

The Development of a Cadastral Template

Daniel Steudler, Ian P. Williamson, and Abbas Rajabifard

Department of Geomatics, The University of Melbourne, Australia

Abstract

While many country reports have been compiled in the area of land administration over the last decade, there has not much attention been given to the basic cadastral issues. As a result, one of the objectives of Working Group 3 "Cadastre" of the PCGIAP is the establishment of a cadastral template, which is basically a standard form to be filled out by cadastral organizations presenting their national cadastral system. The aims are to understand the role that a cadastre plays in a state or national SDI and to compare best practice as a basis for improving cadastres as a key component of SDIs.

The Working Group plans to hold a workshop for the discussion and completion of a cadastral template in July 2003 at the 13th UNRCC-AP and 9th PCGIAP meeting in Japan. The workshop will review national cadastral systems based on the common template to enable the identification of similarities and differences in matters such as national land policy, laws and regulations, land tenure issues, institutional arrangements, spatial data infrastructures, technology as well as human resources and capacity building.

The work of the PCGIAP-Working Group 3 "Cadastre" is being done in collaboration with Commission 7 "Cadastre and Land Management" of the International Federation of Surveyors (FIG), which has extensive experience in comparative cadastral studies. This article describes the creation and the content of the cadastral template and the expected outcomes.

1 Introduction

The "Permanent Committee on GIS Infrastructure for Asia & the Pacific" (PCGIAP) was established following Resolution 16 of the 13th "United Nations Regional Cartographic Conference for Asia and the Pacific" (UNRCC-AP) in Beijing in 1994. The aims of the PCGIAP are to "maximize the economic, social and environmental benefits of geographic information in accordance with Agenda 21 by providing a forum for nations from Asia and the Pacific" (PCGIAP, 2000).

The PCGIAP holds annual plenary meetings, every third meeting in conjunction with the UNRCC-AP. The Executive Board of PCGIAP comprises up to ten members, with the responsibility to manage the activities between plenary meetings. The objectives of PCGIAP have been pursued through four Working Groups, which have the titles "Regional Geodesy", "Fundamental Data", "Cadastre", and "Institutional Strengthening" (PCGIAP, 2000).

Working Group 3 "Cadastre" was established for the period 2000-2003. Its aims are twofold:

- a) To facilitate a workshop to develop an appropriate generic template for country profile analyses describing the status of cadastre and land administration, their contribution to and role in SDIs, and the need for improvements, which will facilitate benchmarking and the development of performance indicators.
- b) To facilitate discussion on marine cadastres, focusing on the issues involved in the establishment of appropriate administrative infrastructures to manage marine resources in the context of the United Nations Convention on Law of the Sea.

In pursuit of the first objective, a workshop takes place prior to the 9th PCGIAP meeting in Okinawa, Japan in July 2003 in order to discuss and develop a generic "template" for country profiles. The workshop is being organized with the support of the Centre for Spatial Data Infrastructures and Land Administration from the Department of Geomatics of the University of Melbourne in Australia.

According to Merriam-Webster (2003), the term "template" can be defined as "an empty standard form that establishes a pattern and that is serving as a sample". In consequence, the project of the "cadastral template" is an endeavour to establish a standard form that allows cadastral organizations to present and describe their national cadastral system in a standardized way. The standardized structure of the cadastral template then will allow the identification of similarities and differences in matters such as national land policy, laws and regulations, land tenure issues, institutional arrangements, spatial data infrastructures, technology as well as human resources and capacity building.

The "cadastral template" project by PCGIAP-Working Group "Cadastre" is being undertaken in collaboration with Commission 7 "Cadastre and Land Management" of the International Federation of Surveyors (FIG), which also has extensive experience in comparative cadastral studies. The actual coordination and facilitation is being done by a research group at the University of Melbourne, consisting mainly of the authors of this paper.

