Chapter Seven: Conclusion and Recommendations

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7.1 Introduction

This chapter will further discuss the research contributions by determining how CW-MSLD fulfilled the objectives as identified. Next, the system strengths and limitation will be defined. Finally, the recommendation for future enhancement will be proposed.

7.2 Fulfillment of the Objectives

Chapter one presented the research objectives for this research (Section 1.3). In addition, it presented six research questions that were used to guide in achieving the research objectives. This section will answer the research question (Section 1.4) which will aid in fulfilling the objectives.

Objective 1: To identify the features of the cadastral information system (CIS).

Question 1: What is the existing situation in the cadastral office for the provision of cadastral system?

This objective was fulfilled by understanding the cadastral system environment and the system information was gathered by interviewing and observing the staffs in Tripoli Cadastral Office. The interview sessions were presented in Chapter Three (Section 3.3). Next, the developer digitized the map and created the DCDB based on observation of the survey staff during their work. Further discussion on identifying the requirements for survey of cadastral map is made in Sections (3.3.2, 3.3.4). Besides that, the developer created DFDs based on the procedure for registration and transfer of ownership for the cadastral (real estate). Some forms are used to fulfill this requirement in the cadastral office (Section 3.3.4). In addition, EERD model and database design were done to obtain
the user requirements (Section 5.3.1.2). Finally, the developer came out with system architecture for development of the prototype (Figure 5.8).

**Objective 2: To compare the tools and techniques that have been used by some countries to develop CIS.**

**Question 2:** What are the present tools and techniques that have been used in developing CIS?

**Question 3:** What are the new tools that can be used to improve the present situation?

The objective is fulfilled by studying the previous studies in CIS and the techniques and tools that were used to develop their projects based on the studies conducted, the author has came out with summary table and this is depicted in chapter two (Table 2.2). The fulfillment of this objective helped the author to identify the tools and techniques for developing the system prototype based on feasibility study and recent techniques available and discussed in Chapter Three (Section 3.4 and 3.5).

**Objective 3: To propose a framework for CIS based on some existing CIS frameworks.**

**Question 4:** What are the general specifications that can be outlined in designing the new system based on analysis of the current system?

The proposed framework is obtained by studying the cadastral features, cadastral reform and cadastre 2014 vision which gives a general framework for cadastral. The proposed framework depicted in Figure 4.1 of Chapter Three proposed many options to computerize the day to day cadastral work at cadastral office and it further proposed a secure way of keeping the database up-to-date. The CW-MSLD System prototype measured by the CIS
framework includes the following:

i) The CW-MSLD System must consist of land, people and law (legal) partners.

ii) The type of CW-MSLD System is Legal cadastre which supports the land markers such as register and transfers the cadastral by issuing a cadastral certificate for the owner.

iii) A component of the system consists of land register (attribute data) and mapping (special data). Attribute data is ownership data and special data is parcel survey data.

iv) Data for the system uses satellite image (QuickBird resolution: 60 cm) with hardcopy map scale (1:1000) for the study area (Section 3.4.4).

v) Technology: hardware and software requirements are documented in Sections (5.2.1.2 and 5.2.1.3)

vi) DCDB created for the urban area studied are created in three layers which are namely parcel layer, building layer and street layer (Section 5.2.4).

vii) Interface design as web mapping for system included search map and search text queries and the exhibited map is interactive. The system’s website supported great image tools that make the system gives clear information from map that are interactive (Section 5.3.1.1).

viii) The system manages geographic data and land register data in the Land Register and Survey Office.

**Objective 4: To design and develop a web mapping prototype for CIS which issues cadastral certificates for the cadastral (real estate) based on the proposed framework.**

**Question 5:** What are the needs of users that the system should be able to provide?

**Question 6:** How does the system work when implemented in a database and GIS?
This objective is fulfilled by developing the web mapping prototype to provide a better computerized solution for the cadastral office in Tripoli-Libya. This system was developed based on the proposed CIS framework. The system requirements and functionality for the web mapping prototype are explained in details in Chapter Five (Section 5.2.2). The interface design and system architecture for CW-MSLD System prototype are explained in detail in Chapter Five (Section 5.3 and 5.4).

CW-MSLD System prototype was developed to increase the efficiency and effectiveness of the daily work on Tripoli Cadastral Office by using the modern GIS techniques (Web Mapping). The current system in office is a manual system. CW-MSLD System works with DCDB and the system can give the location, area, boundaries for any parcel included on the map. The user is able to interact with the cadastral map by using available map-tools on the system.

The search model in the system is not like any other search engine whereby it searches the map to get information. These are the two search models that can be used to get information about the requested parcel. The user can click on a parcel in the map if he or she knows the parcel location. Alternatively, the user can enter parcel ID and click the “Search” button to get the parcel location and other information.

Based on GIS techniques, the system is able to register real estate (cadastral) and transfer the ownership for the registered cadastral. Besides that, the system is able to issue cadastral certificate to the owner and complete the registration without any problem. In addition, the system is able to provide security and save information of the authorized users. The issue of
the certificate and the system implementation are discussed in detail in Chapter Six (Section 6.3).

7.3 Significance of the study

This research should have some interest to both researchers and developers of cadastral systems. It has significantly contributed and enriched the body of knowledge in the context of GIS techniques and cadastral survey procedures.

7.3.1 Theoretical Contribution

In order to develop the theoretical framework for the study, several theories and framework had been refereed to. In addition to these, the study and findings obtained from Cadastre 2014 vision were later applied to construct a theoretical framework for CIS. This framework would have tremendous impact on the study of cadastral systems in Middle East countries notably Libya.

7.3.2 Practical Contribution

Approximately two years of research study has resulted in the creation of CW-MSLD prototype system which is web mapping. This prototype tool when refined could be used to replace the archaic manual cadastral that is currently in use. The new computerized cadastral system would put to right the unsound filing practices and resolve the numerous problems pertaining to title deeds.

7.4 System Strengths

CW-MSLD System is a common integrated system that takes into account the land register and cadastral map. The main benefits of the system are listed below:

i) The system is developed based on web mapping techniques to support DCDB as interactive map.
ii) The database is designed to be available to upgrade the modules to merge and subdivide parcels.

iii) The system allows only authorized users to login and use the system.

iv) The system helps the cadastral office to manage daily work and store data on the computer which will lead to better land management and minimize land disputes.

7.5 System Limitation

A few limitations encountered in this research study are listed below:

i) The development of CW-MSLD System prototype has been implemented based on proposed CIS framework. However the measurement of CIS framework validation has not been done in this research. Measures like easy-to-use, satisfaction and accuracy for the framework can be enabled in further research.

ii) The system does not support merge and subdivide parcels because these two modules need to edit the map directly using a GIS software like Arc/Info.

iii) The system does not support upload for building description architecture or map that describes the building design to store in a database.

iv) The data used in this system is based on digitizing the hard-copy map scale 1:1000. To obtain more accurate map data, the digitizing map should be support with the GPS points taken by survey field.

7.6 Recommendation for the Future Enhancement

The following recommendations are forwarded to facilitate and overcome some of the constraints and limitations indicated above in future study:

i) Future studies should create DCDB to cover all Tripoli city area in Libya.
ii) The system should link with other GIS software such as ESRI package like Arc/Info for editing the cadastral map. It should further link with ArcSDE which is used to manage and maintain cadastral database and ArcIMS to manage cadastral data on the internet which would enable subdivision and merging of parcel.