RESIDENTIAL PROPERTY VALUATION USING GEOGRAPHIC INFORMATION SYSTEM

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Abstract

The comparison method has been the most acceptable method of valuation particularly for residential property. The valuation process generally involves two main types of data which can be classified as spatial and textual data. Several manual problems encountered during the valuation process due to the massive amount of data involved. GIS is a viable alternative to deal with the problems because of its capability to deal with both types of data integratedly and efficiently. This paper highlights the main problems of manual process of valuation and outlines a possible application of GIS via the sample session of VALGIS, a GIS-based property valuation package academically developed at Center for Geographic Information and Analysis (CGIA) Malaysia. VALGIS is capable of carrying out residential property valuation process, easy to use and can expedite the work process.

1.0 INTRODUCTION

Property valuation can be defined as a process of estimating property value for a certain purpose, at a certain time based on the property's characteristics by taking into account all the factors that can affect property value. The service of a property valuer is required to estimate property value.

In Malaysia, property valuation is carried out for several purposes which can be divided into two main categories namely statutory and non-statutory valuation. Statutory valuation includes all those valuation for the purposes of stamp duty, Property Gains Tax, compensation, and rating. Non statutory valuation includes all those valuation for the purposes of selling and buying, leasing, mortgage and fire insurance.

The property valuation process has been carried out manually since the profession was introduced in this country very long time ago. This might be one of the reasons why the profession has been criticised of producing poor quality valuation. A valuation is said to be of poor quality when it is inaccurate, inconsistent, inefficient, illogical, unconvincing, unacceptable and unreliable.

Like any other service sectors, customers' satisfaction is the key to success in the valuation profession. For the private sectors, those who can provide quality services will be more attractive to the customers hence, become successful valuation professionals. Quality valuation service is an asset for the government sector as well. Property valuations done by The Department of Property Valuation and Services, Malaysia (always referred as JPPH i.e. Jabatan Penilaian dan Perkhidmatan Harta) are referenced by other sectors for the purposes of rating, development, economic planning, etc. Quality property valuation can help a decision maker to do their work efficiently, accurately and convincingly which is seen as an important contribution for the development of a country.

Property values obtained from a property valuer must also be acceptable by court. Should there arise any disagreement or contention against any valuations, the corresponding valuer must be able to defend their decision in the court. Convincing defense would be those based on up to date and quality information as well as supported by a method understandable to those with minimum property valuation knowledge such as the lawyers, juries and judges.

The main reason for poor quality valuation is the massive amount of data involved. GIS is a viable alternative to solve the problems. This paper highlights the problems associated with manual valuation process and outlines the operation of VALGIS, a GIS-based property valuation system developed for academic purposes at the Center for Geographic and Information Analysis (CGIA), Malaysia. The system uses MapInfo package as its base and utilizes comparison method in the determination of a residential property value. This paper continues with the issues of property valuation, the manual process of property valuation, the concept of GIS, how GIS can help in property valuation, the operation of VALGIS and conclusion.

2.0 PROPERTY VALUATION

Property valuation is a complex process and may differ from one jurisdiction to another jurisdiction. In order to help readers gain context of this paper, several related issues will be presented in the following sections.

2.1 Value, price and cost in the valuation process

In the context of property valuation, a property is said to have a value in the market when it fulfills the combination of these four criteria (Mohd Harith, 1993):
- useful and beneficial;
- lack in supply;
- there is an effective demand; and
- can be transacted.

Several concepts of **value** arise due to the several purposes of valuation. They include **market value** and **value to an owner**. This paper is concerned with the open market value (OMV) which has been defined as below (Board of Valuers, Appraisers and Estate Agents, 1987):-

> "Open Market Value" is the best price at which an interest in a property might reasonably be expected to be sold by private treaty at the date of valuation assuming:
> - a willing seller and a willing buyer dealing at arms length;
> - a reasonable period within which to negotiate the sale, taking into account the nature of the property and the state of the market;
> - values will remain static throughout the period of negotiation for sale;
> - the property will be freely exposed to the market; and
> - no account is to be taken of an additional bid by a special purchaser.

Price is an amount paid by a seller to a buyer in a property transaction for the exchange of ownership. This means that the market value of a property is not necessarily equivalent to its price. This is so because a property transaction taking place between relatives or a purchaser with special interest might result in a lower price compared to the amount a normal purchaser would be willing to pay. However this type of transaction is not easy to detect because such information is usually not stated in the property transaction form.

Cost here means the monetary amount spent by the party involved in the building construction or renovation. In this paper the term refers to the cost spent by the developer in the construction of residential property.

2.2 Property data for valuation purposes

Property valuation involves geographic data that consists of spatial and textual data. The spatial data involved include land size and dimension; specific location or position of lot (end, intermediate and corner lot); street name; location of the housing estate; mukim; district; and state. The textual data needed include type of building, number of bedroom and bathroom; type of construction and building finishes; and building age and state of repairs. Another type of textual data involved is the restriction of ownership such as Bumiputera or non-Bumiputera and restriction of interest for example Malay Reserve.

2.3 Factors that can affect property value

There are many factors that can influence the value of property. According to Mohd Harith (1993), property value can be influenced by these factors:
- duration of time and ownership:- this refers to the condition of ownership i.e. duration of time, category of land use, restriction of interest;
- legal factors:- this refers to all the legal measures issued by the government to control property development and ownership such as National Land Code (NLC), Town and Country Planning Act, etc.
- physical attributes-: this refers to the land area, location, shape, finishes and neighbourhood; and
- economic condition-: this refers to the aspects that can affect the demand and supply of property for example borrowing rates.

Three main factors affecting property values are;
- external factors:- location, neighbourhood and accessibility;
- integral factors:- physical conditions of land and building, and legal restraints; and
- economic conditions:- national and local economic outlook.

Mohd Hafiz (1994) has put forward ten factors that can influence residential property value.
- date of transaction;
- location;
- "Fung Sui" - this is a custom belief;
- position of lot;
- floor finishes;
- deterioration;
- landscape; and
- building extension and renovation.