2 Similar Activities

With the increased interest in land administration and cadastral systems as part of a national infrastructure, there have been a number of other activities in the recent past to collect data and information about those systems. A common objective of these activities was to a lesser extent comparing and evaluating the systems, but rather to collect information to identify best practice.

These initiatives have mainly been carried out by Commission 7 of the FIG and the UN Economic Commission for Europe (UN-ECE). The UN-ECE was a key catalyst in broadening the focus from cadastral systems to land administration during the 1990s through the work of the "Meeting of Officials on Land Administration" (MOLA), which later was upgraded to the "Working Party on Land Administration" (WPLA).

The following list provides a short overview of the several initiatives (no guarantee of completeness):

- a) FIG-Commission 7 (1995): Questionnaire about Characteristics, Privatization, Fees, Strengths & Weaknesses, Reforms & Trends of Cadastral Systems (31 country replies).
- b) FIG-Commission 7 (1997): Characteristics, Privatization, Fees, Strengths & Weaknesses, Reforms & Trends (54 country replies). The results have been summarized and published in *The Australian Surveyor* (Stuedler et al., 1997).
- c) MOLA (1999): UN-ECE Documentation of Land Administration in Europe (carried out by Austria).
- d) MOLA (1999): Study on key aspects of legislation relating to cadastre and land administration in ECE member states. Compilation of key aspects of legislations in ECE member states relating to cadastre and land administration.
- e) WPLA (2001) – Inventory of Land Administration Systems in Europe and North America (*3rd Edition*) (replies from 49 jurisdictions, carried out by the UK).
- f) FIG-Commission 7 (2001): "Standardized Country Report: Statistical Indications and Basic Characteristics" (13 country replies).
- g) FIG-Commission 7 (2002): "Benchmarking Cadastral Systems" (Stuedler and Kaufmann, 2002).
- h) EUROGI (2002): Questionnaire on cadastres in preparation of the EUROGI presentation at the 1st Cadastral Congress in the European Union (Granada, May 15-17, 2002).
- i) WPLA (2002): Inventory of restrictions of ownership, leasing, transfer and financing of land and real properties in the UN ECE member countries (30 country replies, carried out by Russia).
- j) WPLA (2003): Survey on the restrictions on public access to information about land administration, ownership, land transfer and mortgaging (carried out by Slovakia).
- k) WPLA (2003): The use of Public Private Partnerships (PPP's) in the Development of Land Administration Systems (carried out by the UK).

Most of the questionnaires and results are available on the Internet at either <http://www.unece.org/env/hs/wpla/welcome.html> or <http://www.swisstopo.ch/fig-wg71/>. They cover a large range of different land administration issues, even though they all have their own specific objectives.

With a recent "Comparative Study of Land Administration Systems", the World Bank (2003) aims to provide a basis for a more informed assessment of land administration initiatives. The study systematically reviews the characteristics, accessibility, costs, and sustainability of different land titling and registration options based on information compiled in a number of case study countries. The need for a more comprehensive approach in land administration is illustrated by Lavadenz et al. (2002), who observed that:

'...despite the significant resources being invested by the donor community for modernizing land administration infrastructure, there is little systematic discussion of the key elements of such a system and of what constitutes effectiveness within particular socio-economic, cultural and temporal contexts.'

A comprehensive framework for comparing and evaluating land administration systems may provide some support to identify such key elements and also for sharing best practice lessons. However, the aim of such a framework cannot be to imply similar policy objectives or strategic goals, but to develop a shared methodology for the comprehensive evaluation of land administration systems.

3 Development of Cadastral Template

The development of the cadastral template started with an outline and early draft that was presented in 2002 at the 8th PCGIAP meeting in Manila, Philippines and at the annual meeting of FIG-Commission 7 in Pretoria, South Africa. Both organizations agreed to contribute to the project and each nominated six pilot countries which volunteered to collaborate with the research team and to provide feedback.

