

**GUIDELINES FOR THE IMPROVEMENT OF
LAND-REGISTRATION AND LAND- INFORMATION SYSTEMS IN
DEVELOPING COUNTRIES**

(with special reference to English-speaking countries in Eastern, Central and Southern Africa)

UNITED NATIONS CENTRE FOR HUMAN SETTLEMENT (HABITAT), NAIROBI, 1990

FOREWORD

It is now universally appreciated that land as a resource is unique, in the sense of being significantly different from all other factors of social and political life. Land is the platform for almost all human activities. It is the means of life without which human beings could never have existed and on which continued existence and progress depend. Land is also a part of nature, fixed in location, immovable and incapable of expansion in supply, (except very marginally through the process of reclamation). The necessity for efficient and effective management of this unique resource cannot therefore be overstressed.

Habitat: the United Nations Conference on Human Settlements had in 1976 fully appreciated this uniqueness and singular importance of land in human social, economic and political development and had made important recommendations with respect to national action for its proper management - its protection, development and use and its allocation or distribution. These recommendations have in the main shaped, guided and formed the basis of much of the research and technical cooperation activities of the United Nations Centre for Human Settlements (Habitat) over the years. More recently, the Global Strategy for Shelter to the Year 2000 has further emphasized the need to improve land management through improvement of affordable land-registration systems and other programmes of land-tenure regularization, with the objective of stimulating the flow of a sufficient supply of land to meet the shelter and other development needs.

The present manual is one in a series of UNCHS (Habitat) efforts to contribute to knowledge, exchange and dissemination of experiences and information on better management of the land resource. Modernization of the land-tenure system is a major component of the UNCHS (Habitat) research and technical cooperation programme on improving land management. Land-title registration is a critical starting point in the continuum of this modernization, as it has ramifications for many other aspects of land management. Registration of title to land identifies ownership of the parcel or plot of land, as well as other forms of tenure and interests on it, it simplifies, cheapens and expedites land transactions and conveyancing and improves credit flow to land development, as well as facilitates more effective settlements planning.

The manual reviews the administrative, technical and economic deficiencies and bottle-necks in current practices with land-title registration and land-information systems, and identifies and suggests mechanisms and measures for improving on the efficiency and effectiveness of the system and process in support of efficient land management in human settlements development.

The preparation of this manual has benefitted from an extensive review by participants at the UNCHS (Habitat)-sponsored Workshop on Land-Registration and Land-information Systems held at Nairobi from 15 to 18 October 1990 which was attended by relevant professionals from the various countries of Eastern and Southern African sub- regions. The suggestions and recommendations of this Workshop are integrated into this document. I would also like to acknowledge the immense contributions Professor Peter F. Dale, of the Polytechnic of East London who, as UNCHS (Habitat) Consultant, prepared the basic report on which this manual is based.

It is my hope that this manual will be useful to governments and their relevant departments at all levels, as well as to relevant education/training institutions, seeking to improve land- tenure and land market modernization through improvements in land-title registration and land-information processes and systems.

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I. INTRODUCTION

Land is one of the most important elements in human settlements development. In fact, it is the starting point for all development. Any constraints to the supply of land, therefore, impacts negatively on human settlements development, and thus on socio-economic development generally. In this context, the paucity of land-interest and land-transaction developing countries, seriously hampers development of human settlements and, in particular, the availability of suitable land for the increasing needs of shelter, infrastructure and services. Information on the location and tenure of land is a basic requirement for effective land management and the functioning of land markets.

Furthermore, one of the principal prerequisites for a property-rate system is a system of property identification, i.e. land/property registration and index mapping. Informal settlement areas, which predominate in developing countries need to be incorporated in an improved national registration system so that tenure regularization can be carried out. There is therefore, general appreciation that measures should be taken to increase both the quantity and quality of land information, through registration of land titles, interests and transactions.

The prevailing land-tenure system in most developing countries is still largely a mixture of statute law and customary law, resulting in a situation where ownership, land tenure and usage rights and interests are largely ill-defined, undocumented and untransactable. It is estimated that up to 90 per cent of land parcels in many developing countries have no documentary evidence of title, nor for that matter, any confirmed tenure. It has also been estimated that less than 1 per cent of sub-Saharan African countries are covered by any kind of cadastral survey. Consequently, managing the flow of land from those who own it to those who need it for development has become very difficult, both for governments and for private developers. This situation also creates conflicts between modern development demands and prevailing traditional-land-tenure systems. Uncertainty of tenure and clouded and untransactable land titles inhibit improvements of the quality of human settlements, particularly urban settlements, impedes access to formal credit for land development and hampers efforts at improvement of resource generation from property rating and land taxation.

One of the challenges to land management in developing countries today, therefore, is that of the reform and modernization of land-tenure systems, to adapt them to modern development demands. Promotion of land-title registration is the starting point for land-tenure improvement. It is in recognition of this need that the United Nations Global Strategy for Shelter to the Year 2000 has emphasized the necessity for "increased administrative capacities for land title and land transaction registration, without which efficient and economical land distribution is virtually impossible. Improvements to land-registration systems and the establishment of land-information systems, are basic reforms which are a prerequisite for efficient human settlements development. The Global Strategy for Shelter to the Year 2000, recognizing the merits and importance of land-registration, has recommended as a priority area of national policy action, the establishment of efficient land-registration and Land-information systems, and the introduction of administrative measures and legal reforms to promote the efficiency of land markets. The Strategy acknowledges that poor land systems increase the costs of acquiring and mortgaging land, and, therefore, the cost of shelter. The strategy, therefore, suggests that, in line with simplifying land-registration procedures to reform land-tenure systems, with the aim of increasing private investment in housing.

The eleventh session of the Commission on Human Settlements had called for international action necessary to support the activities of countries in their endeavour to improve the housing situation of their poor and disadvantaged inhabitants. In this connection, the session had emphasized the need for improvement of land-management systems through the introduction of affordable land-registration systems and programmes for land-tenure regularization (1). The need in many

developing countries, for information of past patterns of land tenure, to match changing human settlements and low-income shelter needs is one of the main jurisdictions for this manual.

This manual, which embodies the study prepared by a UNCHS (Habitat) consultant and reflects a subsequent review of the report by the UNCHS (Habitat) -sponsored sub-regional Workshop on Land-registration and Land-information systems, has reviewed the administrative and technical deficiencies of current practices with land-registration and land information systems in developing countries and has suggested administrative/institutional technical and management measures for improving/updating the effectiveness of registration systems in supporting human settlements development. It is hoped that the manual will contribute to increasing knowledge on the setting-up and operation of land-registration and land- information systems, and to disseminating information on land-registration and land- information practices, thereby, stimulating national action in this regard.

The rest of this manual is presented in four chapters. Chapter II reviews the general historical background development of land registration practices, the benefits and deficiencies of Land registration and the technical and institutional problems that need to be addressed. Chapter III examines existing practices, processes and methods, including technologies in cadastre and land registration . Chapter IV discusses the way ahead, and the final chapter outlines the immediate and longer-term strategies and guidelines for improving land-registration processes.

Reference

1. United Nations Centre for Human Settlement (Habitat), The Global Strategy for Shelter to the Year 2000 (Nairobi, 1990) (HS/185/90E), paras. 97-98.

II. DEVELOPMENT OF LAND-TITLE REGISTRATION

2.1 Historical background and review of current practices

There has rarely been a period in history when change has been more rapid or so far reaching as it is today. With the burgeoning growth of populations in the third world, the need to ensure the proper use of land has never been so urgent. The rate of increase in the population is only exceeded by the pace of change that is taking place through technological innovation, which in turn is providing more open access to information. There is a much greater awareness of the magnitude of the land-related problems to be faced and the resources that can in theory be brought to bear on their solution.

Not all human activities have, however, responded rapidly to change. Cadastral systems in particular have been slow to adapt, many being rooted in concepts and practices that are a century or more old and no longer satisfy the needs of present-day society. A cadastral system consists of two parts, the first of which contains a written record or register showing details about each parcel of land such as the name of the owner and the rights or assessed values that relate to the land; it is thus dependent on the juridical system and in particular the land law of the country concerned. The second part is cross-referenced to the first and contains a detailed description of the parcel, either in the form of maps or survey measurements that identify each Land parcel. The overall process of recording details about land parcels for the purposes of land ownership is known as land registration. The origins of the cadastre go back to antiquity although its present form dates from the late eighteenth century.

Within mainland Europe the basis of the modern cadastre is in taxation while in much of the English speaking world the activity known as cadastral surveying has been directed at the protection of property rights. Within developing countries the emphasis in the cadastre has been on Landownership and support for land settlement. In those countries settled by the French, the Napoleonic Code was adopted. The European settlers in South Africa introduced Roman-Dutch law while in much of the British colonial empire, the system of jurisprudence was based on English law and practice. Land was, in general, treated as an estate to be owned in freehold or leasehold; thus many traditional rights in land were ignored. In the case of Zambia, the land law was based on the English system prior to its reform in 1925 so that the Zambians inherited what the English themselves found unworkable. In some countries, such as in Buganda, the central region of Uganda, land rights were granted to the local chiefs as an instrument of land policy; in other countries the land was alienated for the benefit of settlers or to record government properties. In the latter cases, only limited areas of land were cadastrally surveyed - for instance, in Zambia only 6 per cent of the country, along the so-called line of rail, were subject to the grant of title.

The rights in land that were statutorily recognized depended on the customs and procedures of the colonizing power or on the experiences of the settlers. Throughout much of East and Central Africa, either British legal practice was followed or South African procedures were adopted. The system of deeds registration that until two decades ago was practised in Malawi was supported by a survey and land registration system that was based on South African methods and procedures largely because of the influence of the South African surveyors who had worked there. In Kenya, two systems of registration of title to land have been practised - that based on the South African approach to surveying that was adopted in the early part of this century; and that based on the English approach to land registration. The latter was introduced in the 1950s when substantial areas of land that had been settled by expatriates were returned to the indigenous peoples. In Uganda, the system of registration of title has been based in part on the practices in Victoria, Australia, from where sections of the Registration of Titles Act were copied. These were however modified to meet local conditions. The United Republic of Tanzania has relics of its German occupation while many of the English-speaking countries of Central and Southern Africa have had

systems based on South African practice and the registration of deeds. Over the last decades most of these have been modified. In Botswana, for example, there has been the introduction of certificates of rights of occupancy, though still based on deeds registration. The system in Malawi now has been modelled on the English approach to title registration, modified in part as a result of the experiences gained in land registration in Kenya in the 1950s and 1960s.

Throughout the colonial period, relatively little was done to ensure the protection or even identification of customary interests in land - even in the Uganda Protectorate, insufficient care was taken in identifying native rights so that the chiefs who had been trustees of the land became full owners of the freehold. This brought about a major change in the social structure of the Buganda community. Throughout most countries, the general approach to land registration has been directed primarily at the protection of individual property rights, rather than communal rights and has ignored the general concept of land as a resource to be managed. The good use of the land has in most cases been left to market forces or to attempts at town and country planning that have been divorced from the management of land tenure systems.

2.2 Existing land-registration practices

Although the term "land ownership" is in common use, in a strict sense ownership implies the rights to use the land, rather than ownership of the land itself which to many belongs to ancestors and descendants as much as to the present generation. Land includes all things connected permanently to the soil whether above or below the ground. Thus crops growing on the land and buildings erected upon it are structurally attached to it and are therefore a part of it. Land is finite in extent and permanent by nature, qualities that make the land parcel an ideal basis for recording information since the rights, owners and usage may change but the land remains for ever. Although parcels may be subdivided into smaller units or amalgamated with adjoining parcels into larger ones, the land which they cover remains unchanged.

The basic spatial unit of the cadastral record is the land parcel, sometimes known as a lot, or plot. The parcel is an area, or more strictly a volume, of space recognized for recording purposes that may cover many square kilometres in the case of a farm or ranch, or may be as small as 1 square metre for land used as an electricity sub-station. The rights to land parcels may be held through custom or through the more formal processes of the law, the manner in which they are held being known as "land tenure". In order to prove who owns the rights to use any particular area of land. It is necessary to investigate the "title" or entitlement. Title is the evidence of a person's right to property. Land rights have been described as a bundle of sticks, each stick representing something which may be done with the land (1). Each individual stick defines a way in which the land may be used, the profit which may be derived from it or the manner in which some or all of the rights may be disposed of to other people or to organizations. For each right there will be an owner, be that an individual, group or organization. Thus one owner may hold the overall rights but may lease the land to someone else who may use it for a defined period. Another person may be allowed to take fish from the stream which passes through it, while people in general may be allowed to walk over it by a right of way.

Two major systems for recording rights in land have been established - the deeds registration system in which the documents of transfer are recorded, and title registration in which the land parcel is the focus of the records. In general, French-speaking countries and those under Roman-Dutch law have adopted systems of registration of deeds. Under most systems of registration of title, the information on the registers is guaranteed by the State so that in the unlikely event of fraud or error, anyone inadvertently suffering from the incorrectness of the information will be compensated. Two apparently different systems of registration of title to land emerged at much the same time in the nineteenth century - the so-called Torrens or Australian system and the English equivalent. The similarities between the English and the Australian approaches to registration of title to land are much greater than their differences - as Simpson (2)

has pointed out. Both systems have worked well within their own environments and both are equally flawed in terms of overall land management and administration. These flaws stem from their origins which were primarily in support of private conveyancing. Both have effectively protected the property rights of government and of registered private individual owners. Many rights and tenures have, however, been ignored, especially the customary rights and traditional procedures followed in those less developed countries that have been persuaded to introduce registration of title to land.

2.3 The benefits of land registration

The need to record details of land parcels within a cadastre stems from a need for the better administration of the land- Land after all is the ultimate resource from which almost all wealth comes. Improvements in the management of land are essential for the betterment of both the rural and the urban poor. In most developing countries, the inadequacy of land information poses serious constraints on what can be done. Without knowledge of who owns the land, development cannot peacefully take place. In consequence, the emphasis in many development programmes is placed on ensuring that rights in land are identified, recognized by the State and recorded in some suitable form.

According to Williamson (3), the benefits of such land registration include:

- (a) Certainty of ownership. The compilation of land records will necessitate the formal identification and recognition of the ownership of the land, a process known as adjudication. This should provide certainty not only as to who is the landowner but also what other rights exist in the land. This in turn should lead to greater social cohesion.
- (b) Security of tenure. Through the adjudication process, existing defects in any titles to land can be cured by the judicious use of appropriate powers. In many countries the official record is supported by a State guarantee of the title to the land. Greater security should in turn lead to increased productivity, especially in rural areas where farmers have an incentive to take greater care of the land and to invest their capital and resources in it.
- (c) Reduction in land disputes. Disputes concerning land and boundaries can give rise to expensive litigation. The settlement of such disputes should be part of the process of adjudication and will not only lead to greater productivity from the land but also reduce the money wasted on litigation and going to court.
- (d) Improved conveyancing. The costs and delays in transferring property rights can be substantially reduced through the operation of a land-registration system. Duplication of effort, for instance in the repeated investigation of old titles, can be avoided thus saving on costs.
- (e) Stimulation of the land market. The introduction of a cheap, secure and effective system for recording and transferring interests in land should improve the operation and efficiency of the land market. It should not only lower transaction costs but should also permit the market to respond effectively to all the needs of users.
- (f) Security for credit. The land title can be used as security against any loan. Tentative evidence suggests that the combination of a sound title with the ability to raise long-term credit can give rise to substantial increase in productivity from the land.
- (g) Monitoring of the land market. The cadastral system may be used to monitor and, if necessary, to control land transactions and ownership.

(h)Facilitation of land reform. Land redistribution, land consolidation and land assembly for development and re- development can be expedited through the ready availability of information on who currently owns what rights in what land.

(i)Management of State lands. The State is often the major landowner in a country. The development of a cadastral system and in particular, the creation of cadastral maps in a systematic manner will benefit the State in the administration of its own land, often giving rise to improved revenue collection from the land which it leases. In addition, the public acquisition of land through compulsory purchase prior to redevelopment can be expedited.

(j)Support for land taxation. Many countries have some form of land assessment and derive revenue from charges on the land. Often the cost of improvements in the cadastral system are off set by greater efficiency in tax collection and the consequential greater amount of tax recovered.

(k)Improvements in physical planning. The cadastral system may be used to support physical planning in both the urban and rural sectors. Better land administration should lead to greater efficiency in local government. Many development programmes have failed or been unnecessarily expensive through a lack of knowledge of existing land rights. The cadastre also provides a basis for restricting certain uses of the land which might, for example, give rise to pollution.

(l)Recording of land-resource information. The availability of up-to- date large-scale cadastral plans can lead to the creation of an efficient land information system which services a variety of land- resource-management activities.

In addition one might add:

(m)Supporting environmental management. Cadastral records, in their multipurpose form, can be used as a tool in assessing the impact of development, in helping in the preparation of environmental impact assessments and in monitoring environmental change.

