Chapter Four: Proposed Framework

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4.1 Introduction

This chapter presents the proposed Cadastral Information System (CIS) framework and it is designed to enhance the development CIS. It has proposed to define data, techniques, organizations partner and other elements. The proposed CIS framework is used to develop this project and it can be used in future to develop a complete CIS.

4.2 Cadastral Information System (CIS) Framework

The CIS framework in Figure 4.1 is based on the study of system environment. The following have been referred to in creating the framework.

i) The Turkish Cadastral Automation System in Turkey.

ii) The Egyptian Cadastral Information Management (ECIM) in Egypt.

iii) Information System of the Cadastre (ISC) in Bulgaria.

iv) Cadastral Reform Project in Malaysia.

The main information gathered from the above mentioned projects include the following.

i) Turkey project: ESRI package software (i.e. ArcInfo, ArcGIS, ArcSDE, ArcIMS and ArcCadastre) is best GIS software that can be used to develop successful CIS.

ii) ECIM Egypt project: the best type of CIS is multipurpose cadastre. It integrates between three databases which are land register database, survey data (DCDB) and taxation database. Multipurpose CIS can address electronic government services.

iii) ISC Bulgaria project: the cadastral mapping scale is very important for the accuracy of data. The compact city needs small scales (i.e. 1:500) for digitizing process.

iv) Cadastral Reform Malaysia project: accurate DCDB depends on accuracy of data acquisition for cadastral survey. The accuracy of data can be obtained by using GPS tools besides fully understanding to survey area.
Even though this framework is proposed to help in the development CIS by using GIS techniques, it can be used to develop a land register system efficiently. It can follow all the framework elements except DCDB element which is suitable for GIS techniques only. The cadastre 2014 (Section 2.3.2) portrays general framework that attempts to obtain the six statement goals for cadastral reform and cadastral system development in future (i.e. 2014).

As reported by Henssen (1995) “Cadastre 2014 is a methodically arranged public inventory of data concerning all legal land objects in a certain country or district based on a survey of their boundaries. Such legal land objects are systematically identified by means of some separate designation. They are defined either by private or by public law. The outlines of the property, the identifier (i.e. the grant number) with descriptive data, may show for each separate land object, the nature, size, value and legal rights or restrictions associated with the land object”. Finally, the author in this research propose CIS framework to support a developer to set the correct base to develop CIS rather than look for cadastral legislation.

### 4.2.1 Justification of proposed CIS Framework

In this research, as a first step in investigating trends and proposing framework, the author looked at the existing four cadastral systems project and attempts to define and organize the system requirements for developing a cadastral system. A general framework diagram is shown in Figure 4.1. It is proposed by defining the eight elements that all cadastral system shares and it further defines the recent management tools and techniques used for design and development of cadastral information system.

Basically, the framework identifies the relationships between the eight elements of the framework with one another. First, the developer needs to define the type of CIS based on user requirements and feasibility study for the project where each cadastral system mostly
consists of land, people, and legal procedures that need to be followed. Second, the developer needs to select the components based on the type of CIS. For example, if the developer wants to develop the legal cadastral system, then the land register, cadastral surveying and mapping components ought to be selected. Third, the developer needs to capture the necessary data and subsequently select the appropriate software to create the DCDB by digitizing the maps data. For interface design element, the developer needs to use web mapping to fulfill sound GUI requirement. Next, management element needs to organized and next you need to establish the land register, cadastral surveying and mapping data between different departments inside the cadastral office and outside the organization.

Figure 4.1: Cadastral Information System (CIS) Framework
4.2.2 Elements of proposed CIS Framework

The eight elements for the proposed GIS framework as listed below:

1. **CIS Consists of**: CIS consists of land (location), people (landowner) and law (rules to register and certify the ownership for owner). Landowners users are key components in providing data for CIS. Lawyers and notary users are responsible for certifying the ownership and survey users support the cadastral system with cadastral survey data.

2. **Components of CIS**: CIS components are land register (title/deeds), cadastral surveying and mapping, and property taxation. Each component is a subsystem in CIS and it provides the CIS with specific data. The combination between the three components is used to carry out all registration operations and contracts on land rights.

3. **Type of CIS**: There are three types of CIS namely legal cadastre, fiscal cadastre and multipropose cadastre. The type of CIS used in the early stage of development defines the system domain and services.

4. **Data**: Data requirements must be defined - thinking ahead to future policy developments. CIS includes two types of data which are land register data and survey cadastral data (spatial data). The spatial data can be captured from different resources (i.e. field survey, remote sensing, GPS, aerial photos). The output data for CIS can be maps, tables and reports.

5. **Technology**: CIS require high capacity hardware and network infrastructure (ICT) to enable CIS to be accessed by different users on related organizations. The required development software for CIS is GIS software (i.e. ArcGIS, Web Mapping, ArcIMS ..etc). The GIS software can be integrated with some programming language such as PHP and Java and the database used includes SQL Server and MySQL. This
integration between GIS software and programming language helps to develop all user requirements. The technology should support:

- Security, reliability, continuity of service.
- Distribution, publication of data.
- Use of remote access (public or private).
- Data convergence issues.

6. **Digital Cadastral Database (DCDB):** analogue cadastral data is computerized and store as DCDB. DCDB can be created by digitizing the cadastral map (convert raster maps to vector maps). The map scale should be defined based on the features required for digital map. DCDB allows to store the maps in different layers (i.e. parcel layer, building layer … etc).

7. **Interface Design:** GIS techniques support great interface design to CIS. The users can interact with cadastral map to get cadastral information. Web mapping is a new technique that supports web map design. System accessibility and usability is tested interface design for the CIS.

8. **Management:** Management data is most important issue for CIS. DCDB would improve the management capabilities of cadastral data. The data can be shared between survey departments, land register offices and others organization based on type of CIS that is developed.

### 4.2.3 Using Proposed CIS Framework for Develop CW-MSLD System Prototype

In this research, the CW-MSLD System prototype is actually a legal cadastre system and the component for this system includes land register (title/deeds), cadastral surveying and mapping. The GIS technology will be used to develop this system and the interface design
where web mapping occurs by using open source software. In addition to these is Arc/Info software that is used for creating DCDB.

There are two important benefits for using CIS framework. First, it is considered as a guide to developers helping them in creating a plan of development and defining the system requirements. This can be seen on design of the CIS framework as eight elements with specific properties. The developer can implement the eight element sequence to reach the desired goal. Section (4.2.2) provides more details on the elements of CIS framework.

The second benefit is the ability to define data types. As mentioned before, the cadastral system integrates between attribute data (owner data, mortgage... etc) and spatial data (parcel, area ...etc). The CIS framework defines in shortly data type, data source, and data organized in data element (Element 4) and also points the steps for creating DCDB for the spatial data in DCDB element (Element 6).

### 4.3 Summary

In summary, setting up the CIS framework is the most important task in developing successful CW-MSLD prototype system. It provides a great guidance to develop a CW-MSLD prototype system in this research and it can be used for developing a complete CIS. The CIS framework consists of eight elements which are type of CIS, components of CIS, data, technological, DCDB, interface design, and management. Furthermore, each element has specific properties to be looked for or gathered. However, the CIS development can provide a user-friendly system with many advantageous functions such as searching on a map to get other textual or visual information. The Common principles for proposed CIS framework will help CIS developers and ultimately staffs in cadastral office, who will be able to benefit from system in their work.