With the feedback and input from the pilot countries, the research team of the University of Melbourne revised the template questionnaire in early 2003. The basic principles for the design of the questionnaire were that:

- a) it had to suit and serve the purposes of the mostly Asian PCGIAP member countries as well as of the FIG-Commission 7 member countries, which are mainly European with a few African, South American and Asian representatives;
- b) it had to be easy to fill out, without too many explanations;
- c) it had to have a simple structure, but the results should still reflect the main issues of cadastral systems;
- d) it had to be as short as possible because it will mainly be filled out by senior executives;
- e) it had to be simplistic with the question easy to understand in order to have a satisfactory response rate;
- f) respondents would not be asked for precise figures or statistics; estimates will be "good enough".

In order to design and develop a questionnaire, it always is crucial to be aware of the final desired results in the first place. Based on the feedback from the pilot countries, the research team defined four basic key issues that the template should endeavour to cover. These key issues were:

- a) to get an indication of the **order of magnitude** of the basic tasks in a cadastral system: how many parcels there are to survey and to register;
- b) to get an indication of the magnitude and problems involved in the **informal occupation of land**;
- c) to understand the **role of the cadastre in SDI**, and to get an appreciation of the completeness, comprehensiveness, use and usefulness of spatial cadastral data;
- d) to get an understanding of the **capacity building** which is in place or which should be established to support the system.

4 Structure and Content of Cadastral Template – Part One

The template has been structured into two main parts. Part one is a country report, while part two is a short questionnaire.

The first part, the country report, is a descriptive report of the national cadastral system. To make it easier to fill out, this part is designed to have mainly textual descriptions. For easier comparisons later, it is structured into five main topics, each with 2-5 sub-topics as listed in Table 1.

Table 1: Part one of template: topics and sub-topics of country report.

A. Country Context	<ul style="list-style-type: none"> • Geographical Context • Historical Context • Current Political and Administrative Structures • Historical Outline of Cadastre
B. Institutional Framework	<ul style="list-style-type: none"> • Government Organizations • Private Sector Involvement • Professional Organization or Association • Licensing • Education
C. Cadastral System	<ul style="list-style-type: none"> • Purpose of Cadastral System • Types of Cadastral System • Cadastral Concept • Content of Cadastral System
D. Cadastral Mapping	<ul style="list-style-type: none"> • Cadastral Map • Example of a Cadastral Map • Role of Cadastral Layer in SDI
E. Reform Issues	<ul style="list-style-type: none"> • Cadastral Issues • Current Initiatives

4.1 Country Context

The purpose of this topic is to get descriptions of the context of the country or jurisdiction from geographical, historical, political, and administrative perspectives. This topic is structured in four sub-topics, which are:

- a) *Geographical Context:* Description of the basic geographic context, i.e. population, size of country, land use in terms of urban, agricultural, semi natural, mountains, forests etc. as well as other outstanding geographic features.
- b) *Historical Context:* Description of the country's history in terms of relevant periods, e.g. colonization, and political development.
- c) *Current Political and Administrative Structures:* Description of the current political and administrative structures, such as for example political system, number of states or provinces, and similar.
- d) *Historical Outline of Cadastre:* Description of the origins and the development of the cadastral system and what objectives it was designed for.

4.2 Institutional Framework

This topic looks at the institutional and organizational issues of the cadastral system. The objective is to get descriptions of the institutions responsible for land administration, public-private partnerships, professional organizations, and licensing and capacity building arrangements. There are five sub-topics, which are:

- a) *Government Organizations:* Names of the respective agencies that are responsible for land registration and for cadastral surveying, including the ministries to which they are attached and at what level (state or national).

- b) *Private Sector Involvement*: Description of the private sector involvement in land registration and cadastral surveying.
- c) *Professional Organization or Association*: Description if there is a professional organization or association for cadastral surveyors with the approximate number of members.
- d) *Licensing*: Description if there is a licensing system in place for cadastral surveying professionals working in the cadastral system and what the requirements are for the license, for example university degree, practical work, or examination.
- e) *Education*: Description of the education system for cadastral surveying professionals, the number of universities offering degrees, and the approximate average annual number of students graduating from those universities.