Azhari et.al (1992) has come out with a more detailed list. 21 factors are identified, namely;
- date of transaction;
- land area;
- nature of transaction;
- interest in property;
- accessibility and neighbourhood condition;
- porch area;
- type of flooring;

- type of fencing;
- type of airwell;
- type of lot;
- number of bedrooms
- separate bathroom & toilet for master bedroom;
- kitchen extension;
- number of bathroom;
- number of toilet;
- kitchen cabinet;
- gross floor area, building extension;
- closed extension;
- opened extension;
- physical improvements; and
- state of repairs.

By comparing all the lists put forward, it can be inferred that both Azhari et.al (1992) and Mohd Hafiz (1994) have come out with lists for residential properties while the others are meant for properties in general. Since this paper concentrates on residential properties, the lists by the former two are most relevant.

2.4 The comparison method of valuation

Property valuation can be carried out using several methods of valuation which can be divided into two groups i.e. conventional and quantitative methods. Conventional methods include the comparison method, investment method, profit method, residual method and cost method. The quantitative method includes the cash flow, regression analysis and simulation. However, the comparison method of valuation has been the most acceptable method of residential property valuation (Grant & Mc Tear, 1992; Azhari, 1993; Mohd Harith, 1993). It has also been widely adapted in Malaysia (Mohd Hafiz, 1994).

The comparison method is easy to use when the following conditions exist:
- transactions always take place for property with the same type of interest;
- there is no obvious difference in terms of quality of location;
- value and economic condition is stable during the period of transaction; and
- conditions of buyers and sellers do not affect the transaction.

Comparison between the same type of property can either be direct or indirect. The direct comparison is used when there is no difference in factors affecting value between the subject property and its comparables. However, the indirect comparison is often adopted because there are always physical or

locational differences exist between the subject property and its comparables. This has normally involved some adjustments in the analysis process where the differences between subject property and its similar comparables are adjusted in such a way to make them stand very much alike (however the adjustment process is not specifically discussed here since we believe that it needs a further research). Since the comparables are selected from the previous legally transacted property hence, methodical analysis on the transactions taken place is the basis of this method (Grant & Mc Tear, 1992).

The common comparison factors (which normally involved adjustments when differences exist) between the properties are;
- type of unit;
- position of lot;
- the time period between the date of transaction and the date of valuation;
- nature of interest; and
- physical factors.

To summarise, these factors are compared and considered in the valuation process. On top of this, the general concept that is widely accepted and adapted in Malaysia is as below (Mohd Hafiz, 1994):
$$OMV = LV + BV$$
where,

OMV	=	Open Market Value
LV	=	Land Value
BV	=	Building Value

Land value of subject property is calculated based on the land value of comparable properties selected. Building value is calculated based on the current construction cost obtainable from quantity surveyor or building contractor, (less the depreciation). However, the element of depreciation is not discussed in this paper due to the subjectivity in its assessment which requires a further research.

3.0 MANUAL PROCESS OF PROPERTY VALUATION

The valuation process based on comparison method normally consists of a sequence of the following activities:
- instruction from client;
- registration of the valuation case;
- collection of subject property data by checking the details from JPPH or Land and Mineral Department (always referred as PTG i.e. Pejabat Tanah & Galian) and visiting the corresponding property. The data collected needs to be classified systematically according to details of ownership, physical characteristics, legal factors and economic criteria;
- identification and selection of comparable properties by checking the list of recent transactions obtainable from JPPH;
- collection of comparables data by checking the existing information and visiting the site;
- analysis of comparables to determine the range of standard land value per square feet;
- estimation of the subject property land value based on the range established;
- estimation of the subject property market value using the formula stated in Section 2.4; and
- preparation of the valuation reports.

Based on these activities, the valuation process can be divided into four stages:
- data management;
- selection of comparables;
- analysis of comparables; and
- opinion of value.

In each of the following subsections, we will elaborate the problems associated with manual comparison method of valuation.

3.1 Data management

Data volume must be high for the valuation process to be of quality. Spatial and textual data collected for the valuation process must be stored, updated and classified systematically according to details of ownership, physical characteristics, legal factors and economic criteria. Large amount of data can create manual problems during all the stages of data management. This problem is further deteriorated when different data is obtained from different sources and managed by different individuals. Tedious and labourious work can stimulate human fatigue hence errors. So, large amount of data would not guarantee quality valuation if not systematically managed.

3.2 Selection of comparables

Selection of comparables is carried out in order to find recently transacted properties that bear as close as possible the characteristics of the subject property. Since location of the transacted properties is one of the factors considered, this stage of valuation process has always made reference to location plan to extract locational information. This makes spatial data an important source of informatian. What makes it difficult is that there always exists a condition attached to the locational data. For example, a valuer wants to find all residential properties with Bumiputera as restriction of ownership. The task will be tedious enough for the valuer to search for all the location of all residential properties. There are times when a property is situated at four edges of different old maps and the maps must be joint for the whole area to be presentable. At the same time the valuer has to see through various textual information of the properties in order to select only properties with Bumiputera ownership. Thus, manual selection of comparables is a tedious process hence prone to inefficiency as well as time consuming.

3.3 Analysis of comparables

All the selected comparables must be analysed in order to obtain information on the land value. The results of analysis can be regarded as guidance in the next valuation process of deriving the subject property market value. Two sources of opinion referred to have detailed out the analysis of comparables.

Cooper (1993) explained that analysis of property transactions (also referred as property sales) involves;
- collection of raw sales data;
- verification of details;
- observation and measurement of pertinent property characteristics; and
- adjustments for any special conditions and the transformation of prices into a standardised form which will allow for the establishment of a value continuum within which it should be possible to locate the property.

Azhari (1993) presented that analysis of sales comprises three main stages:
- transformation of sale prices into comparable unit such as Ringgit Malaysia per square metre;
- identification of any differences in factor affecting value between the subject property and the comparables; and
- adjustments of differences in factors affecting value.

Based on these two sources of opinion, analysis process can be concluded to involve calculations to derive to the land value per square feet before and after the adjustment process. Manual calculation is certainly tedious especially when there are many properties to be assessed by one individual given a time constraint. So, generally speaking, the analysis of comparables involves meticulous calculation and hence prone to human errors and inaccuracy.

