
- An examination of the national standards situation. This concentrated on the data exchange and cadastral map contents;

- An examination of the status of the compensation data. This examined the compensation process and sought to document the procedures and establish the status of the compensation data produced;
- Development of the TAKAROS information systems strategy. Development of a strategy for the modernization of the cadastral mapping and its integration with the land registration records.

Specific technical activities were carried out, including:

- Acceptance testing of the personal computers and local area networks;
- Software suitability studies of FOMI-developed products (decision support software and application registration software), and a feasibility study of the use of optical character recognition (OCR) for property sheet encoding;
- Cabling recommendations for the Budapest district land offices, and also for the 115 district land offices;
- Preparation and issue of tender for supply of hardware and software to the Budapest district land offices;
- Preparation and issue of tender for supply of hardware and software to the 115 district land offices.

One of the problems encountered was the availability of up-to-date, accurate information concerning such topics as cadastral map status (number, condition, media, content, currency, projection, age), compensation data (amount, storage media, geographical distribution), and the rate of property sheet data loading. A simple personal computer-based system was used to regularly collect and update this information.

One of the aims of the modernization process is to introduce modern ways of thinking, including management, personal responsibility, job involvement, and an awareness of the importance and integrity of the professionals involved. This is supported through a programme of seminars, visits to land offices; the issue of a regular project newsletter; and the support for international meetings and study tours, which have included study tours to Austria, Luxembourg, the Netherlands and the United Kingdom. As part of the communication activity, electronic data processing managers have been invited to work with members of the computerization project team.

IV. The next steps (1995-1997)

The following are the specific planned activities for the immediate future.

A. TAKAROS district land offices

The district land offices were to be equipped with the TAKAROS systems during the second half of 1995. This will provide the basic tools needed for the digitizing of the cadastral mapping, and will embody the results of the national standards work.

The integration of the cadastral map records and the legal and administrative records will be ensured during the data loading, and afterwards all activities (map and property

sheet) will have il single point of entry, thus guaranteeing the integrity of the system. This activity effectively creates over 100 systems for map digitizing. allowing a “bottom up” and “parallel processing” approach to this problem.

B. TAKAROS county land offices

The county land offices detailed user requirements analysis will be carried out, and the procurement will proceed in the next phase for two counties (to be extended nationally the following year). Special attention will be paid to land use, information service requirements, agro-statistics and valuation data.

C. Budapest district land offices

A separate project is to be established for Budapest involving a technical assistance team. This will be implemented according to a carefully agreed strategic plan, which includes the active involvement of a Swiss aid team to support the digital conversion of the map data, and its integration with the existing EU PHARE procurement for the property sheet management software.

D. Management information system

The increasing requirement for accurate information concerning the background data and the monitoring of the EU PHARE project implementation call for the design and implementation of a nucleus management information system (MIS) which can form the future core of a corporate MIS.

E. National standards

Support will be provided for the FOMI cadastral map content standard and the spatial data transfer standard of the GIS Data Transfer Working Group.

F. Strategic studies in support of land registration

A number of strategic studies will be necessary to resolve some of the outstanding issues. This will include the detailed design of the county land office system and the compensation data results. This could also include legal and institutional issues, ownership and copyright, as well as analysis of the particular information requirements of other NGOs, local authority and private sector users.

G. Land and property valuation

The support required for agricultural and urban land and property valuation, and also the development of land markets, are to be specifically investigated.

H. Marketing and services

The introduction of the TAKAROS systems allows an opportunity for the land offices to transform their information services and become proactive suppliers of structured spatial information. The county land offices are to be developed as the regional centres for spatial information, and this will involve the development of marketing skills, product development, project management, and the definition of goods and services to be supplied.

I. Education and training

The role of the professional organizations, the career structure of the surveyor in Hungary, the short- and long-term educational and training requirements of the land offices should be carefully reviewed. The opportunities for wider participation, at an international level, should be examined, and possible partners identified. A TEMPUS Joint European Project involving Belgian, British and Hungarian institutions is now being carried out which will develop a distance learning course in geographic information systems and land information systems.

J. Wider economic and market changes

The importance of the wider economic benefits of a modernized land registration system, and the advantageous position of Hungary, with its multi-purpose cadastre already in place, need to be emphasized. The importance of title and credit security, the demand and availability of credit for agricultural development, the effect on the land and property markets are important in the urban sector. The agricultural sector has seen a severe reduction in the size of its land units, with a consequent impact on the viability of agriculture. The importance of land use/land protection, agro-statistics, reporting units and EU harmonization issues must all be examined and understood.