4.3 Cadastral System

The intention of this topic is to get an understanding of the basic principles of the cadastral system, i.e. the purpose, the different types, informal occupation of land, the actual cadastral concept with the main units and their registration. The four sub-topics for this topic are:

- a) *Purpose of Cadastral System*: Description if the cadastral system has a legal (land transfer, land market), fiscal (land valuation, land tax), and/or multiple purpose role (planning, local government).
- b) *Types of Cadastral System*: Description if there is only one cadastral system covering the complete territory (comprehensive cadastre) or if there are several types of cadastres for different purposes, such as e.g. private owned land, state owned land, urban vs. rural areas, forest areas, houses and apartments, customary areas, or national parks. In this context, it also is important to indicate if there are problems with informal or illegal settlements.
- c) *Cadastral Concept*: Description of the cadastral concept, i.e. what are the main units in the cadastral system, which are surveyed and registered, and on what level (national or state level). This may include the description of terms such as land parcel, ownership units, properties, qualified titles, buildings, etc. as well as their meaning and their relation to one another.
- d) *Content of Cadastral System*: Description of the basic cadastral components and what kind of registers are operated and maintained in the cadastral system (e.g. land book, land register, parcel register, cadastral survey, etc.), their information content and level of computerization.

The issue of the cadastral concept itself seems to be interesting for the understanding of the different systems. During the development of the questionnaire, there was lengthy debate, as to the meaning of the terms "parcel" and "property" and how they are dealt with in the different jurisdictions. This particular issue is further discussed in section 6 below.

4.4 Cadastral Mapping

The purpose of this topic is to get an understanding of the spatial data component of the cadastral systems, which was traditionally referred to as the cadastral map. Spatial data are increasingly being managed in digital formats, making them more suitable for a number of other applications. The main value of this use and flexibility is that cadastral data have increasingly become part of national SDIs. It is therefore interesting to monitor this development in the different countries and jurisdictions. The sub-topics in this topic are:

- a) *Cadastral Map*: Description of the cadastral map, its content, and if applicable, its data model (e.g. information layers or core data sets).
- b) *Example of a Cadastral Map*: Copy of a typical cadastral map.
- c) *Role of Cadastral Layer in SDI*: Description if and how the cadastral map is used for national, state, or local land information systems, and if it is used for other purposes, for example utility mapping or other similar purposes. Description if and to what extent the

cadastral layer is being integrated with other spatial data sets for purposes such as e-government, civic empowerment, or ultimately sustainable development.

4.5 Reform Issues

This topic investigates problems and issues that are currently going on in the cadastral system:

- a) *Cadastral Issues*: Description of the three most important problems that are currently confronted in a cadastre. This may include issues such as boundary disputes, forged titles, and delays in standard transactions.
- b) *Current Initiatives*: Description of current initiatives that are being undertaken to address the above-mentioned issues.

5 Structure and Content of Cadastral Template – Part Two

The second part of the template identifies the basic principles and main statistics of the cadastre. The statistics are kept simple and focus mainly on the population and the number of parcels and professionals working in the system. The questions are listed in Table 2 below.

The aim of questions 1.1-1.4 is to get answers about the basic principles of the cadastral systems. Questions 2.1-2.4 seek to get the basic statistics of the cadastral system, i.e. population and number of land parcels. The formulation of question 2.3 resulted in a major discussion within the development project team about the definition of the term "land parcel" and about what the actual question should be (compare discussion below in section 6).

The intention behind questions 2.5 and 2.6 is to get an approximate understanding of the size of the informal settlement problems that many Asian countries are facing today. As de Soto (2000) pointed out, the economic value of informal settlements can be quite significant, but while not being integrated in the formal legal system, these assets are not able to partake in the lending market and cannot bring benefit to their owners. Questions 2.5 and 2.6 therefore try to clarify this issue by identifying the degree of land title registration in urban and rural areas.