2.4 The deficiencies in title registration

The basic problem with the legalistic approach to land registration is that neither registration of deeds nor registration of title to land meet many of the needs of those administering land as a resource. The following are some of the problems that are not adequately addressed. The comments are generalized and do not apply in all circumstances or to all countries; nevertheless, the problems identified frequently occur.

2.4.1 Multiple ownership

In many systems of tenure, notably Islamic, property can be shared on inheritance between several people. Thus under Sharia law, when a landowner dies, his or her estate will be divided into shares and distributed among the children, each son getting twice as many shares as each daughter. The Torrens and English models prefer that one person should inherit the land or else that it will be divided in a manner whereby each individual's rights can be identified, for instance through joint tenancies or tenancies in common; failing that, the land should be sold and the moneys so released can then be divided between the inheritors. Registration of title has not been able to cope adequately with the ownership of proportional shares nor with extended-family ownership. In Kenya, for instance, Simpson (4) noted the appointment of trustees who, rather than the communal landowners, would be registered for the purposes of dealing in the land. Strictly, the land belonged to all members of a lineage or clan but it was impractical for all of them to be entered on the one certificate, let alone for the records to be kept up-to-date. Hence responsibility and power passed into the hands of a few representatives of the group. Computerization may, however, go some way towards overcoming the

administrative difficulties.

2.4.2 Strata titles

Strata titles pose two problems - the ownership of separate identifiable volumes of space within a building and the ownership of the common parts. Special legislation has had to be introduced to cope with each of these (e.g., Kenya's Sectional Properties Act of 1987). The English general boundaries rule allows flexibility with the definition of the individual units and has given rise to less difficulties than the Torrens system when dealing with both vertical and horizontal subdivisions. Registration of strata titles creates difficulties in identification and registration of the ownership of common areas, for example the freehold in blocks of high-rise apartments. This is of particular significance if the problems of city development are to be addressed.

2.4.3 Multiplicity of parcels

Fragmentation of land on inheritance can only be effectively handled by the issuing of separate titles for each piece of land. In more developed countries, opponents of certain development schemes have taken advantage of the resulting difficulties by subdividing land into very many minuscule plots, for example measuring less than half a metre square, thus causing great administrative inconvenience. Conventional wisdom tends to discourage fragmentation. In some countries, however, farmers hold a variety of plots of land in areas where different crops can be grown in the different soil and climatic conditions thus reducing their overall risk of hardship through individual crop failure. Issuing separate titles to each plot of what is essentially one holding is only a partial solution. On the one hand, it is often wise to restrict the minimum size of an individual parcel for reasons of good land use, but methods for monitoring parcel sizes rarely form part of the registration process.

Conversely, in some developing countries, there is an upper limit or ceiling on land holdings, but no specified minimum agricultural plot size. If separate titles are issued, it is notionally possible, but in practice cumbersome, to locate all the land belonging to an individual and, hence, calculate the total holding. As with multiplicity of owners of one parcel, this problem may be solved through the greater use of computers.

2.4.4 Customary tenure

The Torrens title assumes a simple freehold or leasehold with a limited number of encumbrances; the English system allows for specified restrictive covenants and unspecified over-riding interests which must be investigated by a would-be purchaser of the land. Neither system copes adequately with the complex forms of tenure that traditionally exist in most developing countries. Instead, particularly in the less developed countries, those introducing registration of title have tended to ignore the subtleties of customary tenure giving rise to informal dealings in land taking place outside the register. In several countries, the systems of inheritance that have been practised since time immemorial have continued after the introduction of registration of title. Land has then been passed on in accordance with customary law without the local land registrar being notified. In many developing countries, the formality of registration of title is often out of sympathy with custom and tradition. The benefits of the registration often lie in the initial compilation of the register and the public adjudication of ownership and demarcation of boundaries rather than in the ongoing maintenance of the registers. In consequence, once agreement is reached between the parties, the issuing of a certificate of title that may not reflect the customary rights in the land is of minor interest to the landowners. Hence subsequent dealings in land may go unregistered as the landowners believe that they have the protection of customary law, even though it may technically have been abolished and replaced by statutory law. There is little point in maintaining a registry system if the records are not kept up to date.

2.4.5 Completeness of the registers

Few land registers anywhere in the world contain a complete and up-to-date record of all land.

Many countries operate a dual system - the traditional that may be based on deeds or custom and the more modern but still incomplete registers of title. In Trinidad and Tobago, for example, there has been a tendency for good titles to be kept off the register since there is little incentive for the lawyers to encourage registration unless the title is dubious when the State will offer a guarantee. In most countries, many areas remain in uncertain ownership even though selected regions may have been subject to systematic adjudication. This is especially the case in city areas in third-world countries where there is often a thriving informal sector and unofficial land markets outside the control of government. This inhibits infrastructure improvement and formal development and denies to the individual and the community at large many of the benefits of land registration.

Only in the case of small islands, such as Saird Lucia in the Caribbean, have titles been registered for the whole country. It is particularly noticeable that in those countries where registration of title has been practised for the longest period of time, notably England and Australia, it is still often difficult if not in practice impossible to determine the ownership of some areas of land that are not on the register. While the effective completion of the registers is a desirable objective, land registration does not, however, need to be extended to all areas of a country. What is essential is that the registers contain sufficient information for land-management purposes and that they are kept up-to-date. All too frequently, neither is the case.

In all systems of registration of title, only a limited set of property rights is recorded. The certificate of title may indicate those rights that can be passed on by the landowner, but separate enquiries may need to be made to determine other rights such as those controlled by local planning regulations. In England, local land charges have to be searched for in the local authority records, adding to the delay in land transfer. In 1973, Fielcher (5) reported that in New South Wales there were more than 32 essential pieces of information that had to be searched for at various public offices. Whereas computerization has reduced this figure since then, it is still not yet possible to turn to the land titles register and determine all the interests and rights that exist over any individual parcel of land. As attempts are made to introduce more effective town and country planning in developing countries, so will the complexity of undocumented rights and interests in land create problems in land management.

2.4.6 Consistency of the records

With the growing use of computers to process parcel-based information it has become apparent that the Land parcel used by the registrar of titles may not occupy exactly the same volume of space as that used, for example, by the valuation or tax assessment officers. This stems from the failure to integrate the transfer process with the overall administration and management of land. There is no inherent reason why the property cadastre cannot be used for revenue collection provided that the records are complete and up-to-date. Although land taxes are not universally popular, the international funding agencies tend to encourage developing countries to raise revenue through taxation systems based on property assessment. Land taxes are potentially easy to target and collect and are in effect taxes on wealth. For such to be equitable and successful there must be a complete and consistent record of all taxable units of land. Neither the Torrens nor the English systems have so far achieved this.

2.4.7 Rapid urban expansion

Registration of title has not yet demonstrated that it can respond to rapid urban expansion. The focus in development agencies in general appears to be shifting from the rural sector to the urban since many cities in less developed countries are growing at a phenomenal rate (6). The proper management of such growth can only be achieved with better information than is currently available. In the view of the United Nations Commission on Human Settlements (Habitat):

"...a priority area for national policy action will have to be the establishment of efficient land registration and land information systems at Municipal level."(7)

There is insufficient time to complete the sort of meticulous surveys of land parcels that are carried out in most developing countries, since either development is outpacing the production rate of cadastral surveys or else economic development is retarded by the slow process of issuing titles. Even the less precise survey standards that are adopted under the English system require resource levels that are generally unavailable in less developed countries. Land registration cannot operate effectively without some form of cadastral survey. Although, in many countries, cadastral systems already exist, few operate efficiently. Many are out-of-date, expensive to maintain, inefficient or are largely ineffective in practice and irrelevant to modern conditions and requirements. In some countries, alternative unofficial systems have developed to meet local needs. The so-called informal sector has established patterns of land use and land rights which operate outside the national cadastral system. In many cases, developers have sufficient confidence in their customary rights to construct substantial but unauthorized high-rise buildings within the main urban centres. Few third-world countries have documented the various forms of existing land rights, few can afford more than the most rudimentary cadastral system, and none can afford the financial wastage that arises from the misuse of the land.

2.4.8 Monitoring the land

Strategic decisions are only as good as the data and the information upon which they are based. The role of land registration in monitoring, in planning and in decision-making has been limited. Systems of registration of title to land have in general failed to:

- (a) Reveal the behaviour of property markets;
- (b) Monitor fluctuations in land prices;
- (c) Provide clear information for tax gatherers;
- (d) Indicate the availability of land for development;
- (e) Determine the existing use of the land;
- (f) Identify the potential for other forms of land use;
- (g) Reveal areas of dereliction of the land;
- (h) Indicate costs for land acquisition projects;
- (i) Monitor the environmental impact of development.

Registration of the to land fails to do these things because it was not designed to do so - in many circumstances it was designed solely to support private conveyancing or for the protection of government land. In some cases it has been modified to supplement other methods for monitoring the land, but in general land registration has been "title- based" not "land-based",

and has ignored many of the important attributes of land. In this it has been partnered by the land-surveying profession many members of which have been concerned more with the location of boundaries than with what lies within their limits.

Ruoff (8) described the underlying principles of registration of title as the mirror principle, the curtain principle and the insurance principle. Even within these objectives both the Torrens and the English systems have been deficient. In practice, not all rights are reflected since many customary rights and most statutory restrictions are ignored; the curtain cannot be drawn behind the current certificate of title since, all too often, it may be necessary to search through previous survey information held in other parts of the register; and unlike the system in England where risks are taken in order to reduce costs, in most developing countries it is common to carry out meticulous survey work, thus raising costs in order to reduce the risk of having to pay compensation for mistakes in property descriptions.

Although this critique has so far stressed the problems that occur with registration of title to land, many other forms of cadastral system are proving inadequate for current purposes. Australia has recently begun to explore the issues of cadastral reform (9). Western European countries, too, are finding it necessary to upgrade their system (10), one reason being that computerization of cadastral maps has uncovered many inconsistencies in the survey data. Attempts to marry together the juridical with the fiscal records have revealed anomalies that stem, in part, from the different definitions of the land parcel that have been used by different organizations. The problems are compounded by the quality of modern land-survey techniques that are capable of giving greater precision and accuracy than in the past. The so-called "principle of control" or "working from the whole to the part" means that today's surveys of good geometrical quality have to be downgraded to fit old and less reliable control. The solution that is adopted in some countries, for instance in parts of Germany and Switzerland, is to resurvey both the control and the parcels to the standards that are now possible using modern techniques. It is a solution that few can afford, either in time or in terms of cost.

There is an international trend towards cadastral reform. There are two quite separate issues that are subject to review. These relate to the "what" and the "where", the alphanumeric and the graphic data. These mirror the early developments in land information systems where database and digital mapping technology were linked together by a parcel identifier. While so-called object-oriented databases are being developed to produce integrated systems, cadastral systems do not yet seem ready for such a development. The techniques of cadastral survey currently used are often simply technical upgrades of what was done in the past. They remain almost always two dimensional, that is they ignore the third dimension - height.

With the alphanumeric data, there is a need to replace the current system of deeds and title registration with a more sophisticated approach that can handle complex tenure relationships, that recognises many more rights in land, that can link multiple- parcel and multiple-ownership data, that is fully integrated with land-value and land-use data and that can be used as a tool for monitoring the land - what some may call a multipurpose cadastre though the precise definition of a system may be debated. The challenge for the less developed countries is to achieve this within their very limited resources and expertise.

2.5 The technical problems that need to be addressed

In any strategy for improving the performance of land registration and land management there are a number of technical problems that will need to be addressed. These include the following:

(a) The approach that is currently taken towards land surveying is predominantly method-oriented. There is a lack of flexibility brought about by survey education and training that has concentrated on methods whereby surveys can be executed rather than the problems that need

to be addressed. These are reinforced by survey regulations that are inflexible and often inappropriate, laying down methods of survey that are no longer cost-effective. They are directed at problems that are not necessarily the most urgent to solve.

(b)The standards of cadastral survey are often unnecessarily high for the environmental conditions in which they operate - for instance requiring centimetre accuracy where decimeter or half-metre accuracy would suffice. There is little awareness of the real cost of surveys or the precision that is sufficient for the task in hand.

(c)The expense and delay in quality control for such surveys causes much cost, though often unaccounted for, and much delay to occur in checking the quality of routine work. Checking may take months - in some countries it has led to delays of over a year - during which time development is held back. In some countries, qualified titles are issued to cover the period between the outline survey and its final approval. Such lines allow money to be loaned to the developer by the banks or finance houses. Where this is satisfactory, it is questionable whether there is any short-term need to complete the delayed survey.

(d)While much effort often goes into cadastral survey, with limited effect, little effort goes into creating and, more particularly, maintaining urban mapping. The cover and quality of such mapping is often wholly inadequate as a basis for planning and land management and overall land-development control.

(e)Rarely are there land-use maps, especially in the urban areas. Land is often planned without a knowledge of the uses to which it is currently being put or of its potential for development. There have been many occasions in which development has been planned for areas unsuited to the purpose.

(f)The mapping of facilities provided by the public utilities such as water, sewerage, electricity and telephone supplies are often totally inadequate for effective and efficient management, especially in urban areas.

(g)There is little coherent market information about land values and few opportunities to determine the effect of development projects on the land market. Land-value mapping is almost always non-existent, certainly at a level of discrimination that can help those responsible for the valuation of assets.

(h)Occupation of land is not easily converted into a sound title through adverse possession and the workings of the statute of limitations. While the interests of absentee land-owners may need to be protected, there should be more effective mechanisms to ensure that land is used to its full potential.

(i)There is little understanding of the limitations of information technology, the cost of data, the problems of maintenance or the difficulties of sharing data at a technical level between organizations.

(j)Finally, there is a serious lack of technical expertise that can take advantage of high technology. Few people know how to ensure that information technology is used effectively and efficiently.

2.6 The Institutional problems that need to be addressed

In addition to technical problems, there are a number of institutional problems that need to be addressed. These include the following:

(a) There is a lack of management skills. Many cadastral systems can be made to work if there is good management. Both amongst senior managers, but more particularly at the middle-management level, there needs to be a deeper understanding that management is not only about how to do the job but, more importantly, about how to get the job done. The education of land surveyors almost always stresses the technology that they will have to manage rather than the human and economic problems that determine the success or otherwise of implementing a cadastral system. All too often, management skills are treated as if by instinct and observation anyone of calibre can become a manager without training. If cadastral systems are to be improved then it is a priority to improve the management training of those responsible for managing the systems.

(b) There is often uncertainty about the level of responsibility for the quality of the work undertaken by civil servants and hence a reluctance to take risks. In some countries, such as Thailand, civil servants can be held personally liable for mistakes in the records even if they were not personally negligent. It is right that civil servants should show due care and attention in their work and can be proven to be free from corruption. But a failure to take risks results in over-checking of work, duplication of effort, unnecessary costs and excessive delay.

(c) There is much ignorance as to the true needs of users of the system. The significance of individual cases, for instance of boundary disputes, is often exaggerated out of all proportion and used as a justification for meticulous surveys. Users are rarely consulted about what they truly need; hence in a number of instances, the formal cadastral system affects only 25 per cent of the community, some 75 per cent of development taking place outside the formal sector. Reports (11) suggest that the World Bank has found that at least 40 per cent of development projects - and over 50 per cent of low-cost housing and shelter programmes - have run into serious difficulties because of a lack of adequate land information. The formal system is not responding adequately to user-needs.

(d) Systems are unable to respond rapidly to demand so that additional staff cannot be recruited or be laid off in response to changes in the market - yet demand for development and, hence, land fluctuates.

(e) There is often little awareness by the public of the benefits of maintaining the registers up-to-date. Hence dealings take place in good faith outside the official registration system.

(f) There is a lack of awareness of the applications and implications of land-information system and a failure both within individual departments and within governments as a whole to treat information as a corporate resource. There is a failure to have positive and pro-active policies both about land and about information, both of which are fundamental resources, the proper management of which is essential to the well-being of any society. Consequently there is a lack of awareness of the value of land information as a resource and wholly inadequate policies for pricing and marketing such information.

2.7 Externalities

In proposing ways whereby cadastral systems and land registration can be more affective and operate more efficiently, there are a number of factors which are outside the control of any systems manager. These factors include economic problems, social and cultural constraints, and political problems including the tendency for over-centralization of decision-making, instability of institutions and governments, and tight restrictions on the flow of information. While they do not all apply to every developing country, they frequently occur in many.

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III. EXISTING PRACTICES IN CADASTRE AND LAND REGISTRATION

3. 1 Principles and procedures

In what follows, the surveying and broader land-information elements of recording details about land parcels will be referred to as the cadastral system whereas the term "land registration" will be taken to refer to the legal aspects of recording land rights, either through deeds or title registration. Underlying all cadastral and land-registration systems is the recognition that land needs careful management. As pointed out in the World Bank's development report for 1989 (1):

"The legal recognition of property rights - that is rights of exclusive use and control over particular resources - gives owners incentives to use resources efficiently. Without the rights to exclude others from their land, farmers do not have an incentive to plough, sow, weed and harvest. Without land tenure, they have no incentive to invest in irrigation or other improvements that would repay the investment over time. Efficiency can be further served by making property rights transferable ... In most countries real estate accounts for between half and three quarters of national wealth. If ownership is widely dispersed, tenure is secure, and title transfer is easy, real estate can be collateral for nearly any type of lending. Unfortunately, these conditions are not always met in developing countries. Land distribution is often skewed, tenure (if any) insecure, and title transfer cumbersome. One key to a smoothly functioning system of land tenure is land registers supported by cadastral surveys. In many developing countries these are still woefully inadequate or missing altogether.