K. Liaison with other projects

There is a fundamental shift away from considering the purely technical issue associated with the modernization of the land registration sector. In part this can be attributed to a growing internal awareness of the need for accurate information to support decision-making; in part it can be attributed to the awareness of the special interests of bodies outside the main land registration sector. There is a greater awareness of the need for harmony between projects, both within the modernization framework and in terms of supplying results to other users and projects. This liaison between projects should continue to be given great importance.

V. Summary

The land registration system in Hungary has a clearly defined place in society, and an implicit acceptance by the population. The system works and has up-to-date legal and administrative records, but with major deficiencies in its large-scale mapping. Specific localized problems do exist, which include the extraordinary Budapest situation, the land compensation data, and the future land consolidation problems (which have yet to be worked out).

The wider benefits and implications are becoming clearer. The support for the market development process, the viability of agriculture, the development of land markets, land use and land (and hence environmental) protection, EU harmonization, all of these demands place emphasis on the important role of spatial information systems as technical tools to support decision-making.

It is the responsibility of the Ministry of Agriculture and the land office network to meet these demands in order to promote the interests of the citizens of Hungary in a manner that supports the current activities and protects the interests of future generations. It is becoming clearer that the Ministry needs to harmonize all aspects of its activities (internally and externally) and cooperate with other government sectors, both locally, and internationally in order to meet these objectives.

Glossary of terms

Absolute title: an unconditional title for which no other person has a better right to the land.

Abstract of title: a summary of documents and facts showing the ownership of a piece of land or property.

Adjudication: the process whereby the ownership and rights in land are officially determined.

Adverse possession: the occupation of land inconsistent with the rights of the true owner.

Aerotriangulation: a process for extending horizontal and vertical ground control from measurements of points on overlapping stereo-photographs.

Alienation: the power of an owner to dispose of interest in land or property. In particular land may be alienated from the State and granted to private individuals.

Appraisal: estimating the market value of property.

Assessment: determining the tax level for a property based upon its relative market value.

Assign: to transfer property rights from one person to another, for example in a lease or mortgage certificate.

Attribute: a characteristic of an object which may be used in its classification.

Back-up copy: a duplicate that is made in case original data or software is destroyed.

Base map: a general purpose map upon which specific-purpose maps are based. A base map is usually made with reference to the national geodetic survey network, and plotted in terms of the national coordinate system.

Boundary: either the physical objects marking the limits of a property or an imaginary line or surface marking the division between two legal estates. Also used to describe the division between features with different administrative, legal, land-use, topographic, etc., characteristics.

Cadastral index map: a map showing the legal property framework of all land within an area, including property boundaries, administrative boundaries, parcel identifiers, sometimes the area of each parcel, road reserves and administrative names.

Cadastral map: a map showing land parcel boundaries. Cadastral maps may also show buildings.

Cadastral surveying: the surveying and mapping of land parcel boundaries in support of a country's land administration, conveyancing or land registration system.

Cadastre: a type of land information system that records land parcels. The term includes:

-Juridical cadastre: a register of ownership of parcels of land;

-Fiscal cadastre: a register of properties recording their value;

-Land-use cadastre: a register of land use;

-Multi-purpose cadastre: a register including many attributes of land parcels.

Caution or caveat: an entry in the registers or court records preventing certain actions being taken without notice to the person registering the caution or caveat.

Charge: an interest in property for example when held as security for a debt.

Civil law: the law laid down by the State regarding the rights of inhabitants. Also known as Roman law.

Collateral: the use of property as a guarantee for a loan.

Common law: the unwritten law based originally on common customs and precedent but now administered by the courts.

Condominium: the co-ownership of property especially in a block of apartments.

Consolidation: the planning and redistribution of land into units of more economic and rational size, shape and location.

Contract: an agreement enforceable by law

Conveyance: a method whereby rights in land are transferred from one owner to another. The rights may be full ownership or a mortgage, charge or lease, etc.

Customary law: unwritten law established by long usage.

Customary tenure: the holding of land in accordance with customary law.

Data: a raw collection of facts.

Database: an organised, integrated collection of data.

Database management system (DBMS): a set of computer programs for managing a database.

Deed: a legal document laying out the conditions which land is transferred.

Demarcation: the marking-out of the boundaries of each land parcel on the ground.