3.4 Opinion of value

Deriving an opinion of value involves the estimation of market value based on the results of analysis of selected comparables. Land value of subject property is estimated by multiplying the land area with the analysed land value per square metre (or per square feet). Building value is estimated by multiplying the built up area with the building cost per square feet which is obtainable from quantity surveyor or building contractor. Manual system will certainly take more time than a computer system for calculation to be completed besides prone to inaccuracy.

4.0 GIS

GIS is an organised collection of computer hardware, software, geographic data, and personnel designed to efficiently capture, store, update, manipulate, analyse, and display all forms of geographically referenced information (ESRI, 1992). Geographic data is the data relating to the earth explaining objects in the real world based on;

- location;
- attribute;
- spatial relation; and
- time.

Research is being carried out for the fourth criterion and not available in most GIS packages. Location data is mostly still restricted to two dimensions. However GIS has met many applications because it is an effective tool for different types of data integration particularly locational, attribute and spatial relation which enables analysis function to help decision makers. Three main categories of GIS analysis functions are;

- data retrieval;
- spatial analysis; and
- data modelling.

The above three functions differentiate GIS from other systems such as Database Management System (DBMS), Spreadsheet, Statistical packages, and Computer Aided Design (CAD) particularly in terms of spatial analysis and types of questions a GIS can answer. Most GIS can answer questions regarding the below (ESRI, 1992);

- location   what do we have here?
- condition   where is the property with these characteristics   ?
- trends   what changes have occurred since a certain date to another....?
- pattern   is X the main factor causing the difference in Y in area Z..?
- modelling   what happen to this if ....?

These kinds of question may also exist in the analysis of valuation data. Therefore, GIS can be of great help in the valuation process.

5.0 HOW GIS CAN HELP IN PROPERTY VALUATION

The valuation process makes reference to spatial and textual data. GIS can handle these two types of data integratedly and more efficiently than manual system. From the definition itself, GIS is capable of storing, managing, analysing and displaying valuation data more efficiently.

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5.1 Data storage and data consistency

The application of GIS technology in the field of property valuation is determined by the availability of consistent information. Textual data should be structured to be compatible with spatial information. In South Australia, this level of data consistency is maintained through the use of the LOTS system and also through the coordination of data by certain Commonwealth agencies (Bannerman, 1993). In Malaysia the issue is still being discussed at the national level.

All the data needed for valuation purposes can be stored in GIS database normally designed based on Relational Database Management System (RDBMS). This can ensure the consistency of valuation data to be used. Ng (1993) believed that the up to date and complete information that GIS can provide about any area can give all valuers common data for analysis. This will reduce the differences between valuations and arguments about property values which always occur in compulsory acquisition valuation. Thus, the use of consistent data can reduce error in property valuation.

5.2 Selection of comparables and Analysis of data

The relational database structure employed in a GIS enables three basic processing options (Bannerman, 1993):

- sorting/selection: selecting specified records based on headings criteria;
- mixing/matching: choosing any combination of headings; and
- merging: joining separate but related databases on defined criteria.

Thus. with the GIS technology comparable data with specific characteristics can be selected using Structured Query Language (SQL). Finding a property with a complex condition such as "residential property with a Bumiputera restriction having land area more than..... and........but......." can easily be carried out using a GIS package.

The selected comparables need to be analysed in order to arrive at a range of standard land value per square feet. From the analysis a value per square feet can be chosen (from the range) to be applied in the final calculation of the OMV. The analysis to calculate standard land value per square feet as well as all other relevant calculations in the valuation process can also be carried out in a GIS if the models involved are programmed in the system.

5.3 Output presentation

The data as well as results of analysis can be displayed on the computer screen in a matter of seconds. The location, criteria of comparable properties, graph and chart relevant to the analysis done can be displayed simultaneously. Plan or map as well as the summary of the analysis can be printed out straight away. This can reduce human workload in the preparation of the valuation reports.

6.0 VALGIS -a sample session

The use of GIS in property valuation based on the method of comparison can be further described using the developed computer aided valuation system named VALGIS. VALGIS was developed via two main steps of system development namely database design and system customization (Suriatini, 1995). The valuation database design was carried out based on RDBMS while MapInfo, a low cost GIS was customised using Mapbasic programming language in order to develop VALGIS. VALGIS consists of twelve menus comprising seven original menus from MapInfo and five customised menus (Figure 1).

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This section describes how the five customised menus in VALGIS can be used as an aid in the valuation process of a residential property in housing estate.

CASE : VALUATION OF AN INTERMEDIATE LOT WITH PTD NO 11745

UPDATE

The first thing to be carried out is updating the data related to the subject property. This task can be carried out by using the UPDATE menu. This menu consists of seven items as shown in Figure 2. As a whole this menu can be used to ensure that the database is up to date. In the current case, the first item is the most accommodating in order to update the data for the subject property. This is so because a user only needs to input the lot number for the system to display a dialogue (Figure 3) enabling the data viewing as well as the updating. Assuming that no changes needed, one can just press CANCEL to return to the main menu (see Figure 2 and 3)

FindLOCATION

This menu can be used to get the location of the subject property. It consists of five items as shown in Figure 4. A selection of each of the items will activate a dialog asking for information needed to find the property location. For example, Figure 5 exhibits the results of using the first menu item which requires the lot number as an input for the system to do the search and display the location of PTD 11745 (see Figure 4 and 5).

SelectCOMPARABLES

This menu consists of two items as shown in Figure 6. Best comparables can be searched and displayed by using the first item i.e. best comparables. In using this menu item, the system needs two inputs to carry out the search i.e. the subject property lot number and the year of transaction of comparables required (Figure 7). For the purpose of this paper, the term 'best comparables' refers to those transacted properties which have seventeen characteristics alike the subject property plus the same year of transaction. The corresponding characteristics are as the followings:

- property type- e.g. residential;
- category of land use;
- time duration of ownership;
- restriction of interest;
- condition of interest;
- position of property;
- land area;
- shape of the lot;
- type of construction;
- type of unit;
- building age;
- street name;
- housing estate;

- municipal;
- council;
- town;
- state; and
- year of comparables transaction.

