CHAPTER 1

INTRODUCTION

> "In many Third World countries the greatest pressure on the land is in the urban fringe. Squatters move there from the rural areas in search of work and greater security, since the levels of starvation are often significantly less in urban than in rural communities. At the same time, the urban population is expanding because of the high birth rate. The solution to such problems requires new types of analysis based upon better information than has in the past been available."
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> (Dale and McLaughlin, 1988)

1.1 Introduction

According to United Nations (1989) the annual population growth rate is 1.9 percent in the world. It has been estimated that over the next decade, there will be an enormous, unprecedented physical and population growth of cities in developing countries. Henssen (1990) observes that the population will be more or less stable in both urban and rural areas of the developed countries.

In the less developed countries, the population will be stable in the rural areas, but an alarming growth will be found in the cities and towns. This growth will result in a need for significant acquisition of urban land for public purposes such as roads, housing, schools, hospitals, parks, markets, and other public facilities.

Due to the availability of high living standards and profitable economic developments in urban areas, there have been huge migrations from rural to urban areas. Therefore, the land-use problems confronting urban areas are usually traced to rapid urbanisation and massive urban growth in the recent decades (Gilbert and Gugler, 1992).

As a result of these, rapid urbanisation has dramatically and continuously occurred in most major cities in the developing world. Thereby, these cities are faced with a lack of readily available land and this causes public services to fall further and further behind the demands of urbanisation (Doebele, 1982). In order to provide new services as rapidly as they are needed to support rapid urbanisation, local government authorities must contrive some efficient land acquisition strategies for new settlements and built-up areas.

Many methods, such as nationalisation of land, nationalisation of all development rights, government ownership of peripheral areas, special taxation on the benefits received by parcels from the installation of public services, and others, have been proposed to resolve these urbanisation problems (Doebele, 1982; Dunkerley, 1983; Kitay, 1985). Among the most interesting known devices in this field is *land readjustment*. This method has become an important tool for urban development in Germany, Japan, South Korea, Taiwan, Turkey, and the state of Western Australia (Seele, 1982; Doebele, 1982; Nakamura, 1986; Archer, 1992; Yomralioglu, 1992).

Land readjustment may be defined as an instrument used when developing land for modern urban use. The process aims to take rural or unplanned urban land, usually irregularly subdivided, and reallocate it, in the required balance, for public and private use according to town planning requirements (Yomralioglu and Parker, 1992). In other words, all land parcels within a

project area are grouped together and a percentage of each parcel calculated to determine a contribution to public areas. This percentage depends on the size of the project area and the total size of required public-use areas. The remaining land is reallocated within the site blocks defined by the zoning plan (Muller, 1992).

In urban development, land readjustment helps to eliminate small parcels, irregular plots and land unsuitable for economic use. It creates usable site lots by consolidating, dividing and re-distributing land parcels back to the original land owners. During the land readjustment procedure, it also provides an opportunity to simply and inexpensively resurvey the land and demarcate new boundaries. Therefore, the practice of land readjustment can be considered as a method of strengthening the cadastre (Chou and Shen, 1982).

In helping to provide new built-up areas for urban development, land readjustment affects current land tenure and changes the existing parcel structure according to the detailed urban planning programs. However, land readjustment is a complex management tool with economic, physical, social and planning dimensions (Doebele, 1986).

Land readjustment has great advantages for solving the land-use problems in urban areas but current land readjustment implementations are still faced with some limitations. These included technical limitations in handling the wealth of data, economical limitations in compensation for acquiring land, and social limitations in minimising the inconvenience and perceived injustices.

However, the technical limitations, such as inequitable land distribution and inefficient land information management, affect the effective and efficient use of land readjustment applications in developing countries. For instance, land-value analysis has not been dynamically used in the process. Currently many substantial factors which affect a parcel's value are ignored during the project. Therefore, inequitable land distribution can occur to the original landholders affecting their benefits from the land readjustment project (Miyazawa, 1982; Doebele, 1982; Satoh, 1986).

Information management is another technical limitation that affects the performance of the process. Due to poor information management and the use of a manual process, to follow the entire procedure is time consuming and error prone (Chou and Shen, 1982). This causes some mismanagement and undesirable duplication in the project stages, so that the expenses of a project increase too much. In order to provide an equitable land parcel distribution, with a more effective decision-making process, there is also a need for an efficient information management procedure.

Considering overcoming of the present shortcomings of land readjustment applications, it has been conceived that land readjustment would be a most valuable and powerful urban land management tool to provide suitable land for public and private sector needs. It is also believed that, at the same time, land readjustment can help to establish a reference for the ongoing development of land information systems in developing countries.

Based on the above thoughts, this research has attempted to automate and improve the quantitative and qualitative capacities of the land readjustment technique, to maximise the benefits from the process.

1.2 Problem definition

Due to the widely varying conditions in the cities of the world, in cultural attitudes toward land, and in political and institutional structures, no single form of land readjustment can be universally applicable. While the main concept of land readjustment has been maintained in all applications, current land readjustment implementations are examined in different ways from country to country. Land readjustment still has however some common problems that most of the projects are faced with. As expressed by Satoh (1986), Seele (1982), Chou and Shen (1982), a land readjustment project can take up to ten years to complete as a result of some of social, political, economical, and technical requirements.