Land issues hold the key to economic development whether it be for the planning and implementation of housing and industrial projects in urban areas or agricultural improvement in rural, for collateral for development finance. For improvements to the utilities and infrastructure, or for addressing the major environmental problems of the age. Throughout most of the English-speaking countries of Africa, land registration has been concerned with land administration and land delivery, the term "land administration" being restricted to ownership means rather than to land taxation or to the wider issues involved in optimizing the use of the Land as a resource. Partly because of the influence of South African survey thinking in much of Central and East Africa. The two approaches - deeds registration and title registration - have had much in common, especially with regard to the methods of surveying and the supporting graphic records of ownership. By and large, the benefits of the cadastral and land-registration systems have not been quantified, land-reform programmes having been driven by social or agricultural necessity rather than by objective evaluation of the costs and benefits. Some projects, particularly those funded by the World Bank, have been subjected to financial scrutiny, but no cadastral system has been critically assessed on a national basis.

In the introduction of land registration, priority throughout most African countries has been given to areas

- (a) Where land reform programmes have been planned;
- (b) Where Government has intended to dispose of its own land;
- (c) Where litigation over land has been frequent or where disputes and uncertainty as to the ownership have been holding back development;
- (d) Where there has been a need to guarantee credit;
- (e) Where land values are high as in city centres and business districts;

(f)Where there has been cultivation of valuable permanent cash crops;

(g)Where there has been an increasing number and complexity of land rights;

(h)Where there was an intention to Introduce or improve the basis of tax collection (although this is relatively uncommon in Africa since land-based taxes are politically unpopular). Expediency may also have played a part especially where politicians have seen the benefits of registration and wished to see these extended to their own electorate.

In practice, not all areas are worth incorporating into the system. In every country, there are areas of low land value or low development potential where there is little or no justification for introducing registration of title. Although the total completion of the cadastral mapping of a country is an ideal, especially if it is treated as an information base on which to plan development, it may in practice be long delayed. Some areas may never be completed, for to do so would be an unjustifiable use of resources.

3.2 Existing procedures in cadastral surveying and land registration

Four basic operations take place in the compilation of land ownership records:

(a)Adjudication, or the determination of who owns what;

(b)Demarcation or the marking on the ground of the boundaries;

(c)Survey, or the recording of the position of the boundaries and other elements associated with each parcel;

(d)Documentation or the compilation of all the evidence into a set of registers.

When introducing registration of title to areas for the first time, it is common to proceed in the order:

(1) adjudication (finding who owns what); (2) demarcation (putting in corner beacons); (3) survey (of the boundary beacons); and (4) documentation (recording the results). Where the records already exist as for subdivision work, then the sequence might be: (1) survey (setting out); (2) demarcation (monumentation); (3) adjudication (allocating rights), and (4) documentation. Where the monumentation of boundaries is well established and clear but title is not yet registered, as for example in first registration of land in England, the sequence is in effect: (1) monumentation; (2) survey (in the United Kingdom at 1/1 250 or 1/2500 scale); (3) adjudication (what rights, which owner); and (4) documentation (registration of the title). Thus the permutation of when the procedures are carried out depends very much on circumstances.

In what follows, each of these processes will be examined further - for more information. see Dale (2) and in Dale and McLaughlin(3).

3.2.1 Adjudication

Adjudication is the process whereby existing rights in parcels of land are finally and authoritatively ascertained. Adjudication is the first stage in the introduction of registration of title to land in areas already settled but where the ownership of the land is officially unknown. It is also a prerequisite for land consolidation and redistribution to ensure that each existing owner is treated equitably. Alternative processes and supporting legislation that have been used in adjudication programmes have been reviewed in detail by Lawrence (4). In theory, the land-adjudication process does not alter existing rights in land, nor create 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 produce certainty and finality into the land records, a process which frequently alters the status quo since all too often the ownership and rights in land are unclear- There is an inherent danger that distortions in the land- ownership pattern may be introduced, especially in areas of customary tenure where the rights are uncertain.

Changes may also be introduced for reasons of expediency - for instance, in Malawi where some communal land became family land when precise boundaries were agreed at the edges of dambos or seasonal swamps.

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. By "sporadically" is meant "here" and "there", "now and then". namely whenever or wherever there is a demand or other reason to determine the precise ownership of an individual parcel. The sequence whereby parcels are brought on to the register is piecemeal, haphazard and unpredictable. Such has tended to happen when government-owned land has been brought on to the register. for instance, when alienating land for government schools, hospitals and dispensaries or for police posts. The systematic approach implies a methodical and orderly sequence wherein, area by area, all parcels are brought on to the register. It has, for instance, been used in Kenya and Malawi where large areas of unrecorded land have been brought on to the registers. Systematic adjudication is in the longer term less expensive because of economies of scale, more safe because it gives maximum publicity to the determination of who owns what within an area, and more certain because investigations take place on the ground with direct evidence from owners of adjoining properties. Sporadic adjudication can be used selectively to encourage specific categories of landownership 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 get 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 there is intended to convert it into a titles registry, recourse to adjudication in the field may be avoided - as was possible in Blantyre in Malawi. 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 was theoretically the ownership pattern and what is in reality there at the time of the conversion of the deeds registry into a titles registry. The titles register should always mirror what is on the ground, especially since a registered title to land is in most countries guaranteed.

3.2.2 Boundary monumentation

In a legal sense, a boundary is a surface which defines where one landowner's property ends and the next begins. For most titles, this surface is vertical and may be likened to a bead curtain suspended from the sky such 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. The 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.

be defined and guaranteed without the precise determination of where, within the walls and floors, one set of properly rights changes into another. General boundaries are appropriate where the development of the landscape is mature, for example, where in urban areas the pattern of use is well established. They are also particularly useful when the ownership of properties is being determined in isolation, as in sporadic adjudication, for the ownership of land can be ascertained without it being necessary to consult the owners of the adjoining properties. The advantage of more specifically defined boundaries is the confidence which parties can have as to the precise spatial extent of their properties.

While land surveyors tend to argue about the advantages of either fixed or general boundaries, in reality each approach depends on good monumentation on the ground. This is essential so that the landowners can recognize the limits of their properties. The monumentation of a parcel boundary is generally achieved in one of two ways - the emplacement of corner beacons and pegs in the ground or the construction of linear features such as walls and fences or the growing of hedges. The advantages of pegs are that they are cheap, have a low maintenance cost, are easy to emplace and they indicate the precise location of the corner points of property boundaries. As part of the survey process of setting-out, their positions can be precalculated, a matter of increasing convenience with the extension of computer technology and the use of computer-assisted design for the layout of new housing estates. Their major disadvantage is that they are easier moved or lost either deliberately, carelessly over time or inadvertently during the construction, for example, when bulldozers are used to build roads or to dig drainage ditches. Boundary marks should be visible at all times so that landowners and their neighbours can know instantly the limits of their properties. Pegs buried flush with the ground soon become hidden by vegetation or soil and can be expensive to find, especially if it is necessary to call in a surveyor to locate them.

In rural areas the growing of hedges often provides a simple and practical means whereby boundary lines can be made visible, especially from the air thus allowing the use of cheaper photogrammetric methods of survey. Such methods of monumentation do not, however, provide a universally acceptable solution to the problems of the demarcation. Hedges may conflict with local agricultural practice; they may take nutrients and moisture from the soil which could be more productively used; they may be socially unacceptable - in some societies the concept of a fence or hedge as being a barrier against intrusion is contrary to customary law and practice; or they may form barriers which are resented by pastoralists who have established rights to move freely through the land. Hedges may fundamentally change the nature of the landscape; they may alter their positions over time, reseeding themselves downwind causing a dynamic change in the location of boundaries; they require labour both to introduce and then to maintain, and, of course, they may wither and die. Similar objections can be levied against the use of fences which may be more expensive to construct and to keep in good order. If such methods naturally occur within the community, then advantage should be taken of them. Even though fences are primarily items of defence and guards against intrusion and are often erected for social rather than for legalistic reasons, the general boundaries rule will permit their use for registration purposes. In urban areas, the most permanent monument is often the building itself and the actual boundaries can be referred to it. In rural areas, in spite of the objections above, fences and hedges are more advantageous.

Hedging was the key to success in Kenya where millions of hectares of rural land were brought on to the register in a relatively short period of time. In a major land-reallocation scheme, each prospective new landowner was required to grow boundary hedges so that these could be

photographed from the air and subsequently mapped. A hedging inspectorate was set up within the Survey of Kenya charged with ensuring that the hedges were in fact planted and properly maintained. In general, the landowners were sufficiently convinced of the importance of hedging their land that they cooperated with the authorities. As a result, the granting of title proceeded on the basis of effective and extremely cheap surveys. In Malawi, it was argued that farmers would not be happy with tending hedges during the time that they should be working on their own cash and subsistence crops and hence it was decided to mark the boundary turning points with concrete pegs.

3.2.3 Cadastral surveys

There is some evidence that, in the short term, adjudication of the ownership of parcels and the location of their boundaries, followed by suitable monumentation, provides the necessary and sufficient conditions for secure tenure. This is especially the case in rural areas where many disputes can be avoided if there is sufficient publicity accompanying the adjudication process and there is clear monumentation of points on the ground so that adjoining neighbours can see the agreed limits of their land. The cadastral survey of the boundary beacons or lines further helps to resolve disputes.

Surveying represents a long-term investment for which the advantages, though real, are not immediate. A geometrical framework provides a basis for producing maps which can assist in the administration of the land, for planning and controlling its development for redefining disputed or uncertain boundaries and for structuring geographical or land-information systems. The normal procedure is to establish a network of points around a country, known as the primary control. These are then subdivided into secondary, and then into tertiary control points, so that at all times a surveyor would be relatively close to these coordinated points. For an overview of geodetic reference frameworks see Stem and Young (6).

The network of control not only provides an overall spatial framework but also facilitates quality control for more detailed surveys. Thus cadastral properties can be surveyed and connected to two points on the control network, each connection being a check on the other; hence the accumulation of error throughout all the survey measurements can be monitored. Quality control is a basic problem in all survey operations and survey- control networks provide a ready method for maintaining standards. If, however, the quality of any new survey exceeds that of the control to which it is connected, the new survey will be downgraded if it is adjusted to be in sympathy with the old.

Throughout Africa, the main geodetic control was surveyed by triangulation through the precise measurement of angles at each point in the network strengthened in parts by long-range distance measurements. Increasingly however it is being strengthened by measurements using electronic positioning systems, initially through the use of satellite Doppler techniques and, more recently, through the use of the Global Positioning System (GPS). This has tended to be used to strengthen the quality of the primary control but offers the opportunity for further densification of the secondary and, more particularly, the tertiary networks.

GPS, incorporating the United States Department of Defence NAVSTAR satellites, offers substantial possibilities for densifying the control networks of developing countries at a more economic rate with much faster pace than hitherto has been possible. GPS can operate in most weather conditions and does not require the intervisibility between control stations that is essential for conventional terrestrial techniques. The technology is becoming cheaper and it needs little skill to operate in the field. The major disadvantage is that at least four satellites must be visible in the sky and obstructions such as forest or high- rise buildings can prevent its effective use.

Two approaches to the recording of land-parcel boundaries have emerged - field survey and photogrammetric. Field survey is concerned with the measurement of angles and distances.

The techniques of cadastral survey are standard and routine and well documented in land-surveying textbooks. Throughout Africa, various techniques have been adopted. The options for measurement (7) include: (see page 20)

Most countries use theodolites to measure angles and steel tapes or electronic distance measuring (EDM) devices to measure distances. Points of detail are fixed by traversing or by the measurement of directions, or distances, or both, from known control points. The plane table has been used in rural areas of Buganda in Uganda while subtense bars have been used in Malawi. The standards of accuracy that must be achieved are prescribed in Survey Regulations that may draw some distinction between rural and urban areas but rarely are sufficiently discriminating to allow the choice of method to be made on the basis of land values, land use or the cost of survey.

As an alternative to field survey, photogrammetric methods can be used. These have proved successful in the short term in Kenya where, in areas of land resettlement, the boundaries of properties were marked by growing hedges the positions of which were traced off enlarged aerial photographs. Because of the displacements in the photographic image relative to a map due to the non-verticality or "tilt" of the aerial photograph, and to variations in terrain height, dimensions cannot be accurately measured off standard or enlarged aerial photographs. "Rectification" of the photographs compensates for the so-called "tilt displacement" while "orthophotography" in addition provides compensation for height displacement. Although both processes require relatively expensive equipment, they have been successfully used in a number of countries. In Thailand, for example, where much of the land is relatively flat, there has been considerable success in cadastral map compilation through the use of rectified photography (8).

Surveys from aerial photography are cost-effective where economies of scale can be applied, as for instance in the first compilation of a cadastral record. They are less suited to record maintenance and upkeep, and cannot be used for setting out new parcels. They depend on the existence of air-visible boundaries or clear marks such as the corners of buildings from which the precise location of the boundaries of a plot can be obtained through subsequent field survey measurements. The unit cost depends on the number of parcels that are surveyed and the precision which is demanded. Photogrammetric techniques can produce high levels of positional accuracy, even centimetre precision being practical given sufficient resources. The issue is not one of accuracy but rather practicality and cost under any given circumstance.

A detailed comparison of field and photogrammetric surveys in cadastral surveying was presented in 1973 by a United Nations ad hoc group of experts (9) who saw the advantages of field survey procedures as providing an approach whereby:

(a) Measurements can be taken as soon as the boundaries are agreed, thus reducing the chance of subsequent misidentification;

(b) Techniques can be used for which the necessary investment in instruments and other material requirements is relatively small;

(c) The conversion of field measurements into maps is a relatively straightforward and simple matter.

Field survey Techniques require good, dense control networks, are labour intensive and slow, and are dependent on the weather. They also require considerable logistical support especially in remote areas.

Photogrammetric techniques were seen by the Group of Experts as more cost-effective for the initial compilation of cadastral plans, given boundaries that are visible on the aerial photographs and sufficient numbers of boundary lines to be surveyed. The disadvantages of photogrammetric methods are in their high investment cost in equipment and photography and the problems of keeping the records up-to-date.

For both field and photogrammetric surveys there needs to be some quality control and it is here that Survey Regulations almost always favour the ground survey techniques which are more easily checked. Because of the difficulties of checking photogrammetric surveys - most checking is done in the office rather than out in the field - and because of resistance from ground surveyors who have seen air survey as a threat to their traditional work photogrammetric techniques in cadastral surveying have in general only been used by the public sector; the private sector's contribution has tended to be restricted to flying and the acquisition of the photography. The use of satellite imagery and remote sensing techniques has been advocated by some but the resolution of such imagery is poor and cannot, in general, reveal individual parcels: it is only of value when large unit areas are to be mapped to low standards of accuracy or where the military restrict the acquisition of conventional vertical aerial photography, ostensibly for security reasons. In a number of countries this is a major institutional problem that prevents the cost-effective production of cadastral reform.

3.2.4 Parcel documentation

Having completed the adjudication, survey and monumentation of properties, the results are entered in the registers. Manual filing systems are used although recently there has been some micro-computerization of the registers in Zambia (see below) and in Botswana. Two sorts of record are maintained - the alphanumeric data indicating the name of the property owner and the details of the tenure including any encumbrances, and the graphic data showing on a plan the results of the survey. The latter may contain numeric data, for instance the bearing and distance of each of the property boundary lines. A variety of parcel referencing systems are used ranging from the title number (Kenya), volume and folio (Uganda), subdivision name and plot number (Zambia), block and plot number (Malawi) through to street index and parcel address. Coordinates are not normally used as parcel identifiers or unique parcel reference numbers in less developed countries even though they are more suited to electronic data processing. This has not yet become sufficiently widespread to justify their adoption.

The inherent danger of fire and natural or man-made disaster makes it wise to maintain duplicate copies of all legal documents, for instance, on micro-film.

This can be a significant expense that must be related to the level of risk of the records in a land registry being destroyed. Where there is decentralization of the registers, the risk will be minimized but in the volatile conditions in much of the third world it may still be desirable. Many of the records in one country, for example, were lost during civil war; fortunately many documents had been recorded on micro-film five Years earlier when for economic reasons the creation of disaster copies was abandoned.