(However, it must be noted that the availability of best comparables depends highly on the quality of data stored in the database). Besides the option to have the list of best comparables, user can also choose to view the location of subject property together with the selected comparables on a single map (Figure 8). Suppose that the selection is not satisfactory due to the number of comparables, the second menu item can be activated. This second item i.e. similar comparables, is comprised of a dialog asking for a user to input the criteria of comparables he or she is looking for (Figure 9) and again, choice for location display will be available. It must be realised that in the case of no best comparables found, a user needs to use this second menu item in order to find similar comparables because VALGIS does not do it automatically. As in the current case, one best comparable is found (PTD 11726). Assuming that this is acceptable, search for similar comparables has not been carried out (see Figures 6, 7, 8 and 9).

ANALYSISofcomps

This menu consists of four items (Figure 10) the last two of which are the original MapInfo menu items (hence not discussed here) i.e. calculate statistics and plot graph. By selecting any of the first two items the system will ask for an input of standard land size (i.e. size of the nearest intermediate lot). The system will then carry out the analysis of the comparable data. The system will calculate the elements below and display the results in a table form (Figure 11):

- building value;
- total land value;
- standard land value per square feet; and
- extra land value per square feet (for corner and end lots).
  (see Figures 11 and 12).

VALUATION

This menu consists of an item titled comparison method and one sub item titled opinion of value (Figure 12). A selection of the sub item will activate a dialog asking for the lot number of the property to be valued. The system will then determine which of the programmed formulas to adopt in order to calculate the OMV. If the property is identified as a corner or end lot the system will ask for two input items i.e. standard land size and standard land value per square feet. The subject property is an intermediate lot, thus the system asks for standard land value per square feet only (Figure 13) (it is assumed that the standard land value per square feet of the best comparable can be applied in the current case i.e. RM 97.37). The next step is the calculation of the OMV and displaying the opinion of value together with the formula adopted (Figure 14). The OMV calculated by the system is RM 234,000. It must be noted that the calculations of the OMV here have not involved any depreciation element as well as adjustments. Hence, the OMV derived in this sample session is valid only for the purpose of this paper (see Figures 12, 13 and 14).

7.0 CONCLUSION

consistency, inaccuracy, human fatigue and time consuming. All the problems arise due to the massive amount of data. GIS is a solution to the problems because of its capability to handle spatial and textual data integratedly and efficiently.

A GIS-based system named VALGIS was developed to serve as an aid for valuation profession. It provides the facilities to update valuation data, to search and display the location of subject property and its comparables, to analyse the selected comparables as well as to carry out the calculation of OMV. In Conclusion, VALGIS is very user friendly, is easy to use and can expedite property valuation process. Although the system discussed in this paper is academically based and would need further development before it can be marketed as an actual product, a system based on this concept could be of practical relevance to the valuation profession in the near future.

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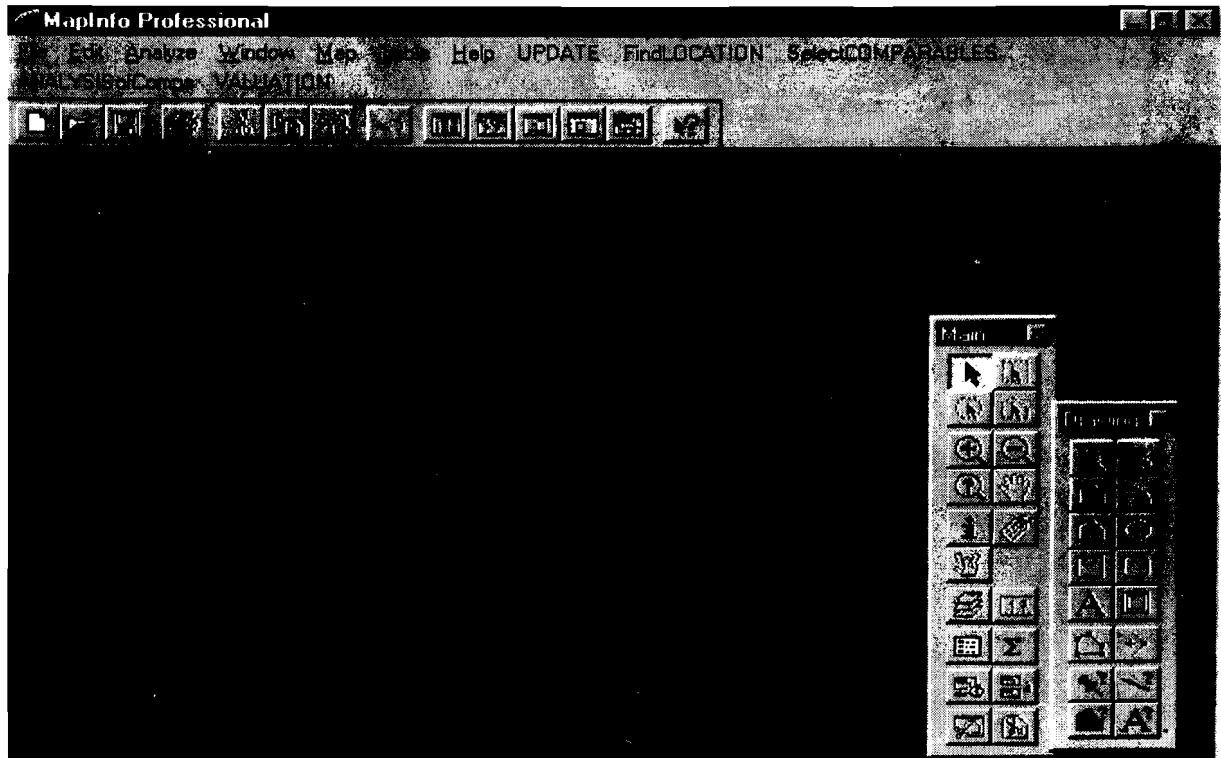
Figure 1 : The customised menu in VALGIS