Demarcation map: a map prepared to show the parcels of land as determined during the process of adjudication.

Densification: increasing the number of survey control points within an area.

Digital elevation model (DEM): a numerical model of the height of points on the Earth's surface.

Digital mapping: (also known as *automated cartography*, or *computer-assisted cartography*): the processes of acquiring (capture), transforming and presenting spatial data held in digital form.

Digital terrain model (DTM): a numerical model of the Earth's surface in which the third dimension may be some quantity other than height (for instance, gravity or land value).

Digitizing: the process of converting graphic maps into digital form.

Disaster copy: a copy of the register kept in a secure place in case the main register is damaged, for example by fire.

Easement: a right enjoyed by one landowner (the dominant tenement) over that of another (the servient tenement), for instance a right of access or for the passage of water or electricity.

Electronic distance a measurement (DEM): the determination of distance from precise measurements of intervals of time taken by an electromagnetic wave passing between two points.

Entity: an object about which information is stored in a database.

Estate: in legal terms, an interest in land. The terms is also used to refer to the physical land and property to which that interest relates.

Expropriation: the compulsory depriving of an owner of property in return for compensation

Feature: a set of entities describing a physical object.

File: an organized collection of related records.

Fiscal value: the value of real-estate property used for taxation purposes.

Fixed boundary: the legal boundary of a property where the precise line has been agreed and recorded.

Fragmentation: the division of land units too small for rational exploitation, usually as a result of the system of inheritance. The process may lead to a multiplicity of parcels for one owner or a multiplicity of owners of one parcel.

Freehold: a free tenure, distinct from leasehold, in which the owner has the maximum rights permissible within the tenure system.

General boundary: a boundary for which the precise line on the ground has not been determined.

General cadastre: an official public record usually recording the ownership rights, value, and quantity of land in a jurisdiction, State or country. The legal land parcels are recorded in registers and on cadastral maps.

Geodesy: the scientific study of the size and shape of the Earth and the determination of positions upon it.

Geodetic framework or network: a spatial framework of points whose position has been precisely determined on the surface of the Earth.

Geodetic survey: the process of determining the exact spatial position of points on the Earth's surface. The geodetic network is a basis for topographic, environmental and cadastral surveying and mapping.

Geographic information system (GIS): a system for capturing, storing, checking, integrating, analysing and displaying data about the Earth that is spatially referenced. It is normally taken to include a spatially referenced database and appropriate applications software.

Global positioning system (GPS): a system for fixing positions on the surface of the Earth by measuring the ranges to a special set of satellites orbiting the Earth.

Grant: a general word to describe the transfer of property whereby rights pass from the "grantor" to the "grantee".

Graphics terminal: a device with a cathode ray tube for displaying digital spatial data.

Hypothec: a charge on property as a security against a financial loan in which the property remains in the possession of the person receiving the loan.

Information: data transformed into a form suitable for the user.

Interface: the connection between two devices that handle data in different ways.

Land: the surface of the Earth, the materials beneath, the air above and all things fixed to the soil.

Land administration: the processes of determining, recording and disseminating information about the ownership, value and use of land when implementing land management policies.

Land information management: the managing of information about land.

Land information system (LIS): a system for acquiring, processing, storing and distributing information about land.

Land management: the activities associated with the management of land as a resource from both an environmental and an economic perspective.

Land parcel: an area of land under homogeneous property rights and unique ownership.

Land reform: the various processes involved in altering the pattern of land tenure and land use of a specified area.

Land register: a public register used to record the existence of deeds or title documents.

Land registration: the process of recording rights in land either in the form of registration of deeds or else through the registration of title to land.

Land tenure: the mode of holding rights in land.

Land title: the evidence of a person's rights to land.

Land transfer: the transfer of rights in land.

Land use: the manner in which land is used, including the nature of the vegetation upon its surface.

Land value: the worth of a property, determined in a variety of ways which give rise to different estimates of the value.

Leasehold: land held under a lease, which is a contract by which the right of exclusive possession of land is granted by a landlord (the lessor) to a tenant (the lessee) for an agreed amount of money for an agreed period of time.

Local area network (LAN): a communication system that allows several processing devices that are nearby to be linked together.

Lot: a land parcel.

Market value: the most probable sale price of a real-estate property in terms of money, assuming a competitive and open market.

Mass appraisal: the process of valuing a group of real-estate properties at a given date, using standard methods.