The purpose of questions 2.7-2.10 is to get the approximate number of professionals that are active within the cadastral system. These numbers may give an indication of the efficiency of a cadastral system.

Table 2: Part two of template: questionnaire about principles and statistics.

<p>1. Cadastral Principles</p> <p>1.1 Is the cadastral system based on <i>deeds registration</i> or on <i>title registration</i> ?</p> <p>1.2 By law, is registration of land ownership <i>compulsory</i> or <i>optional</i> ?</p> <p>1.3 Comments on the actual practice and the legal consequences of the above-indicated type of registration.</p> <p>1.4 Approach for the establishment of the cadastral records: <i>systematic</i> registration during initial establishment of the cadastre or <i>sporadic</i> registration.</p>
<p>2. Cadastral Statistics</p> <p>2.1 <i>Population</i> of the country.</p> <p>2.2 <i>Population distribution</i> between urban and rural areas.</p> <p>2.3 Number of <i>land parcels</i>.</p> <p>2.4 Number of <i>registered strata titles or condominium units</i>.</p> <p>2.5 <i>Degree of registration</i> of land parcels in URBAN areas.</p> <p>2.6 <i>Degree of registration</i> of land parcels in RURAL areas.</p> <p>2.7 Number of <i>professional land surveyors</i>.</p> <p>2.8 <i>Proportion of the time</i> that these land surveyors commit for cadastral matters</p> <p>2.9 Number of <i>lawyers/solicitors</i>.</p> <p>2.10 <i>Proportion of time</i> that these lawyers/solicitors commit for cadastral matters.</p>

6 Difficulty in the Definition of the Term "Land Parcel"

As mentioned above, the definition of the term "land parcel" poses many difficulties. During the development of the questionnaire, it became apparent that "land parcels" have different meanings in different countries and are often used in conjunction with the term "property". Some examples:

- a) *Australia*: "Land parcels" are the units surveyed in the field with the corresponding land ownership titles recorded in the Land Registry. This uniquely identifies each parcel corresponding to the title. The relationship between these two main units is usually a 1:1-relationship, i.e. each land parcel is related to one land ownership entry in the land registry. The term "property" is used by local councils and utilities, which maintain property records for their own planning and tax purposes. A property has one street address and usually one house, but can consist of one or many, normally adjacent parcels owned by the same landowner. In about 90% of the cases, however, a property consists of one parcel only. While the land ownership title is of interest to the land registry, the term property is used by the local councils and reflects their different needs. Buildings are part of the property records.
- b) *Malaysia*: In the 1960s, Malaysia introduced the concept of "Qualified Titles". Qualified Titles are titles of land issued prior to a final accurate cadastral survey, but they are recognized by the National Land Code and have all the properties of a Final Title. This concept was introduced for administrative expediency in the face of the slow pace of registration of Final Titles in the 1960s because a lack of qualified land surveyors (MalaysiaGIS, 2003). This concept was very successful to support an active land market. It however has the effect that in many areas, there are many more land ownership units than there are surveyed land parcels.
- c) *Denmark*: The term "property" is a legal term defined in the cadastral act and may include one or more land parcels as determined in the cadastral register (Enemark and Scholer, 2002). The properties are used as a basis for securing legal rights such as ownership and mortgage, which comprise the whole property. A "land parcel" is part of a property and may only be sold or mortgaged separately when it is divided from the property through a subdivision process. Usually, however, a property consists of one parcel only. Buildings are part of the property. The use and definition of the terms "property" and "parcel" are similar in other Scandinavian countries such as Sweden and Finland.
- d) *Switzerland*: The cadastral system is based on the folio principle, i.e. each "land parcel" on the ground is related to exactly one ownership title registered in the land registry. Every land parcel has a unique parcel identifier number, to which all parcel-relevant information is linked. Buildings are by definition integral parts of "land parcels" and by default cannot cross parcel boundaries. In the case of a building sitting on top of a parcel boundary, the boundary would need to be rectified accordingly or the two parcels would need to be merged. Land parcels can be sold only as complete entities. If only a part of a parcel is to be sold, it has to go through a subdivision process by first creating a new parcel, where the new boundary is delimited by a defined cadastral survey process. The term "property" as such is not commonly used, but it would correspond with the term "land parcel".