Figure 2 : UPDATE menu

Figure 3 : A dialog for data viewing and updating

Figure 4 : **FindLOCATION** menu
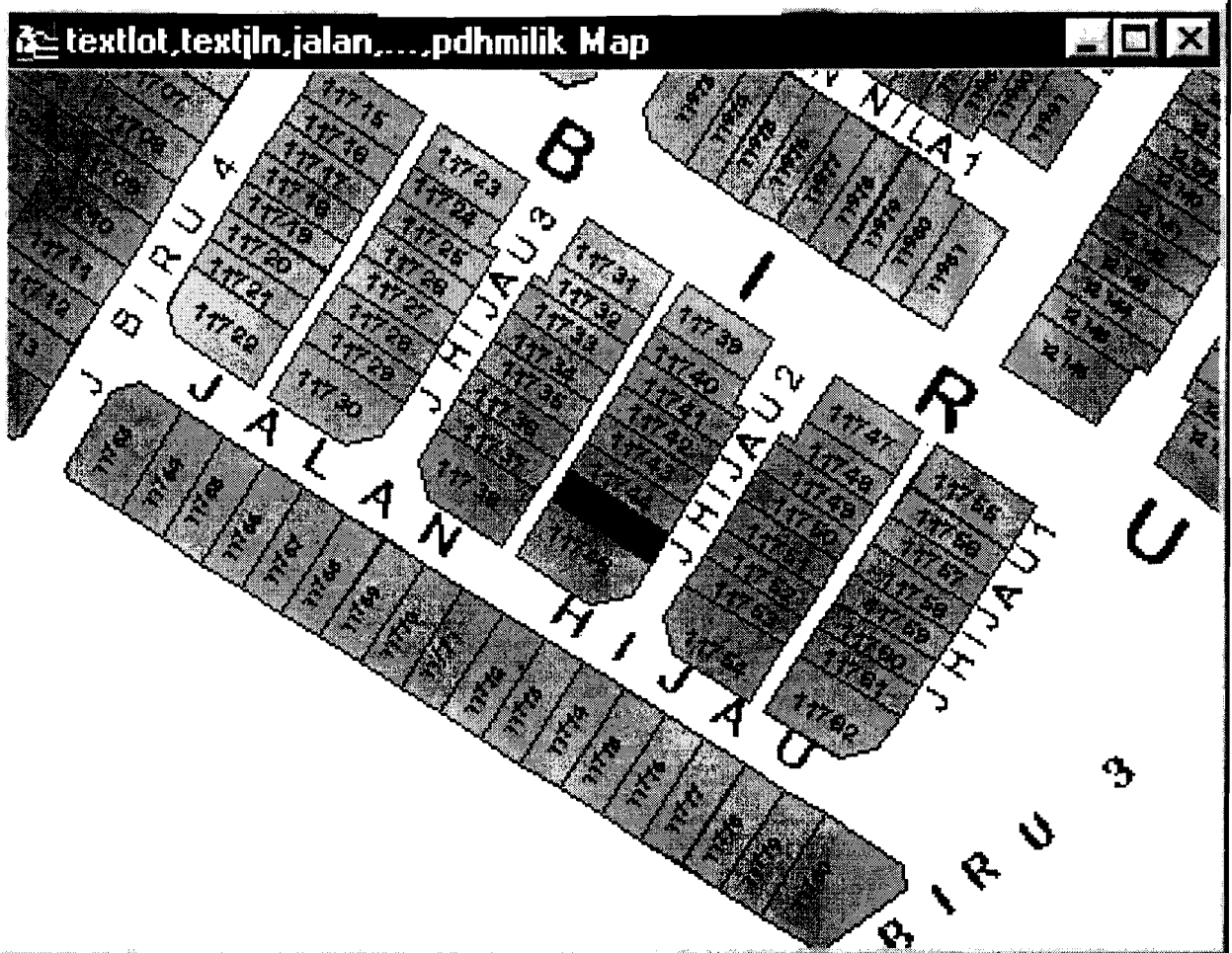
Suriatini Ismail, Taher Buyong, Ph.D

