

LAND REALLOCATION USING GIS : The Control of Rural-to-Urban Land-Use Change

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INTRODUCTION

Rapid urbanisation in the developing world is causing a lack of municipal resources with public services falling further and further behind demand. In a small and crowded nation like the United Kingdom the extent, rate and location of urbanisation are important issues for both planners and the general public. Much of the growth of urban areas can be accommodated by the reuse of previously developed land, or the use of vacant land within urban areas. However, growth at the urban fringe, or through new settlements, introduces issues of land use planning [HMSO, 1990]. Such as, compensation is one of the main land acquisition methods in urban land development applications but it is an expensive and mandatory way to acquire land for public and private sectors. In order to provide new settlements and built-up areas, there should be a more effective land use process.

Land reallocation (LR) is one of the planning tools to deal with these urbanisation requirements [Doebele, 1986]. It has great advantages in solving the land-use problem in urban areas but current LR practices are limited by the use of manual procedures in extracting and analysing management information. To maximise the benefits from LR applications and to establish a reference for further development of land information systems, a valuation-based approach has been developed to LR using Geographical Information Systems (GIS). In this approach, many factors defining the economical, environment and spatial value of land parcels are analysed before and after reallocation to ensure equality in the re-distribution process.

In this paper, a valuation-based LR process using GIS is briefly described. A multi-criteria land valuation analysis procedure for local authorities is also illustrated with a large scale spatial data application in LR.

LAND REALLOCATION FOR URBAN DEVELOPMENT

LR is an instrument used when new and redesigned settlements are needed for modern urban use. The process aims to take rural or unplanned urban land, usually irregularly subdivided, and re-allocate it, in the required balance, for public and private use according to town planning requirements [Yomralioglu and Parker, 1992]. It helps to increase land utilisation to meet the ideal of "best possible use of the land" saving government a great deal of money, project time for urban development.

Despite the fact that LR is an effective approach to provide new built-up areas there are still some issues by the process. Land valuation analysis, for instance, has not been dynamically involved in current implementations. Many substantial factors which may affect land parcel's value are ignored during a project. Therefore, planners have difficulty in making decision about the new parcel locations and landowners become dissatisfied because different approaches provide different land locations and benefits to them.

In order to increase the effectiveness of LR, a value-based approach has been developed to LR using Geographical Information Systems (GIS). The objective of this approach is to

determine a *land parcel value* before and after a project, then giving back a new parcel to a landowner with the same value that owned before reallocation. In here, a *land parcel value* is a single unit figure to represent all factors effecting a property when compared to others.

In this approach, due to the difficulty of collecting real-market value data for a land parcel, numerical parameters are used as unit value for each land parcel rather than a real market value. Using the Arc/Info GIS, first, new site lots are created according to the detailed urban planning, then all land parcels within the project area are analysed with selected land valuation factors. Almost 30 valuation factors are applied to determine a parcel's unit value. This value is derived from the combination of individually formulated land valuation factors. After the land valuation analysis, land re-distribution is accomplished with respect to optimisation criteria. This approach provides a parallel condition between the parcel value profiles before and after an urban development project, so that all landowners within the project area are affected in a same way by the project.

ASSESSMENT AND LAND VALUE MAPPING USING GIS

Not only in the LR projects but also in any other land related projects, fairness and equity of property values are of primary concern to the planners as well as to the landowners. Although LR is not a process applied in the UK, the procedures developed to assess and measure up land values have application in other areas. Where there is a need to compare land parcels, the unit value for a parcel can be determined as a numerical parameter by examining a set of economical, environmental, and spatial attributes, such as land-use, topography, shape, view, proximity to commercial areas, other public facilities, etc.

Due to the complexity of land valuation process, providing property owners with an easy understood explanation of how their property has been valued is a continual challenge for planners and assessors. Today GIS is able to execute all these complex tasks. To deal with land valuation requirements, a value-based LR can also help by the provision of valuation maps of project areas. Thus, using Arc/Info and TIN (Triangulated Irregular Network) modules, a visual value model and required valuation maps are also created by the value-based LR system. The system especially provides a sophisticated mass appraisal analysis by considering selected tangible and intangible valuation criteria.

The required data for land valuation analysis are derived from the property, zoning, thematic, and topographical maps, and from the other related textual records. Land parcel value's are determined by the combination of mathematical analysis and subjective judgement. Then, 3-D valuation maps are created. Although the digital elevation model's were originally developed for modelling relief, they used to model the continuous variation of land value over a two-dimensional surface. Draping desired layers, such as property layer, on 3-D model provides a good visualisation which is useful in the assessment process.

CONCLUSIONS

Because of "land is a finite resource", the controlling of the rural to urban land changes requires careful analysis of spatial characteristics of the land particularly economical, social, and planning dimensions. LR provides a practical approach to rural to urban land use transform by dealing with these dimensions. The integration of LR with GIS provides great advantages to decision makers.

Using GIS in a multi-criteria land valuation analysis is also provides a value estimation mechanism in large scale spatial data applications. Property classification and immediate

visual explanation of the appraisal process help to planners and appraisals for answering to many questions. Especially, a visual value model can be easily understood by individuals unfamiliar with mass appraisal procedures as well as appraisal professionals. More importantly, GIS improves the quantitative and qualitative ability of LR with an effective land valuation analysis procedure for local authorities.

References

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