One of the aims of the template is to determine the size of cadastral systems. The different use of the terms "land parcels" and "property", however, makes it difficult to decide what to ask for. However, another objective of the cadastral template is also to understand the role of the cadastre in SDI. In this context, it seems to make sense to identify the smallest uniquely identified land units and ask for their numbers, because it is those smallest land units that ultimately will be recorded in a land information system serving as basis for SDI.

These smallest uniquely identified land units are often called land parcels, but in some jurisdictions may be confused with the term "property". In an attempt to categorize the cases, we can simplistically distinguish three scenarios in how these two terms are being used:

- Scenario (i): in many jurisdictions the smallest uniquely identified (and usually surveyed) unit shown in the land registry is termed a *parcel*;
- (ii): in many other jurisdictions, while the smallest uniquely identified (and usually surveyed) unit is a parcel, the land registry only records single land ownership units often called *properties*, which may include one or more parcels;
- (iii): in some other countries, there are many properties or *land ownership units*, often unsurveyed, in one legally defined and surveyed parcel

Figure 1 illustrates these three scenarios. While the surveyed or registered units (in thicker lines) may be different for each of the scenarios, the number of the smallest uniquely identified units would be 15 in each case:

- Scenario (i): 15 parcels / 15 entries in land registry
→ number of smallest uniquely identified land units: 15
- (ii): 15 parcels / maybe 8 properties
→ number of smallest uniquely identified land units: 15
- (iii): 1 land parcel in cadastre / 15 land ownership units and 15 titles in land registry
→ number of smallest uniquely identified land units: 15

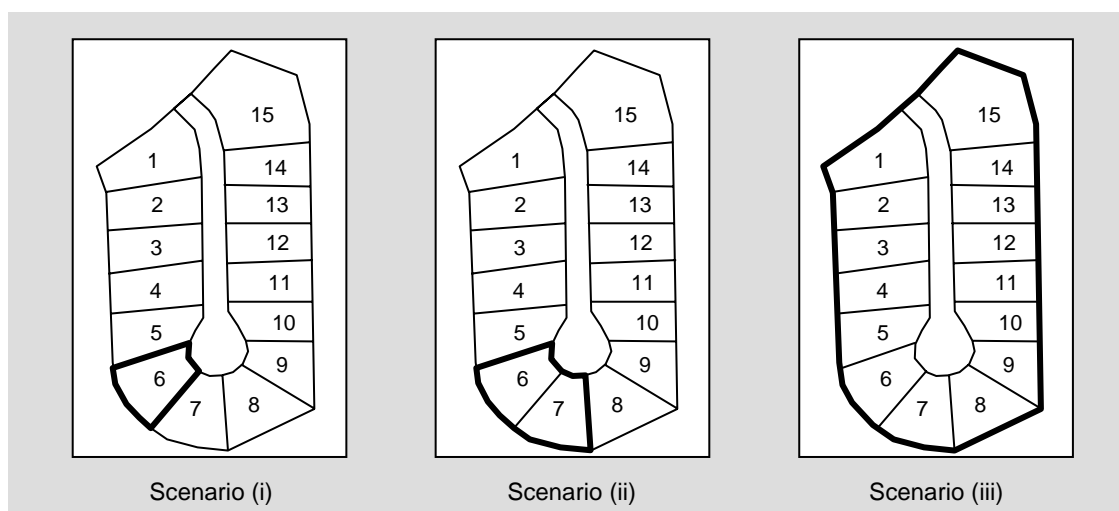


Figure 1: The three main scenarios for the use of the terms "land parcel" and "property".