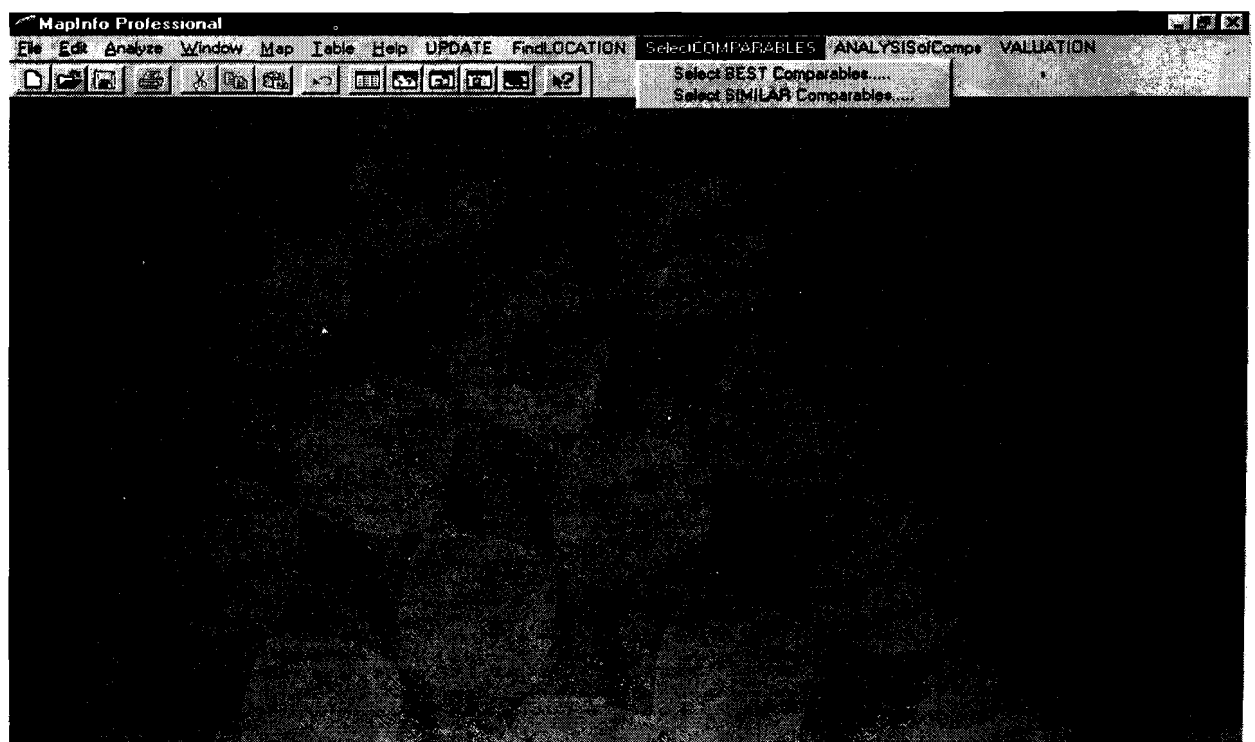Figure 5 : The display of subject property location (Ptd 11745)
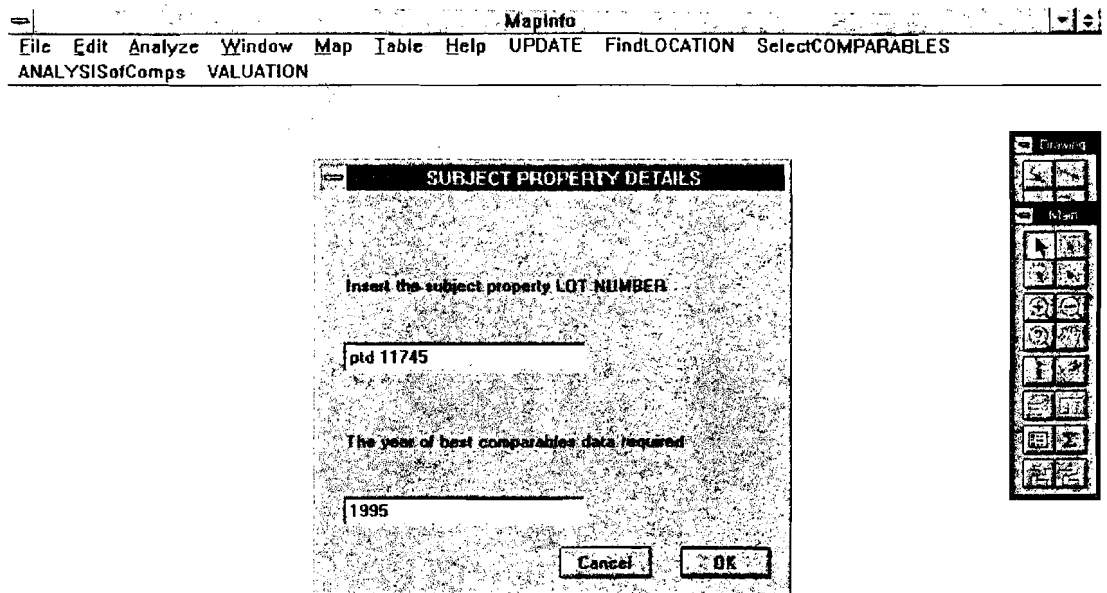

Figure 6 : SelectCOMPARABLES MENU

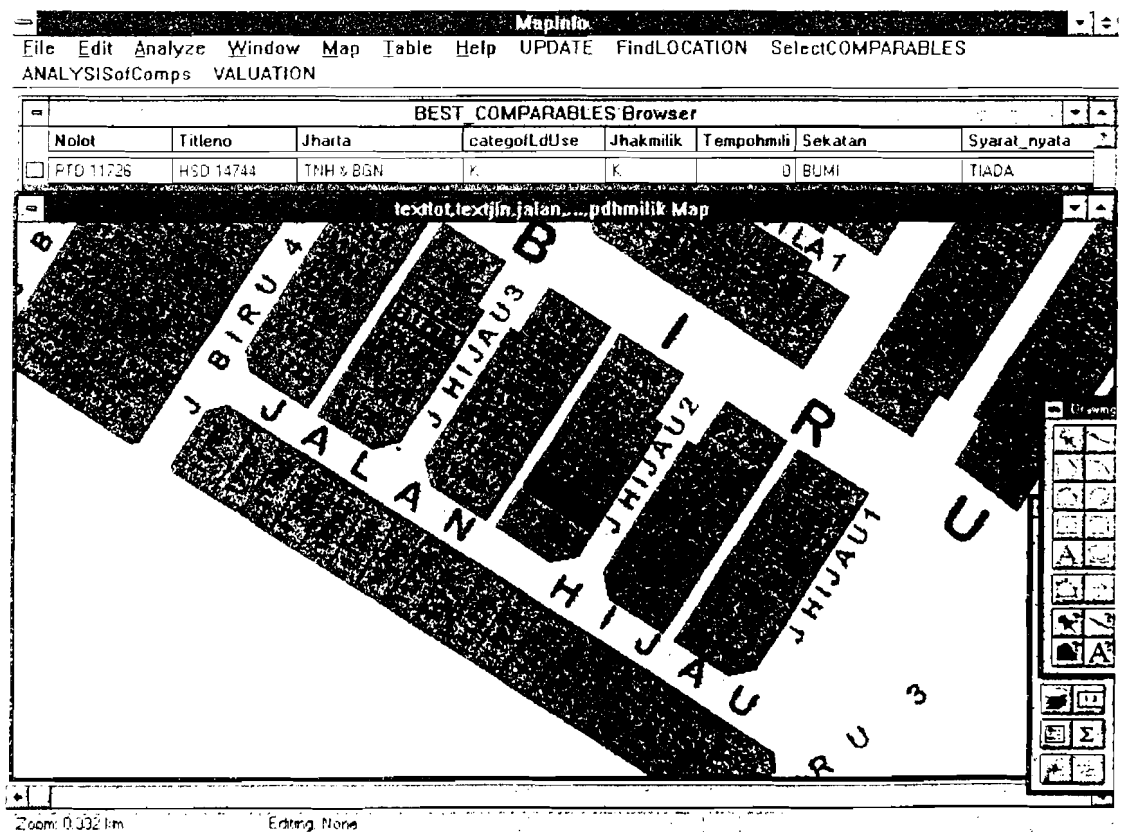Figure 7 : The dialog for selecting the best comparsbles