Metes and bounds: a property description by reference to the bearings and lengths of the boundary lines (metes) together with the names of adjoining properties (bounds).

Microfiche or microfilm: storage media based on photographic processes.

Modem: a "modulator-demodulator" device that allows data to be converted into a form whereby they can be transmitted as a set of pulses down a cable and then reassembled at the other end.

Mortgage: the conveyance of a property by a debtor (called the mortgagor) to a creditor (called the mortgagee) as security for a financial loan with the provision that the property shall be returned when the loan is paid off by a certain date. In some legal systems there is provision that the mortgagee has the power to sell the concerned property when the interest is not paid in time and the loan is not paid off by a certain date in accordance with the agreed stipulations.

Network (computer): a system consisting of a computer and its connected terminals and devices. The term is also used to describe two or more interconnected computer systems.

Network (survey): a series of connected survey points which provide a spatial framework for an area.

Optical disk: computer storage device that uses laser technology to store and read data from disks coated in light-sensitive material.

Orthophotograph: a composite aerial photograph from which height and tilt displacements have been removed.

Orthophotomap: a photomap made from orthophotographs.

Overriding interest: a legal interest in land that has legal force even though not recorded in the land registers.

Parcel: a land parcel.

Photogrammetry the science and art of taking accurate measurements from photographs.

Photomap: a map made by printing photographs rather than using abstract conventional signs and symbols.

Pixel: one of a regular array of cells (picture elements) on a grid, within which data are stored.

Plot: a land parcel.

Plotter: any device for drawing maps and figures.

Pre-marking: the marking of points on the ground prior to the taking of aerial photographs so that the points can be certain of identity.

Prescription: the gaining of a right by reason of a lapse of time.

Pre-signalization: pre-marking.

Private conveyancing: the transfer of rights in land without any public record of the transfer.

Provisional title: a registered title that should in due course become an absolute title provided that no objections are registered within a prescribed period.

Raster: a regular grid of cells covering an area, usually recorded by automatic scanning.

Real estate: land-related property.

Real property: land and any things attached to the land including buildings, apartments and other construction and natural objects such as trees.

Rectification: the legal process whereby errors on a land register may be corrected.

Registration of deeds: a system whereby a register of documents is maintained relating to the transfer of rights in land.

Registration of title: a system whereby a register of ownership of land is maintained based upon the parcel rather than the owner or the deeds of transfer.

Registry index map: a map showing all land that has been registered within a given area.

Remote sensing: the technique of determining data about the environment from its spectral image as seen from a distance.

Rental value: the value of a property in terms of the rent which may be derived from it.

Real property: landed property.

Restitution: the restoration of former rights in land involving the re-privatization of land and property or the creation of new property rights over land formerly taken over by the State.

Restrictive covenant: an agreement whereby one landowner agrees to restrict certain ways in which the land might be used for the benefit of another.

Root of title: a document dealing with the whole legal and equitable interest in real property that provides certainty in any legal disposition.

Servitude: an easement.

Spatial referencing: the association of an entity with its absolute or relative location.

Sporadic adjudication: the determination of rights in land here and there, now and then.

Stamp duty: a levy charged on the transfer of property.

Statute of limitations: a statute that limits the period during which a claim, for instance for the restoration of rights in land, can be pursued.

Strata title: title to land which is not necessarily divided horizontally, such as in high-rise buildings or for mining rights.

Subdivision: the process of dividing a land parcel into smaller parcels.

Systematic adjudication: the determination of rights in land on a regular and systematic basis, for example within one area at one time.

Tenure: the method whereby land rights are held.

Title: the evidence of a person's right to property.

Title deeds: documents giving evidence of title to land.

Title plan: a plan especially drawn to show the boundaries of land parcels.

Topography: the physical features of the Earth's surface.

Topology: the study of properties of a geometric figure which are not dependent upon absolute position, such as connectivity.

Traversing: a land survey technique of measuring successive angles and distances to establish new positions.

Trilateration: a land survey technique of determining position by measurement of distances only.

Triangulation: a land survey technique of determining position by measurement of the angles in a series of triangles.

Valuation: the determination of the value of property.

Vector: a quantity having both magnitude and direction, which in a spatial database is usually stored as a pair of coordinates.

Visual display unit (VDU): a computer terminal with a cathode ray tube used for displaying data.

Workstation: a graphic screen, keyboard and (in digital mapping) digitizing tablet, all on one desk and linked together with a computer.

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