3.3 Institutional Issues

3.3.1 Costs

The most difficult aspect in the operation of cadastral and land- registration systems is to estimate their costs and benefits. Even costs are difficult to assess because of inadequacies in management information, a lack of proper business plans, the complexity of sharing costs between parts of an organization and between different organizations such as departments and

ministries, and a lack of cost consciousness among the staff. Governments have subsidized mapping in general - both topographic and cadastral - and there has been a casual attitude to costs. The benefits of cadastral mapping are similarly hard to quantify because there is no adequate methodology that is simple and effective. Although the cadastre has a fundamental role in improving the delivery of land in support of development, it is only one component in a series of operations and inter-related factors that can bring about better land management. Some of the issues relating to costs and benefits were discussed by Dale and McLaughlin (10). The conventional argument is that secure property rights act as an inducement for investment in real property and in the longer term will result in greater productivity from the land. But, as Holstein (11) has pointed out, little formal evidence is available to support this view in low-income countries.

As a general rule of thumb (12), the hourly cost of any surveyor or clerk working, for example in the field, or in the office checking surveys as part of quality control, is one five-hundredth of an employee's gross annual salary. Thus, divide the annual salary by 500 and the resulting figure is the hourly overhead rate that it is costing government for that person's services. Given a surveyor earning the equivalent of \$US10,000 per year the charge-out rate needs to be \$US20 per hour to cover the cost. Such a surveyor spending two days checking a survey would in practice be costing the government \$US320 to do the work. Such expenditure is rarely justified against the savings that may be made by avoiding error. It is worth noting that in New Zealand the charge for checking work of the private sector has been raised to a unit price of \$NZ600 (13).

In most cadastral systems, the true cost in each survey is not accurately assessed and is very much higher than the scales of fees that are calculated since, in addition to the overhead cost of labour, there are the detailed individual expenses such as transport and subsistence allowances that are associated with any individual task. Somewhat similar problems exist in the office management of records in a deeds or title registry, though here the additional expenditure is easier to account for.

3.3.2 Organizational arrangements

A variety of institutional arrangements exist for operation of the cadastre and associated land-registration systems. Two operations must be administered - the survey and the legal. In addition, however, there is the overall problem of the administration and management of the land as a resource. In all countries under review there is a survey department that is responsible for the execution of cadastral surveys, especially of government land, and for monitoring the work of the private sector. There may be some decentralization to regional survey offices but normally there is tight control from the centre.

The administration of titles as distinct from surveys is normally handled by either the Lands Department (as, for example in Kenya) or by the Judiciary through the Deeds Registry (as in Zimbabwe and in Malawi). Cooperation between the land surveyors and the land administrators is not always as effective as it ought to be. Communication suffers because of a lack of understanding by each party as to the importance of the contribution of the other. In 1973 the United Nations Ad hoc Group of Experts (14) made the following comments that remain valid today:

"Institutional problems are among the most difficult to resolve in the establishment and maintenance of a cadastre, and the lack of recognition and adequate resolution of such problems are probably the most common causes for the ineffective functioning of a cadastre.

"The effective implementation of a cadastre is a complex operation involving the establishing of a functional system of relationships among several institutions for the establishment,

maintenance, use and future refinements of the cadastre. No part of the system is entirely independent of the others; and if one part fails to work, the system breaks down."

"... It will be apparent that :

"(a) There must be an office or offices in which information concerning legal rights and other information concerning parcels relevant to the particular purpose for which the cadastre is used will be registered and maintained;

"(b) There must be a survey organization responsible for the production and maintenance of the cadastral maps and the description and numbering of parcels; this organization might also collect, if feasible, other information required on such subjects as land use or buildings.

Ideally, the registration and survey functions should be performed by a single agency. This arrangement guarantees the best possible coordination between the various parts of the whole operation. In many countries, however, there already exist different agencies, sometimes established by law, which are charged with performing different aspects of the activities involved in establishing a cadastre, or there may be several agencies in one country each charged with establishing cadastrals for particular purposes. These agencies may already have collected at least part of the information needed for a new cadastre, and this work must therefore be correlated with that of any new agency. In practice, it will be difficult to alter existing arrangements of this kind, for which there may be historical or political reasons."

3.3.3 Computerization

At present, progress towards computerization has been slow because of the inherent difficulties with the technology and more especially with data conversion. Whereas computers have been applied to land-survey computations, the development of land and geographic information systems (LIS/GIS) is proving more difficult. A number of seminars have been held on the issues posed by computerization and the development of LIS, for instance, in Zimbabwe. Although there is a growing awareness of the potential of the technology, the technical, economic and institutional problems have yet to be fully addressed, especially where they impinge on such sensitive issues as land.

In Zambia, the Lands Department (15), with the assistance of staff and other resources from Sweden, have applied computer technology to the land registers, namely the Property Register which contains cadastral information about each registered parcel, the Lease/Payment Register that contains information about ground rents, and the Lands Register that contains information about dealings in land such as leases, title holders, transfers and mortgages. All three registers have now been fully computerized and are being continuously updated. The Property Register is maintained by the Survey Department, the Lease/Payment Register is the joint responsibility of the Ministry of Finance and the Lands Department while the Lands and Deeds Registry have control of the land registers.

The information stored in the systems includes: (see page 24)

The main objectives of computerization have been to:

- (a) Reduce duplication in the storage of information;
- (b) Reduce the need for notification routines;
- (c) Improve the collection of ground rent;
- (d) Cater for the expected increase in registration of titles, mortgages etc.;
- (e) Replace registers that were physically damaged and required to be rewritten.
- (f) Facilitate the compilation of information and reports that were impossible or very cumbersome to produce using manual systems.

In Botswana, a pilot study has been underway to produce a computerized land inventory. The present land-registration system covers state land and freehold lands which are mainly in towns or farm areas. There is a deeds registry built on the South African model and administered by the Attorney General while the Department of Surveys and Lands provides the necessary maps and parcel referencing. The remainder of the land some 70 per cent of the country - is subject to the Tribal Land Act and is not properly registered. While the formal registration system for freehold and government land works reasonably well, it does so at relatively high cost with low productivity due to the high accuracy of surveys that is required and a general lack of resources. The system within the Tribal Lands has serious deficiencies when it comes to the allocation of land by the Land Boards. According to Persson (16), there are

"... no identification/numbering system for allocated plots;

"no easily accessible records of owners";

"no compiled maps showing vacant and occupied land or the

"location of plots; and

"no maps/plans showing the size of the individual plots.

These shortcomings of the system seriously hamper the development of Tribal Land. Reliable land records are vital for physical planning, project implementation, land transactions, security of tenure, access to credits etc. They also facilitate public administration, e.g. production of statistical information and taxation."

Experimental work has therefore taken place to introduce a computerized system for the maintenance of basic land records. This complements work already taking place in the Department of Surveys and Lands which has a number of information systems, none of which has, as yet, been systematically computerized. These include numerical cadastral data (mainly of townships), aerial and satellite photography, topographic maps, estate records (governments housing, occupiers, rents etc.) and State land records. The latter include parcel numbers, the names of interest holders, the nature of each interest, the date acquired and the price.

There is currently a major project to computerize the State land records using a networked PC system. It is hoped that the Deeds Registry records will also be computerized and that there will be compatibility between systems. The township rating rolls for the major urban centres have already been computerized on a PC system. Various parastatal corporations, such as for housing and the utilities, are also going down the path of computerization. The major problems have been the shortage of a skilled workforce and the loss of computer staff from government to the private sector. This is a story that can be told in most developing countries.

Throughout most of Africa there is a notable lack of relevant management information especially in computerized form. In many countries, departments have difficulty in compiling their annual reports, Zimbabwe being a notable exception. When it comes to the monitoring of the cadastral survey and land-registration flow line, data are almost always unavailable in a form that will allow proper management analysis. Thus bottle-necks in the system remain undetected and many decisions are made on a reactive basis rather than through anticipation and analysis of the problems. Data, when available, are often out-of-date, creating crisis management, rather than leading to strategic planning.

IV. THE WAY AHEAD

4.1 Introduction

In this chapter, solutions to some of the problems already identified will be offered. Four particular sets of issues will be considered - technical matters including survey and record management, legal matters, institutional arrangements including education and training and cost recovery, that is how to pay for it all. The premise underlying the solutions offered is that the ultimate objective of the cadastral reform is the best use of land as a resource. The cadastre and land registration are instruments of land management- Guarantee of title and security of tenure are important sub-components but are only part of the overall strategy. They are not ends in themselves.

Any improvements to existing systems must be undertaken within an overall framework of Land policy that deals with the social and economic and environmental issues of land management. While national policies are determined at State level, in many cases these merely provide guidelines, the detailed interpretation and implementation of which must be carried out at the local level. Measures must be undertaken to deal with such matters as absentee landlords, illegal squatting, unapproved or encroaching buildings, and traditional and informal use of the land. Any response to these issues will in part depend on legislation covering the adverse possession of land and the terms of any statute of limitations. Policies are also needed to deal with specific groups within the community, especially with regard to the land rights of women. The United Nations Economic Commission for Africa has addressed this particular issue (1).

One of the crucial issues in land management is the extension of the benefits of land registration and cadastral survey to the informal sector. In many countries it is estimated that there are around 90 per cent of the parcels of land that are unregistered. Further, the existing records must be kept up-to-date but this is often only partially undertaken. Maintenance is essential in any long-term strategy for land management - without continuous updating of the records most of benefits can be achieved through a system of private conveyancing without government subsidy.

There are a number of reasons why all too often the records are not kept up to date. One reason is that most existing systems are producer-driven rather than demand driven and do not have sufficient resources to cope both with extending the system and with the consequent increase in the number of dealings and mutations. The process is usually expensive in terms of time and fees (both formal and informal while subsequent transfer taxes add to the burden, especially for those on low income. Further, the processes of registration and transfer may require visits to offices at significant distances away from where the land owners live. The public needs to be persuaded of the benefits of maintaining the registers. People are often ignorant of the benefits, many of which, such as security of tenure, stem more from the processes of adjudication and demarcation than from the issuing of a certificate of title.

In seeking to improve land management through better land registration and land information management, "perfect" solutions are not achievable. Optimization within existing constraints is, however, possible. There is no panacea for all ills and the optimum solutions must depend on the existing political, legal, social, economic and physical environmental conditions. In each country, the solutions will be evolutionary rather than revolutionary, that is, they should build on existing resources and procedures, duly modified, rather than the imposition of yet another alien system.

4.2 Technical solutions

Before improvement can be made of any cadastral system and the technical problems overcome,

there must be recognition by all parties of the urgency of finding and implementing solutions. Training in management techniques will be essential, for without good management by those whose task it is to implement reforms, the exercise will almost certainly fail. All too often, aid agencies have provided resources in the form of equipment to solve problems but have found that through a lack of training and inadequate management skills such resources are under-utilized. Senior staff must be strongly motivated and adequately rewarded so that they are able to get their junior staff similarly motivated and willing to introduce the changes in attitude and procedures that are needed.

In the technical environment, there are two main sets of issues - data acquisition, including field survey, and data and record management. Underlying the approach to each must be an acceptance of risk. Too much time and money are currently spent on precise survey in an attempt to prevent problems in the future. The consequence is a low level of productivity restricting the benefits of the cadastre and land registration to relatively few people and to very limited areas in each country. The overall aim should be complete cadastral cover of all relevant parts of the country though in the initial stages, priority areas and objectives will need to be set in order to realise the benefits as soon as possible.

If the cadastre is to be used as a tool of land management then must contain a "critical mass" of information, that is, there must be sufficient parcels surveyed and registered for the cadastre to be of use to planners and land administrators. To achieve this it may be necessary in the short term to take increased risks and to lower technical standards. The long-term strategy must be " maintenance of high standards that are related to a conscious analysis of risk. High standards do not necessarily require high levels of precision in survey measurement. In central London, land values are as high as anywhere in the world, but developers and land administrators can manage with a graphical representation of each land parcel to register their titles. So can the less developed countries. The challenge is to encourage a realistic assessment of what is necessary and sufficient rather than what is technically the best.

4.2.1 Monumentation and adjudication

Characteristics of good monumentation were discussed in section 3.2.2. What is appropriate for any given set of environmental conditions will, in part, depend upon custom and practice and on local conditions. In the process of demarcating boundaries, timing is an important factor - it is clearly neither efficient nor cost-effective to emplace concrete beacons before development takes place so that many are lost during building and road construction. Where people grow hedges or put up fences at the limits of their properties, these should be used as boundary markers; where there is open planning and resistance to the erection of barriers between properties, then corner pegs may be appropriate though many of these tend to get lost. Corner marks should be obvious to all and tied to permanent features, such as the corners of existing buildings which form, perhaps, the best type of monument from which to redetermine boundaries.

The process of adjudication offers the opportunity for community involvement both in the determination of rights in land and in the selection of priority areas for registration. Where possible, the compilation of registers should be carried out on a systematic basis because the unit costs are less than in the sporadic approach. For this there must be compulsion to register.

If systematic adjudication is to take place it must be supported by an adjudication of titles act or ordinance. Where a sporadic approach is adopted- either for first registration or in the case of subsequent dealings - disputes and uncertainties over landownership will need to be resolved. Frequently the civil courts are too burdened to cope with the demand. In such a case, either additional powers, including those of delegation, should be granted to the chief land

registrar or else separate courts should be established to hear land and boundary disputes. These courts would replace the civil courts except in matters of appeal or in the interpretation of the law.

The standard procedures for systematic adjudication begin with the promulgation of a law defining the powers of those who will take part. This law provides a framework within which to conduct the adjudication process - examples of such laws can be found in Kenya and in Malawi. Normally there will be an adjudication officer who is responsible for making the necessary decisions. Such officers may be assisted by local committees of non-officials. In addition, there will be a demarcation officer responsible for marking out the parcels, a survey officer who will survey the boundaries and a recording officer who will take note of all the decisions reached. One officer may undertake more than one of these functions.

Having selected an area, publicity must be given to the adjudication programme making announcements over the local radio or in the press and holding public meetings to explain what is happening. It is essential that the landowners have an understanding and confidence in what is going on, for without their cooperation the adjudication will fail. They must know at what time and on what day their land will be visited by the adjudication team so that they can prepare and present the necessary evidence. At the appointed time they will explain their claim and the adjudication officer will make a decision which will be recorded by the recording officer. If the boundaries are determined concurrently, then they will need to be demarcated and, at the earliest possible subsequent date, surveyed - too much delay and the surveyor may be unable to find the new boundary beacons. This happened in the early days of adjudication in Malawi when the demarcation teams worked too far in advance of the survey teams who were then unable to find where the marks had been emplaced. Improved survey and management techniques eventually solved this problem.

The results of the adjudication should then be displayed in some public place and landowners permitted a limited period of time - usually between 30 and 60 days - to appeal against the decisions if they have grounds for doing so. Once any appeals are settled, the details are entered into the land registers as the definitive statement of the official rights in the land.

While both systematic and sporadic adjudication will normally lead to a State-guaranteed title, mechanisms may be needed to provide short-term solutions and to deal with uncertain tenures. These may include the issue of temporary occupation licenses, rights of occupancy or use but not outright ownership, or the issue of limited, qualified or possessory title. Such mechanisms should indicate that such temporary titles will be converted into a full title unless, by a certain and predetermined date, either the land is required for specific development or the true owner can prove superior rights to those of the temporary title owner. The use of limited titles enables a more rapid conversion of land on to the register, allowing apparent rights to be recognized. Less accurate methods of parcel identification and survey can be adopted, as happens in Malawi where the provisional title may be supported by a sketch plan. Such preliminary surveys must be upgraded at the earliest opportunity if long-term problems are not to occur - for instance as happened in Thailand with the issue of the so-called NS3K titles that are having to be replaced a decade or so later (2). Even with a general boundary system that guarantees ownership without guaranteeing the extent of land, there is need for minimum standards of accuracy and precision as has been found in Kenya (3). Time will cure many problems especially with regard to outright ownership but problems of boundaries tend to remain until an adequate survey is undertaken.

4.2.2 Survey procedures

In the short term, some land-registration problems can be solved without land survey. Where there is good monumentation of parcels, an effective land-parcel referencing system and a

static environment then simple adjudication to determine who owns each parcel may be sufficient to guarantee title and provide security for the landowners. This is particularly the case where development is complete, as in most areas of cities and towns and in many rural areas. Survey of boundaries is only an investment in case of future dispute over the land. If, however, cadastral survey is seen as more than boundary surveys and instead, is treated as part of the basic information infrastructure for development, or if conditions are dynamic and unstable so that disputes over land are not uncommon, then survey is justified. Since this will most often be the case, the focus should be on the accuracy and precision that is necessary for most practical conditions. Solutions to the problems caused by extreme and rare events should form part of emergency planning, not routine day to day activities.

4 2.2(a) Cadastral map accuracies

The premise in looking at survey procedures is that graphic standards of accuracy are sufficient for most practical purposes. Technology is forcing survey data to be held in coordinate, that is digital form but this can be stored to plotable accuracy. The term "graphic standards of accuracy" means that measurements are accurate to the thickness of a line drawn on the map - for instance 0.2 millimetres which represents 20 centimetres on the ground for a 1/1000 scale map or 1 metre at 1/5000 scale. The long-term objective in cadastral surveying should be to build up a database that will hold the geometry data associated with the cadastre as a set of coordinates recorded at least to graphic standards of accuracy.

