

# Nominal Asset Land Valuation Technique by GIS

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## SUMMARY

Land valuation is the process of assessing the characteristics of a given piece of land. The process may be described as a carefully considered estimate of the worth of landed property based on experience and judgment..However, the objective of land valuation is to determine value; a term generally prefaced by some description such as market value or benefit value. In the land valuation, it is a common understanding that the value and potential of a property are fundamentally determined by its location. This emphasizes the significance of spatial factors in decision making of land valuation. A geographical information system (GIS) is undoubtedly useful in this decision making. A sufficient estimation can be done by analyzing a certain amount of land characteristics in an objective way. In order to make adequate value estimation for a land, there are many tangible and intangible land valuation factors that should be taken into account during the valuation process. In this paper, a method which called “nominal asset land valuation” has been introduced. In this method rather than dealing with the real-market prices, the qualitative and quantitative characteristics of individual land properties have been examined. To determine the value of a land, some land valuation criteria are selected and formulated so that property values are assigned by the numerical parameters rather than real-market values. These parameters are derived from a combination of the selected land valuation factors which can be spatially analyzed by using GIS. Land value can then determined as a single unit figure which represents all factors affecting the land as compared to others. Nominal values based on a pixel such as a bit of land were calculated, and necessary valuation analyses in order to produce land valuation maps were done by GIS. As a result, a visual land valuation model created which will be readily understood by individuals unfamiliar with mass appraisal procedures as well as appraisal professionals.

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## 1. INTRODUCTION

Up to now real estate appraisers have appraised real estate based on their intuition or experiences. Now that the concern with securitization of real estate is brought to attention, the technique of appraising the real estate more logically, quantitatively and accurately is required (Tanaka and Shibasaki, 2001). The pricing of real estate has been studied extensively since the early 1980s using a variety of methods (Din, at all., 2001).

The process of valuation may be described as the carefully considered estimate of worth of landed property based on experience and judgment by identifying and assessing the characteristics of a given land. The purpose of valuation is, however, to determine “value”, a term generally prefaced by some description such as market value or benefit value. In general, lack of information, funds, shortage of technical and administrative personnel delay implementation of the needed large scale land valuation activities..However, the determination of a land parcel value depends on a number of physical and economic characteristics which must be taken into consideration very carefully in a land valuation procedure. Some of these characteristics are intrinsic to the land; others are external or environmental factors. These factors can be determined in an objective way but there is always a certain degree of subjectivity that is difficult to measure in the valuation process (Yomralioglu, 1993a).

Locational influences on property value are widely regarded as the most important, yet their incorporation into valuation methodology is often implicit. GIS-based value maps are introduced as a means of displaying variations in value at the individual property level. There are many property market characteristics that make valuation a difficult and often subjective task that is dependent on a high degree of experience and local knowledge, for example the heterogeneity of each interest, economic influences at the national, regional and local scales. These characteristics cannot be altered and indeed make valuation a challenging profession. However, it would be seem prudent to minimize valuation a complexity by improving data accessibility and dissemination (Wyatt, 1995).

The method of valuation that is widely adopted is that of open market value using the comparative method. This technique requires adequate records of transactions (Wyatt, 1997), but appraisers are often unable to gather information on comparable properties due to commercial secrecy, a lack of data, real estate tax system and ad hoc information dissemination. It is rather difficult to monitor all transactions and it is even harder to track all purchase prices, if you do not work in this job every day. A lot of facts influence the price of a certain fixed asset (Kertscher, 2003).

## **2. OBJECTS OF VALUATION**

The objects of land valuation are generally vacant or built-up plots of land. The value of either type of land is largely influenced and characterized by factual and legal conditions which may be entirely different in nature according to the land involved. Vacant plots may be agriculturally used lands of varying yield potential, they may be areas planned for potential building use or they may be plots available for construction with considerable variation in the type and extent of buildings allowed. All of these characteristics profoundly affect the market value of the plots involved (Yomralioglu, 1992).

In the case of built-up real-estate market values vary to a yet greater extent according to the type of housing on this plot and its neighbourhood, location of the plot in relation to the city, business district, etc. Valuation of vacant and built-up lands is thus a very complex task for it must take into account not only characteristics of the plot themselves, but also numerous neighbourhood conditions and other factors bearing upon their value (Yomralioglu, 1992).

## **3. LAND VALUATION METHODS**

The use of a particular property valuation technique is dependent on property type and the purpose of the valuation (Dale and McLaughlin, 1988; Wyatt, 1997).