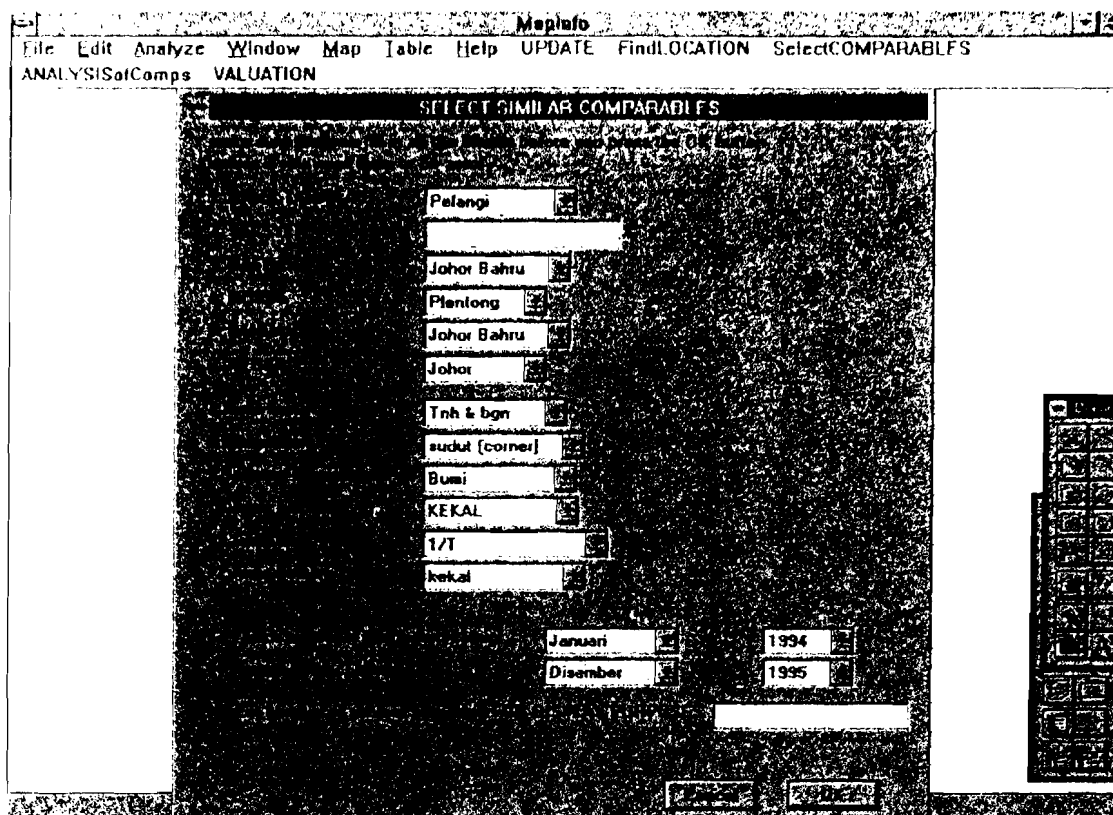Figure 8 : The display of best comparable data and its location ⸬⸬⸬ as well as the location of the subject property ▨

Figure 9 : The dialog for selecting the similar comparables
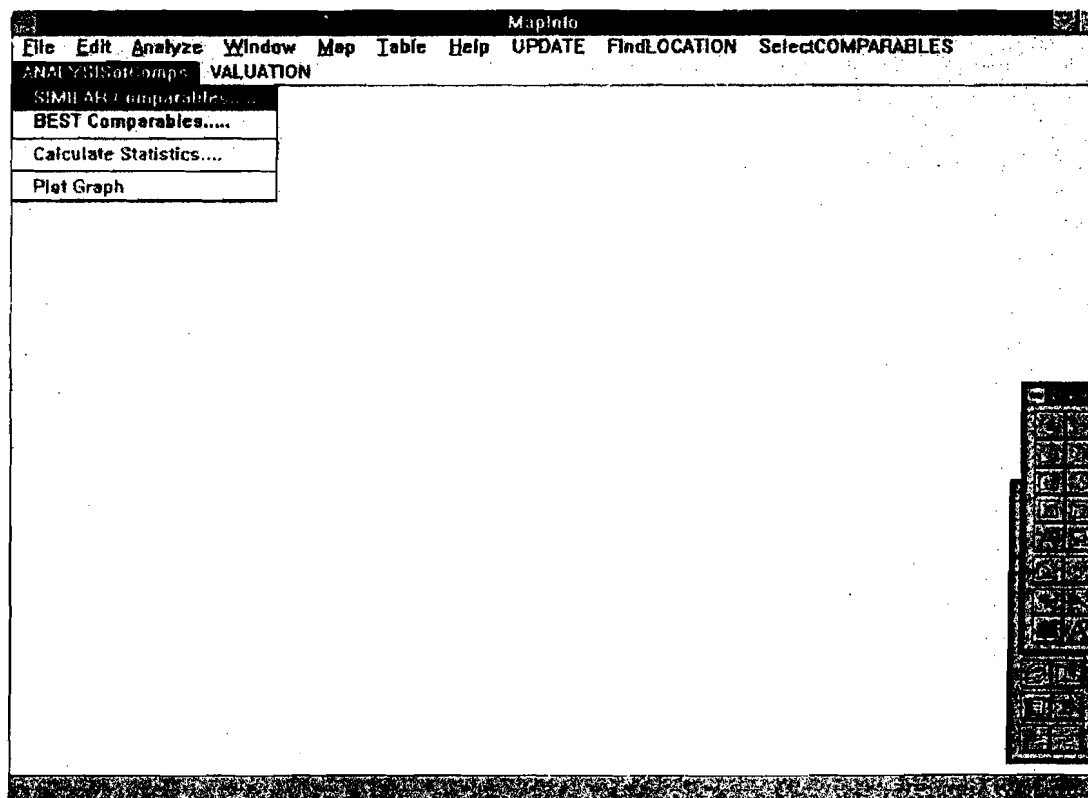
Figure 10 : **ANALYSISofcomps** menu