Standards of accuracy need to be higher in densely populated urban areas and lower in rural and will be reflected in the map scales used. Thus in the central business districts of towns and cities, a map scale of 1/1000 will normally be sufficient; in peri-urban and residential areas 1/2000 to 1/5000 should suffice, depending on the density of development and the type of boundary monumentation that is used; while in rural areas 1/10000 to 1/25000 or even 1/50000 depending on the size of the plots of land may be appropriate.

In essence the scale of map should depend on the modal size of the parcels and the type of monumentation used to indicate the boundaries of each property - in Thailand where much of the land is intensively cultivated, 1/4000-scale maps were deemed appropriate for many rural areas and these were based on rectified aerial photography. Even in the Australian Capital Territory (Canberra) where a Torrens system operates, Section 64 of the Real Property Act provides that:

"(1) The Registrar may require the proprietor applying to have any land brought under the provisions of this Act, or desiring to transfer otherwise to deal with the land or any portion thereof, to deposit at the registry office a map or plan of the land, certified by a registered surveyor under the Surveyors Act 1967.

"(1) A map or plan deposited in accordance with sub-section (1) shall be in a form approved by the Registrar.

"(2) If the land or the portion thereof proposed to be transferred or dealt with is of an area not exceeding 5000 square metres, the map or plan shall be on a scale of not less than 1 to 2000

(3) If the land or portion thereof proposed to be transferred or dealt with is greater than 5000 square metres but not exceeding two hectares, the map or plan shall be in a scale of not less than 1 to 4000.

(4) If the land or portion thereof proposed to be transferred or dealt with is of an area exceeding two hectares but not exceeding 30 hectares, the map or plan shall be on a scale of not less than 1 to 8000.

'(5) if the land or portion thereof proposed to be transferred or dealt with is of an area exceeding 30 hectares the map or plan shall be on a scale of not less than 1 to 20000.'

Notwithstanding the above, much higher standards are set by the Australian Capital Territory Survey Regulations and it is now suggested that coordinate values of corner beacons should be guaranteed to a precision of around 2 centimetres- in part because it is technically possible to measure to that accuracy.

The use of map accuracy to define cadastral standards does not preclude more precise survey for those who want them and are prepared to pay for them. Given a unique property reference number, more detailed surveys can be cross-referred to the national series and separate plans recorded showing measurements to whatever precision the landowner is willing to pay for. It should not be the function of government to provide or insist upon such precise surveys for, on the basis of risk, it is probable that graphic accuracy is both necessary in the longer term and sufficient for most practical purposes.

In the shorter term it may be necessary to dispense with graphic standards and to produce maps by tracing the outline of each land parcel off enlarged aerial photographs as was done in Kenya in the 1960s and 1970s. Such a solution produces a topologically accurate plan in that each plot can be shown correctly in relation to its neighbours even though in conventional topographical terms, the size and shape of each plot is incorrect. This is due to the non-verticality of the aerial photographs and variations in terrain height across the landscape. Such a solution depends upon there being boundaries visible from the air (such as hedges or small earth mounds or "bunds" around each property). In due course, more planometrically accurate surveys can be undertaken to replace the temporary solution, especially since it is possible to take accurate measurements from the aerial photographs. Thus the precision and accuracy of the surveys can be incrementally improved over time.

Such an approach is inherently dangerous in that decisions may be made on the basis of false information since it is not easy to detect which surveys are accurate and which not, especially when the quality of draughting can mislead the unwary to believe that a well-drawn map means that it was based on accurate measurements. Confidence can be quickly lost if the surveys are thought to be good but are subsequently shown to be inaccurate.

4.2.2(b) Survey control

In order to provide accurate scale and orientation to maps and to prevent the accumulation of error, surveys are traditionally connected to a network of control points the positions of which are accurately established. The more dense the control network, the easier it is to check the quality of the surveys and hence the lower the technical grade of surveyor that is needed to maintain high standards of accuracy and Precision.

The essence of a land-information system is that the data can be spatially referenced. For that to happen there must be a reference framework; hence national control networks become desirable to provide a unified system. The greater the density of points established within developed areas, the greater the use of the network. The points co-ordinated need to be permanent and easy to find- concrete marks buried beside roads tend to be difficult to relocate and are often damaged or removed in road construction and repair. Points should be selected after consultation with planners and developers to maximize the risk of damage. Given a dense network, there is little need for sophisticated monumentation - many cities around the developed world have traverse stations in the form of nails driven into concrete pavements and these prove adequate for the survey of detail and the restoration of coordinated boundary points.

The establishment of control networks has traditionally been expensive and time-consuming though the advent of long-range electronic distance measurement systems marked a major improvement. At the national level, these measurements were supplemented by electronic positioning systems using satellite technology. Currently the Global Positioning System (GPS) is being introduced which, when all the planned satellites are operational, will revolutionize control nets and their densification. GPS technology- both hardware and software - is becoming cheaper and although access to the precise ephemeris (which is information that facilitates the precise location of points on the ground using one satellite receiver) is now restricted by the United States Ministry of Defence, the use of two receivers allows for the precise determination of relative positions to centimetre-level accuracy. Developing countries may well be able to take advantage of this technology to densify their control networks. The ready availability of quality control can make all forms of detailed surveys cheaper, quicker and more accurate. This includes topographic and engineering surveying as well as cadastral (land title boundary) surveys.

There is a doctrine among land surveyors that all surveys must start with the control net so that work may proceed "from the whole to the part". In one interpretation this means that new surveys, which may because of developments in technology be to higher standards than old surveys, must be downgraded to fit the old control. In another it means that detailed mapping cannot proceed without the control network being completely observed and the coordinates of all points calculated. As such, cadastral surveys in areas lacking in control would be delayed for several years since observations of the geodetic network are time consuming. Fortunately, technology is available so that surveys on temporary control can be undertaken and subsequently adjusted when the geodetic network is complete. Given the pace of development especially in urban areas, no delay is tolerable. It is now feasible to adjust surveys to the national control network at a later date so that some of the immediate advantages of recording land-parcel boundaries can be realised at a much earlier stage. A number of studies have been undertaken into the costs and benefits of geodetic control (4). The payback period is long-term but, when seen in the context of a total mapping system and the overall benefits, it can be seen to be significant.

The principles underlying survey control and "working from the whole to the part- can be applied to boundary surveys by accurately measuring the perimeter of blocks of parcels.

Sub-division within these blocks can then take place using cheap and simple survey methods as and when they are required. This is particularly appropriate in urban and suburban areas where the layout design approved by the planners may include a series of regular, equal-size rectangular-shaped plots surrounded by roads of standard widths. particularly in rural areas, the landscape can be "polygonized", the subdivisions within each region or district being undertaken as and when there is demand. The broad outlines of the framework can be surveyed photogrammetrically, leaving internal subdivisions to be undertaken by ground-survey methods when resources are available. This approach is for example being adopted in the United Republic of Tanzania in order to provide outline maps of some 8000 village settlements (5) - the objective being to map village land to standards that meet the needs of those administering the National Land Use Policy.

A similar approach has been advocated by Jeyanandan and Williamson (6) who in designing a cadastral model for developing countries suggest:

"The basic land unit for the purpose of the cadastral map will be aggregates of proprietary land parcels. These aggregates, blocks, enclosures or tracts shall contain about one hundred to four hundred land parcels - lower figures for urban areas - bounded by permanent natural or artificial features. The delineation of blocks will be

on the basis of land value and use in urban areas, availability of infrastructure facilities and development needs in peri-urban areas, agricultural and social considerations in rural areas. Where possible state land should be separate blocks with any lease, vested or reserved land identified.

"Cadastral maps will be prepared by recording the block boundaries on available large-scale topographic maps or on maps derived from unrectified enlargements of aerial photographs. The accuracy and scale of the maps will correspond to block sizes and available survey and mapping resources.

"All land registration records, land and building tax rolls and planning and development data available at present will be rearranged to accord with the block system. Land parcels without registration records will be identified.

"Each block shall be assigned a unique identifier. Every land parcel and corresponding record will be referenced to it."

Such an approach would allow subdivision to take place within each controlled framework, preventing errors in one part of the system adversely affecting the records of other areas and allowing priority areas to be addressed first. In the United Kingdom, for example, the total mapping of the country by the Ordnance Survey has set up such a framework and the first registration of any property can take place, using the general boundary principle, without affecting neighbouring properties.

4.2.2(c) Field survey techniques

The survey of property boundaries by field techniques (as distinct from photogrammetric) has traditionally been restricted to very few methods by Survey Regulations. Surveyors acts prescribe who may conduct surveys while the regulations lay down the methods that they must adopt. The most common technique of survey has been traversing with angular measurements to be taken by theodolite and distances measured by catenary taping or by electronic distance measurement (EDM). For the purposes of coordinating property corner beacons, such a technique is relatively efficient while the accuracy of the calculations is easy to check. The standards of accuracy that are expected have tended to be those that were technically possible when the regulations were introduced rather than those necessary for the probable uses of the measurements. Further, the checking process has given rise to wholly unnecessary delays and expense, lightly controlled by the regulations rather than by the reality on the ground.

Field survey techniques are important both for setting out parcels prior to development, for recording existing development where economies of scale make the use of photogrammetry uneconomic, and for re-establishing lost boundaries. With the increased use of precalculated plot-layout designs and the use of "total stations" that can electronically display the coordinates of points as and when they are being set out, technology is offering greater efficiency to the field surveyor. The cost of such technology is, however, high while the problems of maintenance and repair in the case of breakdown can be considerable.

A basic problem has been the way that surveyors tend to concentrate on the means to the end rather than on the end itself. If emphasis is placed on the end-product, that is a map of properties, including the boundaries and what lies within them. then cadastral surveying can be seen in a different perspective. Any method of survey should be acceptable provided the end-product meets the accuracy for the specified map-scale in the area. Thus topographic urban maps at a scale of 1/1000 or 1/2000 may, for example, already exist for some towns. The cadastral boundaries can be surveyed on to these maps using, if necessary, only a linen tape provided that the measurements are to plotable accuracy of, in these cases, 200 or 400

millimetres.

4.2.2(d) Photogrammetric techniques

While photogrammetric techniques have played a major role in the development of topographic mapping, their contribution to the cadastre has been limited. A number of excuses have been offered - for instance, that they are too expensive, too inaccurate or that the licensing system and survey regulations do not permit their use. Photogrammetric methods are in the cadastral context, mass production techniques that are only cost-effective if sufficient boundary points or lines need to be measured. They are capable of all realistic levels of accuracy needed by the cadastre controlling factor being one of cost. Where regulations do not permit the use of photogrammetry, the legislation should be changed. Photogrammetric techniques are like all other methods of measurement available to the surveyor - tools that should be used when they are the most appropriate for the circumstances. While the same might be said of remote sensing techniques, their resolution and quality is rarely sufficient for cadastral purposes or mapping at scales greater than 1/20000.

Photogrammetry is ideally suited to the compilation of base maps and to the recording of physical features of the landscape that are visible from the air. An aerial photograph is an historical document and record of the landscape at a particular moment. It, therefore, has archival qualities and permit the investigator to go back in time, especially to the moment when the photograph was taken. Historical evidence of older boundaries, sometimes dating back thousands of years, may also be revealed to the skilled interpreter. The photograph is a data store and the existence and location of boundaries, buildings and construction and land use can often be determined from careful examination. The aerial photograph can be used in the survey of boundaries and in the compilation of multipurpose type records - for instance, 1/10000 scale maps for planning and administration. By working to graphical standards of accuracy, field survey and photogrammetry become interchangeable and hybrid systems, mixing both types of technique, become possible.

Photogrammetry is particularly relevant in the initial compilation of registers. A number of approaches may be adopted, including:

- (a) The identification and interpretation of features on contact prints of the original photograph. This will normally allow for stereoscopic examination of the photographs using cheap pocket stereoscopes. Because of the size of the photographs (normally around 230 millimetres square), annotation of the photographs, outlining the boundaries, can often obscure the underlying detail. Contact prints are good field documents but are less useful for record management.
- (b) The preparation of enlarged aerial photographs. These are more expensive to produce but allow some adjustment for scale so that rough dimensions can be measured. They were for example, successfully used in Kenya for compiling cadastral index diagrams which were in many cases subsequently upgraded through stereoplotting.
- (c) The production of rectified enlargements. These have been successfully used in Thailand (7). Rectifiers are relatively expensive (costing around \$US50,000) and are not suited to mapping areas where there is hilly terrain. They are, however, appropriate in flat terrain where they allow reasonably accurate measurements of distance and area to be taken. The enlargements can be reproduced in the form of photomaps and used as a base over which different layers of information can be laid.
- (d) The use of orthophotographs. These are relevant in more mountainous terrain. The technology is more complex than for the simple rectifier but the end-result is a map in its own right and an effective base for conventional map compilation.

(e) Stereoplotting, using analogue or the more expensive modern analytical plotters. This provides good-quality line maps showing the detail selected by the operator. The problem with aerial photographic images rather than line maps is the visual overload, that is, there is often too much information for the user to absorb or interpret when looking at a photomap. Line maps are simple and effective and can be held in computer systems using relatively little storage. They are also more easy to keep up-to-date since lines can be added and deleted. With photomaps, new photography and recompilation of the whole map may be necessary to keep them up-to- date. Experience in Thailand has suggested the following relative costs (8):

| | |
|---------------------|----------------|
| Rectified photomaps | 100 cost units |
| Orthophoto maps | 800 |
| Line maps | 2300 |

On the grounds of completeness of detail, cost, speed of individual production, total time of series production, and the general flatness of the terrain, photomap methods were chosen for Thailand. Line maps, either in graphic or digital form, can always be extracted from the Photomap base by tracing off the relevant outlines.

(f) Mono- and stereo-comparators that can be used to produce precise coordinates of points. These are devices that allow the operator to take very precise measurements from photographs so that if property corner beacons can be precisely identified on the photographs, their positions can be very accurately determined. While this is valuable for densifying control, it exceeds in accuracy what has been judged above as being necessary and sufficient for the cadastre.

4.2.2(e) Record management

Both maps and textual records need to be stored and retrieved, maintained and updated in an efficient and cost-effective manner. In general, systems which have evolved from the South African approach to deeds registration have detailed and effective documentation - as is, for instance, the case in Zimbabwe. In a number of countries, however, a thorough examination of the flow line of document handling is needed. In many cases, there is little or no management information that can indicate quickly where an individual document resides within the flow line, how long it has been there, or where, in general, the bottle-necks exist and how serious they are. Some form of document tracking is common but it is not usually in a form that can monitor progress and indicate problem areas. Often, when problems are known, no serious attempt is made to deal with them. The checking of surveys is a particular case where reform is long overdue.

To illustrate the complexity of processing documents, consider the following sequence for dealing with a land application - it is in fact an extract from a more detailed set of over 30 movements of the dealings file, any delay in any one of the operations adding to the total delay in completing the whole transaction. It included:

- (a) Submission of application to the Chief Land Officer;
- (b) Transfer to Local Land Board or Town Planning Authority for approval;
- (c) Meeting of Land Board or Planning Authority and possible site risk;
- (d) Return documents to Chief Lands Officer;
- (e) Pass details to the Surveyor General;

- (f)Collect existing cadastral records from survey office;
- (g)Send to district office;
- (h)Job instruction issued to local field surveyor;
- (i)Notification of local land owners of intention to visit the site;
- (j)Execution of field survey (sometimes delayed by non-attendance of interested parties);
- (k)Survey completed and sent to district office for checking;
- (l)File returned to headquarters for further checking;
- (m)Details sent to plans section for plotting and archiving;
- (n)File sent to fees section to calculate survey costs;
- (o)Details then sent to Surveyor General for approval;
- (p)Results then sent to Chief Land Officer for approval;
- (q)Details then sent to Registrar of Titles for registration;
- (r)Final results sent for archiving;
- (s)Notification sent to the applicant that application was successful.

One value of computerization is that it encourages a review of procedures and an examination of the type of data that are held within the system. Most processes of document handling are sequential so that any unnecessary delays are cumulative. In a number of countries these delays can compound to years rather than months. Some of the delays relate to matters of trivia, some to the reluctance of junior staff to take decisions on matters of which they are uncertain, and some to a lack of incentive to increase productivity.

What is needed is a thorough review of the whole flow line for managing cadastral and land-registration information. As pointed out by Zwart (9):

"Commonly, when discussions take place about improving Land Information Management (LIM) practices, it is taken almost without question that we are referring to systems based on Land Information System (LIS) technology with data in digital form and information about the spatial characteristics and distribution of land. As a consequence, the design, implementation and technology of those computer based systems seems to dominate the discussion and our thinking. Yet LIM is not just about computerisation. It is about improving information management irrespective of the medium used to store the data.

"It is now generally agreed that the major problems to be overcome in improving our land information practices are organizationally, managerially and human based. In brief, it is the manner in which the responsibility for land data is allocated and distributed between institutions, how records are maintained and administered, and the experience and education of the people who run these systems that determines their success or failure, not the technology used. At the same time, the largest expense in establishing computer-based LIM systems is data conversion and the removal of redundancies, the elimination of low quality erroneous data, and the acquisition and maintenance of a complete and current record of our land holdings. Once again, these activities are

independent of the medium used. While it is true that having the data in digital form may speed up and reduce data conversion costs, these are marginal benefits, not central.