### **3.1 Comparative Method**

This method assumes that the market value is equal to the price recently paid for a similar property or interested in land. The valuer's problem is to determine what the market considers to be recent and similar. Adjustments may need to be made for differences between the properties used in the comparison and changes that have subsequently taken place in the market or are of a structural nature. If an almost identical house were recently sold next door for a known price but which lacked a particular facility such as a garage or central heating, then slightly different assessment would be expected. The approach is often the most simple and efficient means of determining market value, especially for single-family residential properties in an active market (Dale and McLaughlin, 1988).

### **3.2 Income Method**

This method is also a comparative method and holds that the market value of an interest in land is equal to the present value of the net income that should in future come from the land. The net income is the gross income less the cost of overheads, such as depreciation of the building stock and its maintenance and upkeep. It is equivalent to a national rent and must be discounted at an appropriate rate. The valuer's problem is to determine the net benefits that should come from the land by comparison with similar properties; and then to determine the market discount rate by analyzing recent sales of similar assets (Dale and McLaughlin, 1988).

### 3.3 Cost Method

This is also known as the contractor's method or the quantity survey approach. It assumes that the costs of replacement, less appropriate depreciation, are equal to the value. The problem is to assemble suitable cost data, including the cost of the site, and to estimate depreciation rates. The method is particularly useful for insurance purposes, where the cost of site clearance may be added to cover the possibility of a building being destroyed by fire, and for valuing new constructions (Dale and McLaughlin, 1988).

## 4. NOMINAL ASSET LAND VALUATION METHOD

Using the comparison method of valuation, physical, legal and market factors can be compared directly but every property are spatially unique, so spatial factors requiring an alternative method of adjustment. Such properties would be good comparable evidence, although rare in practice (Wyatt, 1995).

The value of property reflects its capacity to fulfill a function. With regard to commercial property, functional qualities may include,

- Location influences (accessibility to the market place, proximity to suppliers of raw materials and important nodes such as railway stations, car parks and open spaces)
- Physical attributes (size, shape, age and condition)
- Legal factors (lease terms and restrictive covenants)
- Planning and economic factors (planning constraints, permitted use and potential for change of use).

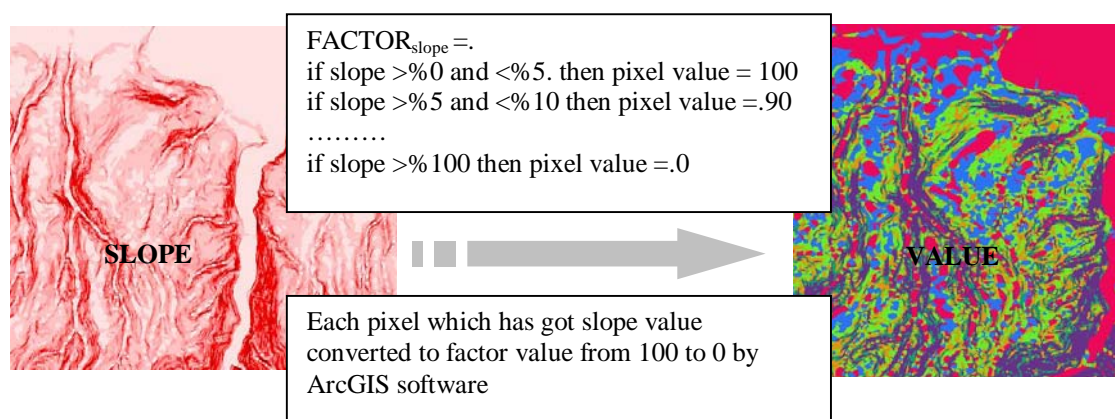
Property valuation is the process of identifying and quantifying these “value factors”. The result should be an informed opinion of value based on an assessment of those factors considered relevant to the value of the subject property (Wyatt, 1997). In various land valuation process, market value approach is the fundamental. However, units specified by valuation methods used in the application can be change depending on the nation’s economic structure. Whereas, characteristics owned by real estates can not generally different. Because these changes in market conditions cause price speculations, controlling unit values of real estates are very difficult. As a matter of fact, such problems can be seen in valuation processes done for real estate taxation. Generally, real estate values which have same region or street are same. Whereas, each real estate can has positive or negative characteristics in economic perspective from neighbor real estates (Nisanci and Yomralioglu 2002).