Considering the technical aspect of land readjustment, some of the common major problems with the present approaches to land readjustment may be classified as follows:

(1) Land Valuation

During the land readjustment projects, there is no dynamic land valuation analysis. Unit land value especially is not involved in the calculation of the percentages to be contributed by each landowner for public areas. In most cases, the only criterion is the parcel size, and the contribution factor is the public-use land area required in the zoning plan. This single coefficient is calculated and applied to all landholders in the project to derive their contribution to the public land. Redistributing land on an *area* rather than a *value* basis, does not provide an equitable approach for the landowners, because many other factors which affect a parcel value, are ignored. Such factors include, land-use, topography, shape, view, proximity to commercial

areas, other public facilities, etc. However, during the project, each basic geographic unit of a land parcel should be characterised by a set of some economic, environmental, and spatial attributes.

(2) Decision Making

Land re-distribution is the most crucial part of the entire land readjustment process. In this stage, cadastral parcel boundary locations are changed and landholders are moved to new locations by the planner's judgement only. Due to a non-standardised land re-distribution process, the planners often have difficulty in making a decision about the new land parcel locations. The landowners are, therefore, at risk, because different approaches provide different land locations and benefits to them. Land re-distribution itself is a complex task which requires highly specialised expertise because there are many questions that should be analysed. In regard to the priorities of zoning plans, the questions are, for example, who will receive the new parcels; how will land be evaluated; what criteria and land characteristics should be considered; how will landholders be redistributed or be consolidated so that landowners will be satisfied, etc.

(3) Information Management

Analysing existing spatial information, searching legal land records and providing outputs for land readjustment applications are done with conventional manual methods which are time-consuming and error-prone. Sometimes, the information is not readily available for later use because of poor information management. Following the procedures in land readjustment calculations is a difficult task that requires great responsibility and accuracy. When any small mistake

happens, whether technical or non-technical, it can mean repeating all the land readjustment processes. Sometimes unnecessary duplication can occur too. Therefore, information cannot be managed effectively and efficiently. In order to deal with all kinds of data within a considerable time period, a capable information management environment for land readjustment should be established with the aid of current spatial information analysis equipment, such as Geographical Information Systems (GIS) and Land Information Systems (LIS).

1.3 Research objectives

Considering the technical issues of land readjustment applications, a new approach to land readjustment has been developed in this study. The main objective of this research is to design and develop an automated urban land readjustment prototype model which will, specifically, deal with the land valuation, decision-making, and information management issues of the current land readjustment applications. In order to accomplish the objective of this research, the following specific tasks are considered.

(1) to define the land readjustment concept, and identify the current status of land readjustment structure and its role in a rural-to-urban land use change program;

(2) to classify the issues and requirements for better use of land readjustment, and investigate the potential use of land readjustment in the provision of land for public and private needs in urban areas;

(3) to establish a general framework for the development of a prototype model to increase the qualitative and quantitative capacities of land readjustment method;

(4) to design an algorithm which deals with the land valuation requirements and provides an equitable approach to land distribution process;

(5) to develop application software which deals with the prototype development requirements and provides a solution to entire land readjustment process in a single package;

(6) to introduce GIS/ LIS to the land readjustment model, to establish an effective information management environment for users and evaluate the capability of GIS/ LIS with land readjustment applications;

(7) to test and demonstrate the entire prototype model with a case study;

(8) to report the study results, and to make recommendations for further development.

1.4 Methodology

In order to achieve the thesis objectives, the outlined problems were individually examined. A solution to the combination of these problems was attempted in a single model. First, it was necessary to gain some background information on the concept of the land readjustment method, with its potential use, shortcomings, and requirements.

An approach for the land valuation problem is that each basic geographic unit would be characterised by a set of economic, environmental, and spatial attributes. To determine the value for land parcels, an understanding the land valuation concept was also needed. Usually the objective of land valuation is to determine *market value*. In this study, *value* is used as a *nominal asset value* which represents a land parcel's significance when compared to others. Hence, value is a numerical parameter for each land parcel, rather than a real market value. The nominal asset values are calculated from the combination of selected land valuation factors. A survey was carried out to classify land valuation criteria which can affect the total perceived value of a land parcel. Then, each land parcel is spatially analysed with regard to determined valuation criteria.

In addition, some terminology on computing technology matters were also reviewed, relating to spatial data processing demands. The concept of land-related information systems, and data organisation in such a system were also investigated. GIS and LIS are used to serve and support the entire model for data collection, storage, retrieval, and spatial analysis requirements.

Since every country has its own land policy system, documentation of the land readjustment procedures is not standardised world-wide. Therefore, land readjustment implementation depends on the land policy and the other land-related acts of the country. In this research, as a case study for a developing country, Turkey has been selected to examine the land readjustment procedures. The Turkish Land Readjustment Act, existing cadastral standards and zoning rules were considered during the case study. All required textual and non-textual data were obtained from Turkey.

1.5 Thesis outline

Chapter 1 gives some of the problems of the land readjustment process, the objectives of this research, and the study methodology.

Chapter 2 outlines the concept of land readjustment with its importance in the urban land development process. Land readjustment practices in some countries are also reviewed. Some examples of the land readjustment process are also included.

Chapter 3 proposes a new approach to land readjustment. A value-based land readjustment prototype model is detailed with its conceptual design and requirements.

Chapter 4 overviews the current land-related information systems. Particularly, terminology, definitions and components of GIS and LIS are described.

Chapter 5 includes the software design and algorithm development of the proposed model. Based on the combination of the ideas in Chapter 3 and Chapter 4, the proposed model is described using the data processing and spatial analysis functionality of GIS.

Chapter 6 describes and gives the details of the software components. The procedures, requirements, file management, spatial analysis, data input and output activities are explained.

Chapter 7 presents a case study and examines the results of this study. In order to implement the proposed prototype model, it has been tested using currently available data from Turkey. This gives a practical demonstration of data collection and integration using the developed software.

Chapter 8 outlines the conclusions of this work. Some suggestions are also included for future work that would extend the research already performed.