"Switching mediums, usually from paper and data in analogue form to digital formats has however one major advantage - it brings about a re-examination of all the data held, their organization, and administration. In particular when moving to a digital format, the data and the procedures to handle them have to be very formal and structured. Computers simply cannot tolerate the vagaries and idiosyncrasies in the data that manual, human information processing can accommodate. The rigour imposed on data and data processing practices by computerisation has to happen outside the computer, and is a necessary and inescapable precursor to the introduction of a computer based LIM system. It is a moot point as to whether the benefits of a computer based LIM system derive mainly from the computer or from the data conversion and reorganization process. So why not simply do the first step and nothing else?"

"Many countries do not have the financial, technical or human resources to move directly from their manual paper based land records to a computer format. Furthermore, in many circumstances, computerisation may not be necessary, even though fashionable and "with it"; it may be an over-kill, given the nature of the country and its requirements. Most countries are, however, in a position to put into place a review of their current information practices, to examine such things as their data recording, data maintenance and data quality procedures, to reform the allocation and responsibility for data between different governmental agencies, and to identify and reduce duplicate collection and storage of data. These activities do not rely on investments in high cost technology, but primarily require an investment in people, as individuals, and in organizations. They avoid many of the problems associated with computerisation, such as costly foreign funds, ongoing software and hardware maintenance, and the shortage of computer specialists; yet they achieve most of the benefits.

"The time to decide as to whether to use computer based schemes is when these organizational and management reforms are in place. They need not, and in most cases should not, go hand in hand as the common wisdom seems to suggest. In the meanwhile, by reforming your existing LIM system before introducing the computer, you will have taken the major step to secure the success. You will also have minimised the risks and gained most of the benefits."

There is little doubt that in the longer term, computers will be necessary to cope with the growing volume and complexity of land related data. In particular, computers offer one way of handling complex records that stem from the fragmentation of land - both into multiplicity of parcels and multiplicity of owners - by facilitating cross-referral through database management systems. In the short term, however, much can be done to improve systems without turning to computerization.

A number of initiatives in the field of computerized record management are currently taking place - those in Botswana and Zambia having been cited in section 3.3.3. If attempts to accelerate the cadastral process are successful, then not only will there be a great increase in the first registration of title to land, there will also be a great increased volume of dealings. Countries may be forced to computerize their record-management processes albeit using Personal Computer (PC) technology. Before doing so, however, a careful analysis of the flow line should be undertaken and unnecessary procedures and redundant data eliminated. Where manual techniques are to continue, the ergonomics and health and safety aspects of record management should be reviewed. Files need to be stored in fireproof and damp-proof cabinets, with easy and comfortable access for the staff but safe from interference by members of the public. There should be a "back-up" system, as microfilm, in case of disaster. Aspects of computerized record management and office organization have been reviewed by Dale and McLaughlin (10). While it is possible to make generalizations about what is needed, the problems of office management in each country are different and need independent review.

4.3 Legislative reform

In countries where there is a system of registration of deeds, an incremental approach to reform may be possible. The suggested strategy (11) should include:

- (a)Improvements to basic record management, including better administrative and accounting procedures;
- (b)Standardization, including the redesign of forms to make the document-handling process more streamlined;
- (c)Improvements in the storage and retrieval of records and documents;
- (d)The use of microfilm for document storage and retrieval;
- (e)More realistic, cost-effective and flexible standards of surveys and cadastral mapping;
- (f)Partial examination of documents and title and the acceptance of business risk;
- (g)Compulsory registration to achieve economies of scale;
- (h)Automation and the use of computer technology to store, retrieve and in some cases check documents;
- (i)Computerization of abstracts of title to facilitate searching for important categories of information.

A number of defects in systems of registration of title to land were reviewed in section 2.4. In most countries the land law is well established and Real Property Acts or their equivalent govern the rights and dealings in alienated land. In many cases there is different legislation covering customary or tribal land as against alienated land. Customary land-tenure systems are often not well documented and hence the rights are not necessarily incorporated into the legislation. In some countries the statute of limitations does not apply to landownership and the prescription of land rights through peaceful adverse possession is not allowed. Legislation covering land- use control may be weak and ineffective and often does not cover rural activities. Procedures for land acquisition may be cumbersome and misunderstood. Reform of the land law will, however, be a slow and complex process which, although necessary, precludes such an option in the short term. The total package of land-related legislation should be reviewed for consistency and in the context of emerging land policies. There will need to be detailed consultation - in Nigeria for example it has been suggested that the Land Use Decree is not fully effective as there was insufficient dialogue with interested parties, including professional surveyors.

Many of the delays that take place in registering title stem from the processes of survey. Fortunately, in many cases, the existing land law provides relatively few constraints on the cadastral survey operations - in Uganda for instance the Real Property Act requires that surveys be carried out to the satisfaction of the Commissioner of Surveys, thus in theory giving great flexibility. The major constraints on cadastral activity come from the survey legislation that ties the surveyor to procedures and practices that can no longer cope with the level of demand for spatial information. Survey legislation normally has two components laws governing who may carry out surveys, and regulations saying how and to what standard the surveys must be executed. Such legislation only relates to boundary surveys, not topographic or engineering. In the more developed world there are moves against systems of regulation through licensing. The trend has been towards deregulation and the use of total quality control or quality assurance to maintain standards.

For this there are a number of models such as the British Standard BS.5750 or the European Standard ISO-9000. To obtain quality assurance an individual or organization must be able to demonstrate competence through the professional qualifications or abilities of the senior staff and the implementation of detailed and documented procedures that will ensure the quality of the end-products, such as maps and surveys.

Such standards have a level of sophistication and management control that is not necessarily appropriate to the developing countries where the individual cadastral surveyor may work independently and have little expertise beyond the technician level. It is probable that some form of licensing will continue in Africa for the next few years until professional standards are raised and management skills are improved in both the private and public sectors. Companies as well as individuals should, however, be able to become licensed; both should carry professional indemnity insurance. In order to reduce costs, there is a need to increase the number of technicians rather than professionals that can be employed on cadastral work. A well-managed private company with quality assurance should then be free to employ as many unlicensed technicians as the company wishes and to present their work in the company's corporate name. This will allow the public sector to make greater use of the skills in the private sector and to use private surveyors whenever the demand dictates. Under the present system, Lands and Surveys Departments are often chronically short of skilled and semi-skilled workforce and cannot respond to the fluctuations or growth in demand for their services. Increased use of the private sector will permit the flexibility that is needed provided quality-control procedures are in place.

Major changes are needed in the survey regulations that govern the operations involved in surveying land parcels. The legislation needs to be much more flexible, laying down standards for the end-product rather than defining standards whereby that end should be achieved. It should not be a matter of Law how many rounds of angles a surveyor must measure or the manner in which distances are to be measured and to what accuracy. The only matter of assessment should be the quality of the end-product. This should be checked randomly rather than the present procedure of completely checking all surveys. The responsibility for the quality of the survey should lie with whoever carried it out; if the work is undertaken by members of the private sector then the individual or company must carry professional indemnity assurance and face litigation if defects are found in the work or if negligence can be proved. The Surveyors Acts should lay down the minimum amount of insurance cover and the necessary standards of competence and quality of work. These standards must be strictly enforced with significant penalties for incompetence or negligence.

Further specific areas of legislation that may need to be addressed include strata titles for the multiple ownership of buildings and the use of the statute of limitations in adverse possession of land and in the processes of curing title. Several African countries are currently exploring strata title legislation in response to the growth of urbanization. A number of models exist - for instance in Singapore and the condominium legislation in North America. Review of the statute of limitations is necessary to ensure the curative effects of time in first registration and in providing time limits for registering transfers of land, especially through inheritance where delays in notifying the registrar may occur.

4.4 Institutional arrangements

It was noted in section 3.3.2 that it is the institutional arrangements that are often the most difficult to reform. In this section, three aspects of the problem will be addressed - organizational structures, management procedures, and education and training.

4.4.1 Organizational structures

If the cadastre and land registration are to be seen as part of the overall problem of land- resource management, then the manner in which land and land information are administered is of crucial importance. Most land-information systems that have failed (or been less effective than they should) have done so because of a failure to address adequately the institutional and management problems. In the context of the cadastre, and land registration in particular, there must be integration between the surveying activities, the legal processes of recording landownership, the management of land in economic terms (rents, leases, taxes, acquisitions etc.), and in environmental terms (urban and rural planning and development control), and in terms of land-information management. The latter may be part of the cadastre or subject to separate administration.

The key to these administrative arrangements lies in communication. Hence, it lies with those responsible for information management in general and land-information management in particular. Individual departments tend to have their own objectives and priorities which may be at variance with the concept of information as a corporate resource. Rarely do governments have integrated policies for the release and marketing of information - thus one department may charge for information that is given away for free by another, as happened at one time between the Department of Lands and the Department of Surveys in Zambia. Guidelines are needed for instance on copyright and the ownership of data, pricing policies and who may have access to government held data sets.

A variety of models for institutional arrangements have been discussed by Dale and McLaughlin (12) and more recently by Holstein (13). The latter concentrated on the urban environment where the public utilities have a major role to play, unlike in much of the rural environment in the third world. A suggested model for administrative arrangements is shown in the figure 1.

The structure necessitates the establishment-of two advisory boards, one to coordinate land policy (the Land Management Advisory Board) and the other to deal with, land-information management (the Land Information Advisory Board). The role of the latter would be to ensure the coordination of all information relating to land and the environment - a matter of growing international concern as countries become more conscious of environmental issues. The Land Information Advisory Board would develop policies for handling such information and sharing it as a corporate national resource. As Holstein (14) has pointed out:

"In most countries there are usually no policies for the provision of mapping, for the supply of land information and its maintenance. In many cases there is usually no nominated agency for urban information, inadequate resources and no agency has a mandate to recover costs in general, there are few policies for urban development and its sustainability, or for determining how priorities should be set once the resources for development are made available. There has been a general failure to address the poky problems in the need for urban area information systems including maps- especially institutional arrangements.

Because of the relationship between information and power, the Land Information Advisory (LIA) Board would have to have authority above departments and ministries so that it could act as coordinator and ensure that no one department or ministry dominates the priorities. It would be answerable directly to Cabinet. The LIA Board would also have a consultative committee that would represent the quasi- governmental bodies such as the public utilities, local governments and the private sector.

A model for this comes from Australia where, in 1986, the Australian Land Information Council (ALIC) was set up by the Federal Government to:

(a)Address land-information issues at the national level.

(b) Support the development and implementation of national land information guidelines and standards;

(c) Provide a national forum for the sharing of experiences and exchange of information on land-information management at the policy level.

ALIC in turn has a consultative committee, known as the Australian Advisory Committee on Land Information.

Figure 1. Organizational arrangements for land management

In the United Kingdom, a somewhat similar body, known as the Association for Geographic Information (AGI) has been set up to provide a forum in which to discuss matters relating to the handling and sharing of geographic information, a term that embraces all spatial data. AGI has representatives of central and local government, the utilities, the hardware and software vendors, academics, professional bodies and others. In the United Kingdom, there is no equivalent of ALIC since AGI is only answerable to its members and does not totally advise the Government.

The development of an integrated approach to land-information management will require technical support. The decisions of the LIA Board will need to be executed by a Land Information Management Support Group that would coordinate spatial information and, for example, draw up technical standards for data exchange. The Support Group must be multidisciplinary, drawing on computer scientists as well as surveyors, geographers, planners, environmentalists and others. While land surveyors may have a major role to play in the provision of spatial data, the nature of geographic and land-information systems is much broader than the traditional fields that they have covered. If Survey Department has the strength and depth to provide the support service, and is willing to commit computer scientists, geographers, planners, environmentalists and others, then its role can be redefined. If it is only able to act as a service industry providing measurements and maps, then a separate support group and data co-ordinating body will need to be set up.

In addition to the LIA Board and its support there will need to be a Land Management Advisory Board that will be responsible for coordinating land policy, the implementation of which will still be with the individual departments. At present, many disciplines claim expertise in land management, from planners and surveyors through administrators to land economists. What is needed is a body to coordinate all this expertise and solve the overall problem of land- and environmental-resource management. In many countries there is a ministry that specifically is supposed to address this. Its terms of reference are almost always too narrow and do not encompass all the related interests and departments concerned- Hence the need for an Advisory Board above ministry and departmental level.

The Land Management Advisory (LMA) Board would not be the same as a Land Board. The term "Land Board" is currently used in many countries in the context of administering the allocation of land in areas of customary or tribal tenure. The Land Management Advisory Board would apply the land information that results from the work of the LIA Board to the better use of land. Thus it would have different priorities and different objectives from the LIA Board even though it would need to consult the same range of departments.

Given such a structure, the role of the departments would be to administer the coordinated policies. With few exceptions, their underlying roles would not change. Each department would, however, have its own brief, set in the context of the needs of other ministries and departments. The department that might experience the most change would be the Survey Department which could be transformed into the Land Information Support Group. Alternatively it could continue with its present mandate.

In terms of delivery of land-registration services- survey, registration and transfer- it is important for there to be community involvement. If land registries are a long way from the parcels they record, then landowners will not visit the offices and transfers will take place without notification to the registrar. This has, for example, happened on some occasions in Kenya. There must be a reasonable degree of decentralization so that the community of landowners does not have far to travel and feels that land registration is there to serve them rather than to serve government bureaucrats in distant offices. The greater the degree of decentralization, the greater the need for good communications with headquarters and the greater the need for good management in the coordinating body. Decentralization should allow the overall registration process to proceed more quickly and will permit the system to respond more effectively to local community needs.

4.4.2 Management of the cadastre

The single most important factor in the success or failure of the land-information systems in general and cadastral systems in particular has been the quality of their managers and their skills in 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 politics, of institutional arrangements and the consequences of reorganization and change that are inevitable in the implementation of cadastral reform. They 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. They must understand that management is not only about how to do the job but more importantly, about how to get the job done.

Management training, especially of top managers, is common in developed 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 less developed countries - at all levels of management from senior, through middle to junior. Relatively few courses of this nature exist for people in the developing world and very few degree courses incorporate management techniques into their curricula. 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 who they in turn manage, through greater awareness of the issues. All too often, management skills are treated like parenthood as if by instinct and observation anyone of calibre can become a manager without training. If cadastral 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.

4.4.3 Education and training

In all areas and levels of cadastral activity there is need for better education and training. Speaking in the context of land information systems (LIS) Holstein (15) has pointed out that:

"There is a lack of representation at high government policy levels, of professions with knowledge of spatial affairs. The spatial information industry is much to blame. Generally the LIS industry does not express itself in macro and economic terms nor does it understand the effect LIS products have upon the community. It needs to spell out its contribution to primary industry, the land markets, resource mobilization and national development in general.

The education of land surveyors, for example, almost always stresses the technology that they

will have to manage rather than the human and economic problems that determine the success or otherwise of a system implementation. At present, most degree courses in surveying fail to address the many institutional and management problems that every responsible surveyor has to face. Most courses are method oriented, emphasising the "how", not the "why" and "wherefore" of land surveying. An understanding of management, of the nature of information, and of land must be introduced into courses. At present much of the teaching about land deals with the legislation and constraints on survey activity rather than the resources with which the surveyor has to deal.

Although some survey education courses run a land economy option that deals with valuation, the total breadth of the subject "land" is never addressed. Part of the process of cadastral reform must be a broader education that examines the context within which cadastral systems operate. There must be a balance between measurement science and the understanding of land and information that are the reasons for those measurements.

There is a need for broader knowledge amongst all those involved in cadastral systems and for greater exchange of information between neighbouring countries, especially in English-speaking Africa where there is much experience to share. There should be awareness seminars at all levels, from politicians and managers to office staff and field workers. There is need for continuing training for all members of staff- it is no longer possible to assume that the knowledge imparted during initial training continues to be sufficient. Systems are dynamic and change not only at the technical level but also in concepts and procedures at the administrative and land-management levels.

At the higher level, some of this training may take place overseas. This is not always successful since students may not return on the completion of their courses, even when bonded to do so, and many overseas courses lack experience of the problems faced in the less developed world. So many of the problems, for instance in East, Central and Southern Africa are the same, it should be possible to set up courses at regional centres that address training requirements that cannot be met locally, particularly in areas that are dependent on expensive equipment such as photogrammetry and the use of high technology. These centres would be equipped with appropriate technology including hardware and software - and could be contracted to undertake research and development of new products relevant to the region.

Initial funding would need to come from aid agencies. National jealousies and loyalties and a lack of exchangeable currency may make this solution impossible. Yet resources are often not available within an individual country so that it cannot run courses to the standards that are required. One solution is for the staff based at the regional centre to run short courses in each of the countries of the region, adapted as appropriate to local conditions. These courses would be on such matters as computer systems, management skills, surveying techniques, concepts in land management, legislative review, etc. Some would be aimed at developing awareness, others at developing skills. The courses would be supplemented by in- house training by local training officers who would be responsible for local arrangements by the visiting team from the subregional centre. Longer courses, and those requiring the use of new information technology, would be run at the centre which over time would build up a consultancy role for land management and land-information management within the region. Thus the centre could have a dual role - to promote education and training and to provide advice on land management.