There are many property market characteristics that make valuation a difficult and often subjective task that is dependent on a high degree of experience and local knowledge, for example the heterogeneity of each interest, economic influences at the national, regional and local scales. These characteristics cannot be altered and indeed make valuation a challenging profession (Wyatt, 1995). For this reason, by evaluating in a region is existing properties, value dispersion between these properties under consideration should be determined. In this value dispersion process, base unit may be the real property value or parametric values obtained by grading effective factors on property. In this aim minimum and maximum points are determined by formulizing value criteria taken into consideration, and a value coefficient

representing each property is calculated. This value coefficient shows property situations between each other in respect of the value, and these values are easily converted to real value when needed (Yomralioglu, 1992).

The most significant process for land valuation is determined of the weighted factors effect real estate values. Thus, the value specified for a unit area can be reflected to all real estates with same proportions. This method is named as “*nominal land valuation method*”. Respect to this method, *nominal values of real estates can be calculated in a parametric way instead of definite value*. Objective and subjective criteria selected for this aim are evaluated one by one. Then, doing in a unit area or volume, these evaluations are reflected to all real estates (Yomralioglu, 1993a).

To determine the factor values, it was assumed that each factor value could have a maximum value of 100 for a fully developed land unit. Thus, each selected factor is evaluated out of 100 percent. Each land valuation factor is formulated and the results are derived from spatial analysis by GIS. As an example, topographical factor value analysis is illustrated in Figure 1. The topographical factor formula is based on the idea that there is a reverse ratio between value and slope (Yomralioglu, 1993b).



**Figure 1:** The topographical factor value analysis

#### 4.1 Determination of Land Valuation Factors

The number of land valuation factors is uncertain. Therefore, the precise value for a land unit cannot be determined easily. To determine the significance of these factors for a land parcel, they need to be expressed mathematically so that the effect of each valuation factor can be determined for the complete land parcel. To determine the significance of these factors for a land parcel, they need to be expressed mathematically so that the effect of each valuation factor can be determined for the complete land parcel (Yomralioglu, 1993a).

In reality, the determination of an exact value for a land parcel is almost impossible but an estimation of the asset value can be conceivable. To estimate the value, some land valuation factors which can affect the total perceived value of a land parcel have been selected and spatially examined with the developed model. The list of considered land valuation factors

are given in Table 1. Each land valuation factors does not have same effect on the total value. For instance, land parcel shape can have a different magnitude of effect to the topography. Therefore, a “weight” for the selected factors is also necessary. The weights for these factors have derived from the survey results (Yomralioglu, 1993b).

**Table 1:** Land valuation factors which may affect a land parcel value

1) Supplied basic services	15) Distance to educational centres
2) Permitted number of floors	16) Distance to health services
3) Permitted construction area	17) Access to highway
4) Landscape, view	18) Distance to shopping centre
5) Access to street	19) Available utilities
6) Environment	20) Distance to recreational areas
7) Parcel location within block	21) Topography
8) Street frontage	22) Distance to religious place
9) Distance from nuisances	23) Distance to play garden
10) Land parcel shape	24) Distance to car parking area
11) Currently usable area	25) Distance to fire station
12) Distance to city centre	26) Access to waterway
13) Distance from noise	27) Distance to police station
14) Soil condition	28) Access to railway

## 5. USING GIS IN LAND VALUATION PROCESS

GIS provides a technological platform on which to base such an analysis and an initial stage is the spatial representation of property information in the form of value maps (Wyatt, 1995). GIS capabilities not only facilitate the organization and management of geographic data, but they also enable researchers to take full advantage of location information contained in these databases to support the application of spatial statistical and spatial econometric tools (Can, 1998)

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. Thus, using Arc/Info and TIN (Triangulated Irregular Network) modules, a visual value model and required valuation maps are also created. Even, using raster based GIS; a pixel which represents unit land value is defined as a weighted average of the environmental quality notes according to the following formula:

$$V_i = \text{AREA}_i * \sum_{i=1}^n (P_i * W_i)$$

where;

V: Total nominal asset value of a land parcel..... Area: Land parcel size (or pixel size)