Figure 11 : The results of comparable analysis
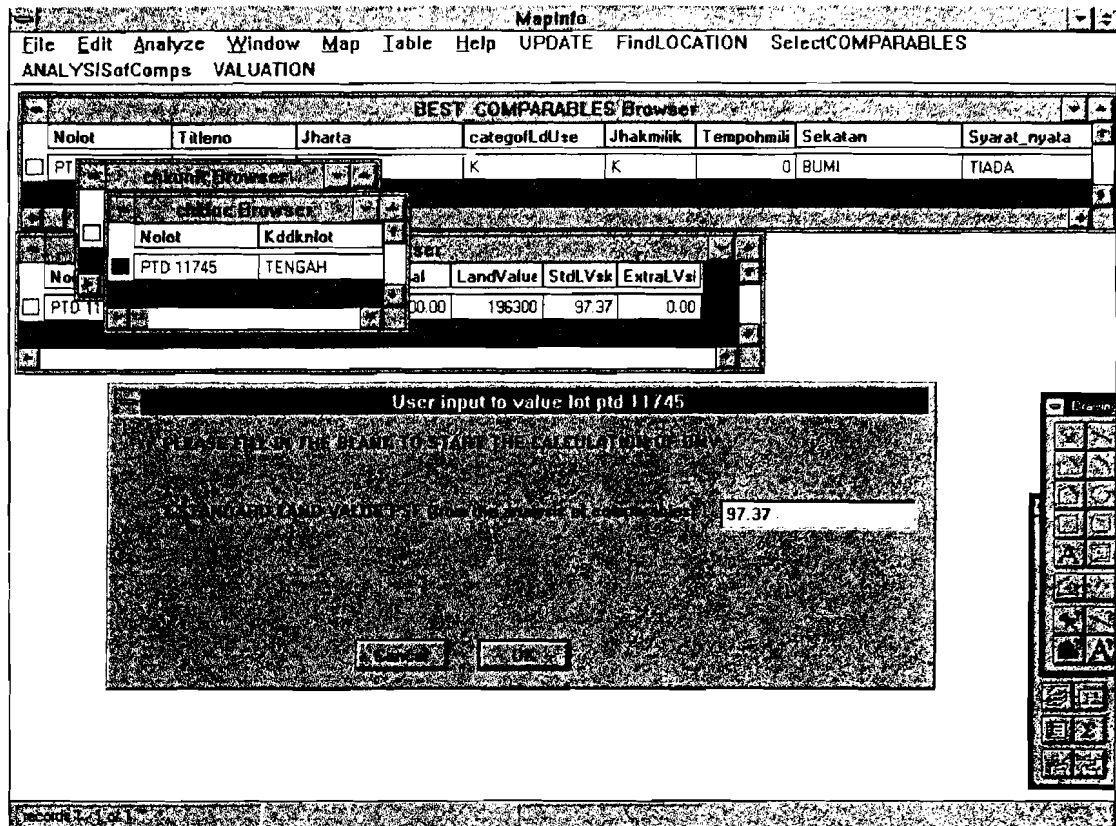

Figure 12 : VALUATION menu
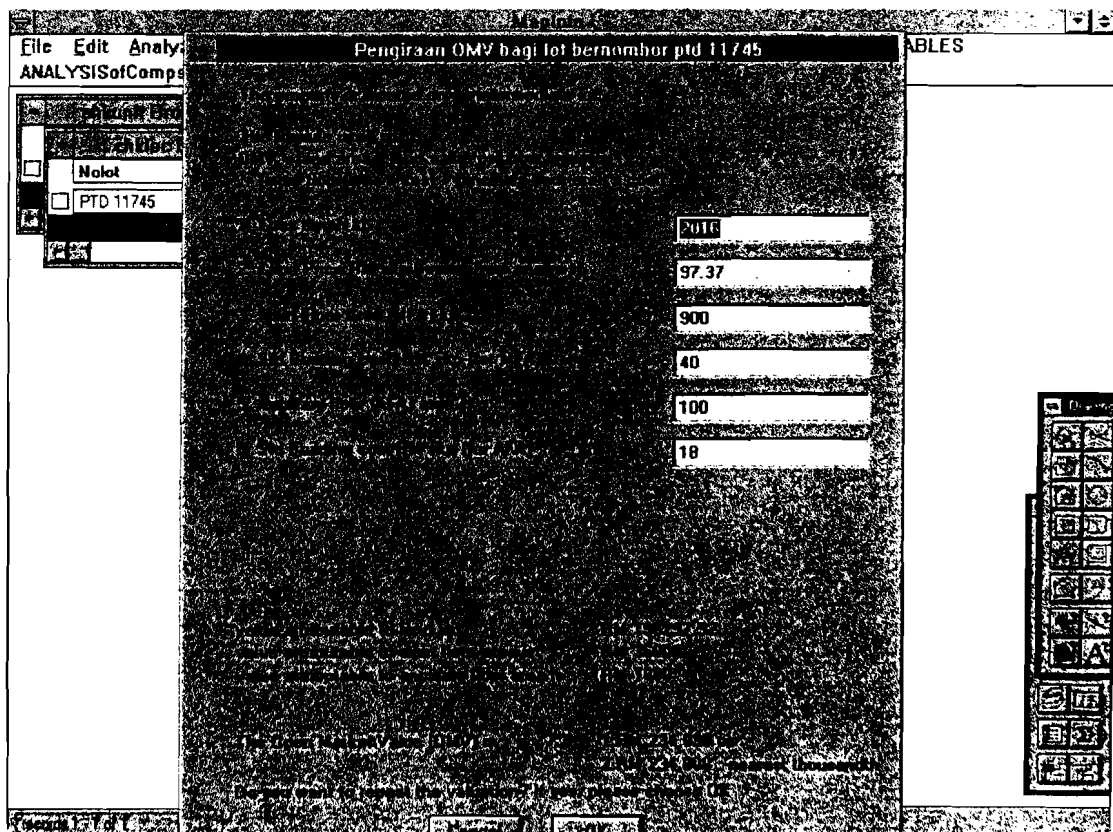
Figure 13 : The dialog for input required from the user

Figure 14 : The summary of the opinion of value