4.5 Cost recovery

The reform of the cadastre, as with the development of any land- information system, requires investment (16). Even limited reform may require the purchase of new equipment -both hardware and software - and expenditure of time and effort on training and organization.

Expenditure on consumables, the maintenance of equipment and their updating and subsequent replacement by bigger and better components or by more modern computer systems which further add to the costs. The most basic question is "How can anyone afford to get started?"

In almost all developing countries, the processes of first registration of title have had to be subsidized either by the State or through subsequent dealings. Indeed, in England and Wales, the costs of first registration far exceed the fees charged, the deficit being made up out of charges for later transfers and other dealings. In developing countries it will be necessary to subsidize the initial compilation of the registers but ongoing costs and further investment in the system, such as introducing computerization, can often be funded out of revenues rather than further subsidies - provided that any surplus income that can be generated is allowed to be reinvested in the organization.

There are three ways of moving towards self-funding. The first is by making savings in current expenditure; the second is by increasing revenue from current products and services or by marketing new products using existing resources; and the third is by grant or loan either from central funds or from development agencies. In less developed countries, the latter is the more common approach. The first two options should not, however, be ignored.

There is often little economic justification for the existing approach. Many cadastral systems would not pass the tests that are being applied to the funding of more sophisticated land-information systems. They rely either on inertia and the maintenance of the status quo or on the argument that "You cannot manage without it". Yet, as has already been observed, many are grossly inefficient, low in productivity and no longer cost-effective. Procedures are often rooted in the past, being based on legislation that was introduced many decades ago. In most cadastral systems there have of course been marginal modifications to take account of the more significant technological developments - such as the introduction of electronic methods of distance measurement.

In general, there has been no fundamental reappraisal of the aims and objectives of the cadastre, nor any assessment as to whether current activities are the most cost-effective way to meet existing objectives. All too often there has been no attempt to measure the efficiency of internal procedures, nor to analyse their effects on the socio-economic environment. It is rare to find that the economic consequences of poor land-record management have been quantified. Insecurity of tenure, delays in land transfer or a lack of collateral security all affect the rate of investment in land and property and hence the creation of wealth.

One of the important elements in reducing overall costs is the systematic approach to adjudication, survey and mapping. The unit costs of mass production are always lower than in the "one off" approach. In general, by working systematically and by reducing the time-scale for the introduction or reform of a cadastral system, not only are the benefits more rapidly available but the unit costs can be reduced to between 10 and 20 per cent of those that arise from the sporadic approach.

The first stage in cadastral reform must be through an examination of current procedures, aims and objectives and a detailed analysis of what they cost. It is almost certain that capital can be released by reducing present wastage. There are obvious political differences in advocating such an approach - many people are fearful of change. But it would be dishonest to pretend that it cannot be done.

A critical examination should be made of all current procedures to determine whether they are, in fact, necessary and if so, whether they can be carried out more cheaply. Often the true cost of the existing approach to the management of the records is unrecognized or deliberately concealed.

At the same time as reducing costs, revenue can be increased. Revenue can be generated from a range of land-information products. Land information reaches the community both in the form of goods (maps, plans, aerial photographs, certificates of title etc.) and services (setting out roads or sites, transfer of land, valuation, spatial analysis etc.). All government departments use spatial information in one way or another. It is possible to form a matrix (such as the very simple example shown in figure 2) and identify those departments and ministries that are providers or receivers of land information. It will very soon be found that every ministry is in some way involved.

It is common to find that little attempt is made by government departments to generate income. Existing scales of fees for carrying out cadastral surveys are in many countries unrealistic. While it may be reasonable to subsidize cadastral operations for social and political purposes, it is unreasonable to pretend that they cost little or even can be had free of charge. The actual costs should be stated and the government contribution deducted to show the level of subsidy provided. This will focus attention on the true nature of what is involved.

Figure 2. Exchange of spatial information

Survey departments have frequently concealed the costs of mapping and given the impression that surveying is cheap. Maps are often sold at a subsidized rate or are given away to other government departments and ministries. If maps are issued to departments, then they should be charged for. If the Departments of Lands and Surveys undertake work acquiring land for other government or quasi-governmental organizations, then a charge should be made for that work. This should be based on realistic estimates of cost. No money need change hands but the paper record should show the magnitude of the service rendered. This would enhance the status of the departments concerned. It is a procedure that already exists in some governmental agencies - for example the Ministry of Works may charge for service other government agency's transport.

The gross costs of running Lands and Surveys Departments are, of course, known because they are published in the annual estimates. The extent of the services which such departments render to government is not usually recognized. The strategy outlined above would allow that service to be recognized.

Additional income can be generated not only by the better marketing of existing products and services but also by introducing new ones. There can be increased charges for cadastral plans; aerial photographs can be sold, so long as there are no military restrictions in force; town plans and tourist maps can be produced; street indexes and gazetteers can be published; atlases can be produced and marketed; assistance can be provided to the utility companies to survey and manage their records of underground services; and all these can be done through savings in the workforce and better management techniques applied to existing budgets. Each will generate income that can, if ministers agree, be used to purchase new equipment.

Several national organizations responsible for survey and land information are coming under pressure to recover their full costs. Such a view was unthinkable in the past as no way could be seen to generate the necessary income. There is a valid argument that certain services are a public good and are therefore the duty and responsibility of government alone. National defence is one such example, the police force another. In traditional thinking, surveying and mapping have been in the same category - after all, the military needs maps, and maps must be based on control, and that is a national responsibility. Similarly, cadastral mapping has been seen either as a community service or else as a basis for taxation. It is therefore arguable that national mapping should be paid for at the national level.

This climate of opinion is however changing. If the military needs maps then it should pay a fair price out of its budget to the national mapping agency not a subsidized and artificial price. If the cadastre is designed to raise taxes, then the cost of running it should be drawn from revenues raised. In some countries, the cost of the cadastral service can exceed the revenue collected - as happens in India, parts of Nigeria and several other developing countries. The tax must be set at a reasonable level or else the cost of revenue collection must be drastically reduced. If this is not possible then the cadastre should either be abolished or else subjected to fundamental reform.

It is sometimes argued that social considerations dictate that the cadastral service should continue, either to provide employment to those who operate it or to support the local community. If these are valid arguments, then the costs should be borne by the social services, not by those responsible for providing cadastral information.

The benefits that come from improved land-information products and services affect many people. Conversely, the defects of existing cadastral systems add to the costs of the same people. Costs that arise through lost opportunity, delay and inefficiency are extremely difficult to quantify. They are nevertheless real. In appealing for support from central government funds or from outside agencies, these costs must at least be identified. There are costs to the community in having derelict land. There are economic consequences of delays in the issue of building permits or land-ownership certificates where a developer cannot receive an immediate return on his or her investment. There are lost opportunities for land or property-related taxes, and lost revenue through their incomplete collection. Both time and money are lost due to traffic delays resulting from bad highway design or poor maintenance of the infrastructure such as drains.

The list of areas where cadastral survey and Land information can help the urban community is extensive. It includes the following record management activities (17):

- (a) Archaeological site recording and monitoring;
- (b) Billing customers and ensuring that no address is missed;
- (c) Building permit allocation, control and monitoring;
- (d) Central government reporting, supplying data and maps;
- (e) Communication through maps and graphics with decision makers and the public;
- (f) Competitive tendering, for instance, assessing areas for grounds maintenance;
- (g) Compulsory purchase orders, identifying and monitoring those affected;
- (h) Demographic analysis including socio-economic data;
- (i) Development control, planning and implementing enforcement;
- (j) Emergency planning, in case of major disaster;
- (k) Emergency services management on a routine basis or in times of crisis;
- (l) Environmental control and endorsement of regulations;
- (m) Environmental impact assessment for proposed development;

- (n)Financial control;
- (o)Finding sites for new developments;
- (p)Fire-services management, including checks on buildings;
- (q)Footpath maintenance;
- (r)Health and safety analysis and control;
- (s)Highway maintenance;
- (t)Land-based taxes, ensuring complete cover and collection;
- (u)Landownership records, possibility linked to national registers;
- (v)Land searches for local land charges;
- (w)Land use management, including monitoring of present use;
- (x)links to other data sets, based, for example, on parcel identifiers;
- (y)Managing building assets, ensuring their efficient use and maintenance;
- (z)Management of mineral resources;
- (aa)Monitoring contracts that have been let to the private sector;
- (bb)Monitoring energy use;
- (cc)Monitoring the land market over space and time;
- (dd)Physical planning, identifying resources and constraints;
- (ee)Police management and the analysis of patterns of crime;
- (ff)Pollution control, identifying sources and monitoring effects;
- (gg)Population forecasting over time and space;
- (hh)Pupil data for school resource planning;
- (ii)Resource optimization in general;
- (jj)Road traffic orders;
- (kk)Route planning, optimizing services such as refuse collection;
- (ll)Social services, optimizing and managing their work;
- (mm)Street light maintenance;
- (nn)Targeting mail shots for more efficient mail distribution;

(oo)Traffic accident analysis and planning road improvements;

(pp)Traffic modelling to predict traffic flows;

(qq)Transport planning in general;

(rr)Tree preservation orders;

(ss)Utility management (water, sewerage, gas, electricity, telephones);

(tt)Valuation and property assessment for acquisition or taxes.

In light of the above, it is as valid to ask whether a country can afford to be without a land-information system as it is to ask whether it can afford to install one.

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V. STRATEGIES AND GUIDELINES

5.1 Introduction

In this chapter, strategies will be suggested for the reform and improvement of cadastres and land-registration systems. Inevitably, individual solutions will need to be tailored to meet the needs of individual countries. This chapter therefore relies on generalizations.

Short-term options may differ from long-term, especially with regard to the introduction of information technology (IT) and with institutional reform. Certain actions need to be taken immediately so that existing techniques can be made more efficient and new areas of land that are in urgent need of the benefits of secure title and better resource management, can be brought into the system. Other matters will require longer-term reflection and investigation.

5.2 Immediate action

5.2.1 Increase management training and training

It is often personalities rather than principles and procedures that determine the success of an organization. There is an immediate need to increase the understanding by managers of the skills and techniques that are now available to help them. In almost every cadastral system, productivity can be increased through better management. Hence management training courses should be set up, such courses must target the specific needs of those attending - thus there will be very different courses for senior management and those at more junior level. Consideration should be given to holding courses for senior managers at a regional level. The function of these courses should be to improve:

- (a) The quality of financial accounting;
- (b) Business and marketing techniques;
- (c) The management of people;
- (d) Leadership and Communication skills;
- (e) Understanding of technology transfer;
- (f) The use of management information systems.

5.2.2 Hold awareness seminars

There is need for greater awareness of the institutional and technical issues that must be faced when cadastral and land- registration systems are treated as tools for land-resource management rather than merely as a support system for private conveyancing. A sense of urgency must be engendered if economic development is not to be held back and land is not to be misused. In particular, the attention of those in political authority needs to be drawn to the benefits and opportunities that are created by effective land registration and land-information systems. These benefits must of course be maximized.

The attention of the user-community must also be drawn to the benefits of registration. The number of unregistered dealings will be reduced if more people are aware of the reasons why they should help to keep the registers up-to-date. Many people often lack an awareness of what can be done with a certificate of title to land. There are, of course, those who benefitted from this ignorance and uncertainty over land ownership and they may oppose improvements

to the system. They cannot be allowed to succeed.

Changes must be carefully explained both to those who will implement them and to those who are affected by them. This will be most important when new technology is being considered. As Holstein (1) has pointed out;

-Many professionals believe that technology is an important answer. Technology does not improve institutional arrangements, procedural and system deficiencies, and lack of staff knowledge. Indeed technology introduction without the necessary supporting measures may introduce new problems especially manpower problems and may bring about the inability to pay for the service levels required for support of systems."

5.2.3 Improve management-information systems

It is difficult, if not impossible to manage an organization efficiently when the detailed operations of that organization are not known. Yet this is often the case. Costs and delays are not well documented and details of the flow-lines of information within many organizations are not monitored. On the basis of better management information, substantial improvement can be brought about by analysing and costing existing procedures, abandoning unnecessary practices, taking limited and calculated risks and making better use of existing resources. Such an approach has, for example, been successfully implemented in Bahrain. In many countries, too much is done because 'it always has been done' rather than because it is still essential to meet modern objectives. One justification for computerization is to force managers to re-examine their procedures. A further advantage is that it should permit better monitoring of their organization's performance. It should also provide information on what is happening to the land so that problem areas can be identified and the resources needed to overcome them assessed.

As part of this process there should be a management audit undertaken by a multidisciplinary team of experts including accountants, systems analysts, management consultants, and representatives of the public and private survey sector. Such an exercise is reported to have taken place in Trinidad (2).

5.2.4 Revise the Survey Regulations

In almost all cadastral systems, significant improvements in productivity and the reduction of cost are thwarted by technical Survey Regulations. Such regulations restrain the options of how best to achieve the goals. The cadastral system should be dynamic - it should not, for instance, be necessary to wait for changes in the law before new techniques can be tried and, if appropriate adopted. The regulations need to be reviewed so that simple and cost-effective methods of survey can be introduced. In particular, there should be flexible standards for survey accuracies that relate to environmental conditions. These standards should be defined in terms of the quality of the end-product rather than the means whereby that quality is to be achieved. Accuracies should be related to mapping standards and map-scales, that in turn will vary with the type of land use. This will provide the flexibility needed and will allow field survey or photogrammetric survey, or a combination of both types of technique, to be used at the discretion of the surveyor. When the descriptions of property boundaries should in the long term be held in co-ordinate form, in the short term this may not be economic and is not essential.

There is no inherent reason why a substantial proportion of cadastral surveys should not be carried out by the private sector. Indeed, where an individual landowner wants a more precise survey than that required by the regulations, then the private surveyor should be commissioned for an appropriate fee. It is no part of the government service to survey plots to standards of

accuracy higher than are necessary and sufficient for the majority of landowners. The responsibility for the quality of the work undertaken by the private sector should lie with the individual surveyor. Governments have a responsibility to oversee the general standard of work but not to protect the private surveyor from legal liability. Quality control of private-sector survey work should be by sampling with severe action taken, such as fines or refusal to accept future work, as penalty for poor performance.

5.2.5 Review boundary monumentation procedures

Both the timing and effectiveness of property boundary monumentation need to be reviewed. Many corner beacons are lost because they are emplaced prior to development and, in consequence, are damaged during the construction process. Physical occupation on or near boundary lines should be accepted as evidence of the legal boundary, provided that such occupation is peaceful. The statute of limitations should apply to adverse possession.

In many countries, the planning legislation and the interpretation of development-control requirements is a major influence on the standards of accuracy of boundary surveys. Road reserve widths or the distance that a building is set back from a boundary may be precisely specified so that the standards of accuracy of setting out exceed what is necessary and sufficient for practical purposes. Such regulations need to be brought into line with those advocated for the cadastre in general, that is they should be based on plottable accuracies at map scales.

In areas of existing development the boundaries should be plotted in relation to permanent features such as buildings. In new areas, the boundaries should be provided only in outline until such time as the development is complete. An exception is the outer corners of block developments which should be marked with clearly visible posts that would be surveyed to reasonable standards, giving an overall framework for the development. Internal boundaries can then be recorded to map accuracy using cheap and simple survey techniques. The costs of marking out boundaries for setting out the subdivisions should be done by the land developers and not be a cost on the land registration system.

Where registration of title is being introduced for the first time into large areas, photogrammetric techniques should be encouraged. In urban environments, if fences and hedges do not exist, there will probably be sufficient physical features such as buildings from which the boundaries can be identified on the ground. In rural areas, the use of hedges or earth mounds around parcels should be encouraged.

5.2.6 Provide on-going training for all staff

Surveyors in both the public and private sectors will need to be trained in the new techniques while Lands Office staff will similarly need to be brought and kept up-to-date. Training should be planned as a regular and on-going activity. The training may be run by the government service, or contracted out to educational establishments. In either case, the private sector should be allowed to attend, but be charged accordingly.

Within government, there should be a personal development programme for each member of staff, part of which should be the requirement to attend training courses. Not only will this demonstrate organizational concern for each individual and improve staff morale, it will also ensure that the system is dynamic and hence more likely to be kept up-to-date.

5.2.7 Improve cadastral management flow line

In section 4-2.2(e), an example was cited of the complexity of handling an application for the

allocation of a piece of land. Each stage in that operation needs careful scrutiny to ensure that the delays are kept to a minimum. It may be possible to eliminate some procedures and combine others. Within many Survey Departments there is an urgent need to radically change the way in which both government and private-sector surveys are checked. In many government offices there is often unnecessary and expensive duplication of work - including, for instance, excessive use of photocopiers. There is opportunity for greater productivity if existing procedures are analysed and streamlined.