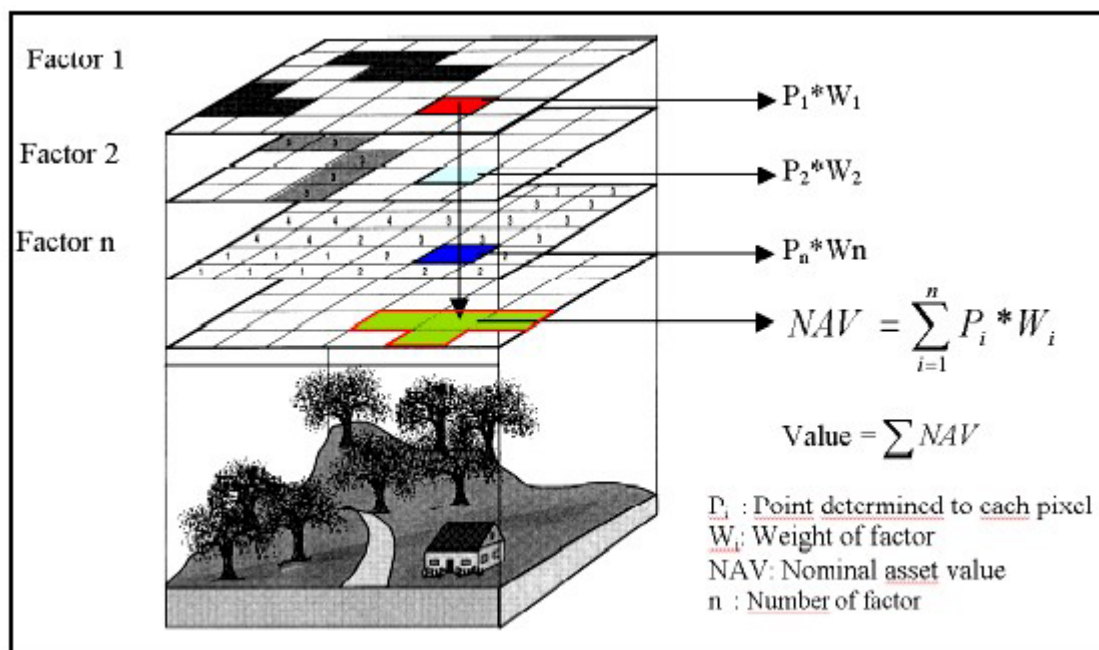
P: Factor value.....W: Factor weight

n: Total number of factors

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 values are

determined by the combination of mathematical analysis and subjective judgment (Figure 2). Then, 3D valuation maps are created. Although the digital elevation models were originally developed for modeling relief, they used to model the continuous variation of land value over a two-dimensional surface. Draping desired layers, such as property layer, on 3D model provides a good visualization which is useful in the assessment process.

Value maps are powerful decision-making tools that illustrate the geography of property values over space and time in a way that most property professionals find intuitive, namely map form. All the maps were generalized, related to one land use only and a specific point in time. Problems included choice of scale, presentation, availability of data and valuation difficulties. Geographical display was achieved by using value maps. Value maps illustrate the spatial distribution of property values. The functionality of a GIS means that a value map need not be a static display but can form part of a more analytical process. Problems in the past related to a lack of staff resources, the production of expensive paper maps and the complex calculations involved. A GIS can manage data input, calculations and the presentation of the results (Wyatt, 1997).



**Figure 2:** Calculation of a nominal asset value on a pixel-base

## 6. CONCLUSION

To increase the effectiveness of land valuation process, a nominal asset value-based model has been developed using GIS. The main objective in this model is to determine the asset value of a land with different land valuation factors which are formulated and spatially examined. Using GIS in a multi-criteria land valuation analysis is also provides a value estimation mechanism in large scale spatial data applications. In this method rather than dealing with the real-market prices, the qualitative and quantitative characteristics of individual land properties have been examined. To determine the value of a land, some land

valuation criteria are selected and formulated so that property values are assigned by the numerical parameters rather than real-market values. These parameters are derived from a combination of the selected land valuation factors which can be spatially analyzed by using GIS. Land value can then be determined as a single unit figure which represents all factors affecting the land as compared to others. Nominal values based on a pixel such as a bit of land were calculated, and necessary valuation analyses in order to produce land valuation maps were done by GIS. As a result, a visual land valuation model was created which will be readily understood by individuals unfamiliar with mass appraisal procedures as well as appraisal professionals. More importantly, GIS improves the quantitative and qualitative ability of land valuation analysis procedure for local authorities.

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## **BIOGRAPHICAL NOTES**

Recep NISANCI works as a research assistant in the Department of Geodesy and Photogrammetry Engineering at Karadeniz Technical University (KTU), Turkey. He completed his MScE study in 1998 with his thesis titled “Analyzing Property Information for Municipal Information Systems: The City of Corum Municipality Case” at KTU. He is continuing his Phd study focused on Land Valuation. His research interests are GIS, real estate valuation, land management. He has GIS skills including experience of packages such as Arc Info Grid, Arc View, AutoCAD.

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