7 Expected Outcomes

The aim of the cadastral template is to provide a description of the status of cadastral and land administration systems as a basis for improving them. In simple terms if you do not understand the existing systems, you cannot improve it. With the involvement of the PCGIAP and FIG-Commission 7, it is expected to obtain replies from over 50 countries worldwide. The replies will be published on-line on the Internet, which may attract further interest and widen the basis of the template. It is intended to compile all the replies in a report by the end of this year.

It is expected that the results will provide a good basis for comparing and identifying good practise among the participating countries. The results will also provide a broad basis for further research in regard of the role of cadastral systems in national SDIs.

8 Conclusions

The cadastral template project is a first step to collect generic information about cadastral and land administration systems. There are many more aspects – such as the cadastral processes of land transfer, subdivision, and adjudication; the main entities of the cadastre and their roles; linkages between main entities; types of registers within the system and their roles; etc. – that would deserve further investigation. This project, however, aims at the most basic issues in order to

remain relatively simple and manageable. However, it will provide the basis for further research and future data collection.

9 Acknowledgments

The authors wish to gratefully acknowledge the support of the members of the Centre for Spatial Data Infrastructures and Land Administration at the University of Melbourne for assisting and supporting the preparation of this paper and the associated research. The support and contribution of two colleagues were of particular value: first of all, we would like to thank Prof. Stig Enemark for his keen interest and his close collaboration in the design of the template and for the preparation of the Danish country report as an example for the template. We are also very grateful for the contributions of Kate Dalrymple, member of the Centre for Spatial Data Infrastructures and Land Administration at the University of Melbourne providing valuable support in preparing the Australian data as an example for the template. However, the views expressed in the paper are those of the authors and do not necessarily reflect the views of the University of Melbourne.

References

- De Soto, H. (2000). *The Mystery of Capital: Why Capitalism Triumphs in the West and Fails Everywhere Else*. ISBN 0465016146, September, 276 p.
- Enemark, S. and Scholer, K.L., Eds. (2002). *The Danish Way*. The Danish Association of Chartered Surveyors, Copenhagen. (<www.ddl.org/thedanishway>, accessed 7 May 2003)
- Lavadenz, I., Sanjak, J., Barnes, G. and Adlington, G. (2002). *Concept Paper and Annexes – Comparative Study of Land Administration Systems*. Unpublished report, prepared by the World Bank, January (cited in World Bank, 2003).
- MalaysiaGIS (2003). *GIS glossary with terms associated with GIS and other related technologies specifically used in Malaysia* (<<http://www.malysiagis.com/resources/glossary/index.cfm>>, accessed 9 May 2003).
- Merriam-Webster (2003). *On-Line Dictionary*. (<<http://www.m-w.com/>>, accessed 12 May 2003).
- PCGIAP (2000). *Permanent Committee on GIS Infrastructure for Asia & the Pacific*. Information from web site (<<http://www.pcgiap.org/>>, accessed: 9 May 2003).
- Stuedler, D., Williamson, I.P., Kaufmann, J. and Grant, D.M. (1997). Benchmarking Cadastral Systems. *The Australian Surveyor*, September, Vol. 42, No. 3, pp. 87-106 (<<http://www.geom.unimelb.edu.au/research/publications/IPW/bnchmrk.html>>, accessed: 10 Oct. 2002).
- Stuedler, D. and Kaufmann, J. (editors) (2002). *Benchmarking Cadastral Systems*. FIG-Commission 7 – Cadastre and Land Management, Working Group 1998-2002 - Reforming the Cadastre, International Federation of Surveyors (FIG), Denmark, April, 76 p.
- World Bank (2003). *Comparative Study of Land Administration Systems – Global Synthesis of Critical Issues and Future Challenges*. Report prepared by Tony Burns, Chris Grant, Anne-Marie Brits and Kevin Nettle of Land Equity International Pty Ltd under a contract with the World Bank, March, 147 p.