5.2.8 Scrutinize all land-related legislation

The objective of all land-related legislation is to ensure the best management of land as a resource. Technical-survey and development-control regulations have been cited above as in particular need of reform. Title legislation should incorporate a "general boundaries" rule so that selective first registration can be expedited. When small changes in boundaries are agreed between neighbours, they should not need to be surveyed or incorporated in the registers. Where appropriate, titles can still be guaranteed even if the precise limits of the boundaries are excluded from the guarantee.

The use of the statute of limitations should be reviewed in the context of the acquisition of rights by adverse possession and the regulation of unregistered dealings so that what is on the register can reflect what is on the ground. The introduction of limited title, for instance, a qualified or possessory title or even a right to occupancy, should be considered as a means to secure the short-term benefits of registration. There should however be an option to upgrade these to a full title within a finite period of time.

The introduction of strata title legislation should be explored. This is of particular relevance in urban environments where the pressures on land have led to the construction of high-rise buildings.

There may be a need to introduce an Adjudication of Titles Act.

Other land- and survey-related legislation. Including any survey acts that control the licensing of surveyors and the conditions under which they operate, will need scrutiny to ensure that the short-term objectives can be met without further legislative amendment.

5.2.9 Upgrade the land-registration flow line

As with the cadastral management flow line, so, in particular, the office procedures within a land registry need to be scrutinized. Many techniques are available to improve office management. These vary from giving staff incentives to simplifying the procedures for checking and cross-checking each title document. It may be possible to design better and simpler forms and to reduce multiple entries and copying. Studies of "time and motion" in running the office should be undertaken to determine where there is waste and inefficiency. In the United Kingdom it was recently discovered that very substantial sums of money (more than \$US500000) were being spent on handling maps and plans within one local authority and that significant savings should be possible through moves towards a computerized land- information system.

5.2.10 Improve data storage and retrieval

A particular feature of many land titles and survey offices is the poor storage of files and documents making the retrieval of data and information difficult if not, at times, impossible. Much time is wasted locating and gathering relevant data from vaults or from the desks of other members of staff. There must be a balance between the ease of access to working documents and the security measures that are needed in case of loss or damage to important archival

material. Improved data storage and retrieval are of particular importance when upgrading deeds-registration systems.

5.2.11 Examine possibility of computerizing registers

In the storage and management of documents, the use of computers may be advantageous although computerization tends to introduce problems of its own and must be supported by a good back-up system. Computerization is of particular advantage when there are multiple owners in any piece of land or where individuals own a multiplicity of parcels since database management systems facilitate cross-referencing between files. If productivity is increased and registration is extended to a much wider area, the volumes of data to be stored and retrieved will grow significantly. This will place an increased burden on existing staff and record-management systems. Personal computers (PCs) are a cheap and effective way of coping with this problem although local environmental conditions may not favour them. Experience is being built up with regard to their suitability in less developed countries. The evidence in support of computerization of the record-management process at present is encouraging - provided that operators are well trained and motivated.

5.2.12 Identify priority areas for registration

The selection of priority areas for introducing cadastral and land- registration systems will depend on existing land policies with regard to formal and informal tenures, customary and statutory systems and the needs for better land management. They should be based on considerations such as where land reform is planned or where the use of land is to be optimized; where there is new development; where there is much litigation; where there is a need for more secure title for instance to support credit; where land is to be taxed; where there is public demand; and where there is need for better land resource management. Ultimately it should be the responsibility of the Land Management Advisory Board (see section 5.3.1 below) to advise on priorities.

5.2.13 Produce urban and rural base maps

The basis of the proposed solution to the survey of land parcels is the compilation of base maps upon which properties can be identified to reasonable standards of accuracy. Such maps can then form the basis for a land-information system and can be used for recording land use, land value, utility services and data relevant to engineers, architects and developers. In many areas, photomaps may form the most cost-effective basis, as has been demonstrated in Thailand. Staff will need to be trained in the use of such techniques.

Conventional line mapping may be needed in densely populated areas where vegetation or tall buildings may make the recognition of boundaries impossible. Urban mapping should for preference be at 1/1000 or 1/2000 scale depending on land values and other map-user needs. In rural areas, 1/5000 mapping may be sufficient, depending on the density of cultivation. In sparsely populated areas, much smaller scales may be acceptable.

5.2.14 Ensure that the land records are kept up-to-date

This is of vital importance if the heavy investment in the initial compilation of the registers is not to become a wasting asset. Land-registration and land- information systems both require continuing expenditure on their maintenance. To ensure sufficient funds to achieve this, the fee structure should be reviewed to make the system self-funding.

5.3 Longer-term strategies

5.3.1 Create a Land Information and a Land Management Advisory Board

There is a need for the coordination of both land-information management and land-management policies, taking into account the many and varied interests both in the public and private sectors. Issues relating to a Land Information Management Board have been addressed by Holstein (3) who identifies a need for consultative committees and task forces to achieve specific objectives. There is a distinction between information and the application of such information and it is the latter that the Land Management Advisory Board should address. In all countries there is at least one minister responsible for land. Rarely, however, does one minister have overall responsibility for managing all interests in land, coordination often being left to Cabinet-level discussion. The functions of the two boards proposed would be to reduce risk for decision-makers, such as politicians, by providing mechanisms whereby complex issues can be monitored and modeled and implementations efficiently and effectively coordinated.

5.3.2 Review total land data flow line

A total review of what information is used in decision-making within government needs to be carried out. There needs to be a clear mandate to each agency responsible for providing land related information and services, identifying who is responsible for acquiring and updating information and how the data should be made available to other users. There must be consistency in approach so that overlap of responsibilities and duplication of services and effort are reduced to a minimum.

5.3.3 Revise policies for land information

Land-related information must be treated as a corporate resource: that is, it must be managed in the interest of all. Policies on the ownership and access to information are needed, including guidelines on pricing products, cost sharing and cost recovery, and legal liability for the data. The restrictions on the use of maps and aerial photographs that are imposed by some military authorities must be questioned since the value of such products to the country are directly related to the extent of their use. The sharing of costs and benefits between the public and private sectors must also be addressed - for instance where the private sector places the results of its surveys in the government's archives. Part of the role of the Land Information Advisory Board would be to make proposals on the form of land-information policies and guidelines.

5.3.4 Extend marketing of land information

Money must be found in order to pay for the improved cadastral and land-registration services. The initial registration of title will need to receive subsidy but subsequent dealings can be self-financing and even profit-making. There needs to be an awareness that information is a valuable resource that can be marketed within the framework of government policies. Some suggestions for cost recovery were given in section 4.5. One of the management skills that should be incorporated into the training of senior managers (see section 5.2.1 above) is marketing. The activities that are deemed to be in the public good should be identified and figures for their worth agreed with government. Those activities that are outside that defined service should be subject to full cost recovery. Where the benefits are directed at selected members of the community rather than the community at large, then if such individuals are able to pay, they should be charged accordingly. This will necessitate the development of a greater awareness amongst the public and in government of the cost and value of information. A degree of commercialism needs to be incorporated into the cadastre so that it becomes more cost-effective, more responsive to user-needs and more attractive to government Treasury officers and to funding agencies. Joint ventures with the private sector in managing and marketing cadastral information may prove beneficial.

5.3.5 Document customary tenures

At present, insufficient is known about customary tenures and the performance of the informal market. Many land transfers take place outside the formal government registration system. Many governments in less developed countries are either unaware or choose to ignore what is going on. This, in turn, leads to difficulties in land development. A research institute, for instance, at a local university, should be funded to investigate the operation of the informal sector so that its strengths can be tapped in any future cadastral reform.

5.3.6 Integrate policies for land management

Land policies may differ between different departments and ministries since decision-making on land matters is often an independent and disaggregated process. The function of the Land Management Advisory Board should be to coordinate land-use activities, the objective of land registration being primarily to support that activity. "Land" needs to be placed on a parallel basis to finance which comes under the overall control of the Treasury.

5.3.7 Review and amend land-administration laws

As indicated in chapter 11, the present approaches to registration of deeds and title to land have a number of defects when viewed from the perspective of land- resource management. Changes should be made in the light of the findings on customary and informal tenure systems proposed above (see section 5.3.5). While the law should be kept as simple as possible and some over-riding interests may not be worth recording, a system that is out of tune with customary practice is likely to fail. The totality of land-related law needs to be reviewed, not just that concerned with deed or title registration. Thus, for example, the legislation on planning and Land-use control must integrate with that on the cadastre and with environmental-impact - assessment regulations. Kenya, for example, is at present exploring the possibility of drafting a unified set of land laws that will replace the present disparate legislation that has been its inheritance.

5.3.8 Insist on quality assurance

The present system of licensing should be replaced by quality assurance so that companies as well as individuals can undertake all forms of cadastral work, including boundary surveys and spatial data management. Quality assurance should be backed by professional indemnity insurance. As already suggested (see section 5.2.4), work undertaken by the private sector should be subject to minimum scrutiny but strong action should be taken if it is found to be defective.

Appropriate standards for quality assurance will need to be developed. Models are being created in Europe and elsewhere that should act as a guide. In Australia and New Zealand, for example, significant progress has been made towards deregulation but with the retention of the necessary standards to maintain the quality of the land-registration system.

5.3.9 Develop an integrated spatial information system

There are steady improvements being made to the technology and a growing understanding of the institutional issues that arise when operating land or geographic information systems (LIS/GIS). In the longer term, the use of information technology will grow as the value of information becomes more clearly recognized. In the short term, the impact of fully integrated LIS/GIS will be marginal on the less developed countries since the cost of data acquisition or conversion is so high. Developments in LIS/GIS should, however, be anticipated so that data

structures and management flow lines can be created that will, in due course, take advantage of the new technology. The Land Information Advisory Board proposed above (see section 5.3.1) should advise on an appropriate strategy.

5.3.10 Monitor land use and land values

The underlying thesis in this report is that land must be better managed. Part of that process is better land-information management, monitoring and modelling such matters as land use and land value. All too often good-quality agricultural land is used for housing, thus destroying its productive capacity, when lower grade land was available. Similarly, variations in the value of land are poorly recorded, both in terms of space and time, and governments do not manage their real estate assets efficiently. Monitoring land use and land values should be a part of the land-registration system for, with little additional effort, substantial amounts of additional information can be collected and recorded.

5.3.11 Improve education and training

Courses exist throughout much of Africa that provide in-house training for technicians and graduate training in surveying and land economics at the universities. Much of the education is based on traditional approaches, dealing with surveying, for example, in a method-oriented way. If cadastral reform is to succeed, this needs to change.

There has been a recent initiative in the United States to provide material for the training of graduates in geographic information systems. The National Center for Geographic Information Analysis has prepared material for a series of 70 lectures,⁽⁴⁾ that are commercially available and which academic institutions are adopting as an aid to improve their teaching in this area. Similar material should be produced in the cadastral field to ensure that a base level of information is available. This could then be adapted for individual countries and systems. The topics covered should include both technical and institutional issues as well as management. Regional seminars directed specifically at the problems of training and education should be held to update teachers.

It should be self-evident that education and training are on-going processes. Government departments need to bring continuing education into their offices, setting aside time for staff training and development. At present, in many countries, it is an ad hoc process that is not structured in terms of each individual's career development. All too often, promotion to higher positions is based on seniority rather than knowledge and ability. Further education must be matched with opportunities for those with ability to progress their careers more quickly.

5.3.12 Respond to user-needs

It is important to identify the needs of the user-community more clearly. Many of these needs should be catered for by the strategies outlined above. Management is as much about listening as acting. As Holstein put it, information managers must:

"... follow a demand driven approach for the improvements: thus trying to achieve improved response times and improved revenue generation; ... and that priorities should be set on a demand basis rather than being based on a long term systematic program of products". (5)

5.4 Summary and conclusions

By way of summary, the following issues in relation to the improvement of land-title registration and land-information systems deserve to be reiterated:

1. Survey regulations and requirements for valid land-registration should be reviewed with a view to making them more flexible and reducing the length of time involved, particularly with respect to the requirements for full checking of survey plans or records before registration.

2. While recognizing the necessity for quality control of surveys in land registration and land information, it is relevant to distinguish between what is feasible under the circumstances and what is desirable or ideal. Given the circumstances of most developing countries generally, and given the goal of achieving total identification coverage of all properties, it should be possible to accept less than precise surveys for land registration in the short term ("half-way cadastre"), by issuing temporary permits, certificates of rights, possessory or qualified titles etc., and to improve upon these incrementally in the long-term. It is necessary that government guarantee should stand behind any form of land-title registration as this is perceived as one of the most important benefits of land-title registration. Even if such guarantees are for ownership rather than for the precise extent of the parcel involved.

3. To ease the constraints created by surveys further, consideration should be given to increased use of licensed private-sector surveyors, and even to making survey departments parastatals, so as to free them from some of the bureaucracy of the civil service, thus enabling them to offer more attractive remunerations and, thereby, enabling them to attract and retain land surveyors and associated professionals and technicians.

4. There is need for stepped-up training and capacity building for skills in the land-production line (land surveyors, town planners, land economists, land registrars and land administrators) at all skills levels (professional and technician levels) using largely national institutions, but also using regional, subregional or international institutions where appropriate, for training or upgrading in higher-level or specialized areas. Training of national trainers may help in the process within individual countries. Above all, there is the necessity for management training and updating of the top managers of the system, so that they could keep abreast of the everchanging ideas and technologies.

5. Given the volume and backlog of work to be done, higher technician/assistants to professional ratios should be permissible, than the current 1:3 in the case of land surveyors. Appropriate emphasis should also be placed on greater output of technical level skills as support to the professionals. Also while retaining licensing, establishment of larger private-survey companies may be allowed in which larger numbers of assistants are used but supervised by professionally licensed surveyors.

6. Specialists should be assigned to their specialist areas and be used more appropriately and effectively. They should not routinely be assigned away from areas of their specialist training (ostensibly as a process in their career development). It should be possible to develop parallel career structures which accommodate specialists in their highly skilled areas while at the same time allowing them to move progressively into purely management positions in those same areas.

7. As with the need for an increased workforce, there is need for adequate and steady supply of relevant materials (stationery etc.) and equipment (survey instruments and computers) including vehicles, to facilitate preparations and production of land registration and information documentation. Governments should give consideration to authorizing their land departments to keep a reasonable proportion of the revenues they generate, so as to enable the departments to keep and maintain a steady flow of supplies of materials and equipment for land registration (among other objectives). This would, in turn, enable the land department to generate greater revenues.

8. The necessity to collect, process, create, sustain and continuously update and improve land information requires both technological and institutional improvements and rationalization. While computerization of land information is desirable and recommended, it should be embarked upon gradually and with very careful planning and forethought for the data format, programmes adopted, equipment and its compatibility, as well as its ease of management and maintenance. Emphasis here should focus on relevant and functional technologies not just always on high technologies as such, and adequate consideration should be given not only to starting up a new technology or system but also, more importantly, to the expected costs of maintaining such new systems.

9. There is need for greater co-ordination among the departments and agencies of government in the production, management and sharing of land data information. In this regard, it may be necessary to designate one department or agency (this may be the Land Department) as the lead agency or focal point for land records, and ensure that all other agencies and departments relate to it and inform it of all transactions. This could be done by building in a device that necessitates that a copy of any land transaction by other departments or agencies is sent to the designated coordinating department or agency as a matter of routine. It should be possible to achieve this without radical or fundamental changes in existing management structures, though such changes may evolve and incrementally change overtime.

10. Land-registration offices should be decentralized to the district or local-government level so as to expedite land- registration transactions and ensure greater accuracy.

11. Funding for land-registration and land-information systems could be improved through land taxation, charging for services currently rendered free to the public and reasonably increasing the existing level of fees for charged services; selling of appropriate information to users, particularly developers, and generally adopting a cost-recovery approach. Government authorities are reminded that land is a great wealth-creating resource, contributing significantly to government revenues, and that the land-registration and land-information system prepares the resource for revenue generation. More governmental resources should therefore be made available for the land-registration and land- information processes.

12. The general population should, through public information and awareness programmes, be made more aware of the benefits of land-title registration (certainty of ownership, security of tenure, reduction of land disputes, credit collateral, facilitation of land transfers etc.) and be encouraged to have their interests in land registered at very reasonable costs to themselves.

13. Efforts should be increased to achieve a complete basic map coverage of the whole country as a start, and coverage at scales appropriate for cadastral work for areas of high potential and priority, such as urban areas.

Two strands run throughout this report - the land-based strand and the land-information strand. Both are connected though each poses very different problems. The solutions offered are incremental, that is although there is need for radical change, especially in thinking, the goals can be reached in a steady and logical manner. The need for reform has not been questioned for the existing systems are simply unable to cope with present levels of demand within the resources that are available. Even with additional resources none will make significant improvement without a change in attitude to the form and function of the cadastre and land registration. Land registration, cadastral surveys and land- information systems are all means to an end, that is the better management of land as a resource and the reduction of risk in decision making processes. They provide a basic framework that is essential for the improvement of land delivery, the stimulation of land markets, the protection of the environment and, ultimately, the creation of wealth for the community. Given a willingness to change and a recognition of the importance of good management, many of the difficulties that

exist with existing systems can be overcome.

References

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