A Prediction of Residential Land Value, Case study of Klong Nueng Subdistrict, Klongluang District, Pathumthani

Sukulpat Khumpaisal, Issarest Weeraprajak and Dechphun

***Abstract*— The case studied area of Klong Nueng subdistrict, Klong Luang District, Pathumtani Province combining the various types of land utilization, whether residential projects (high rise, low rise), commercial and retails, or industrial estates. It has the high development potential due to it located closed to the Bangkok Metropolitan Area (BMA)'s periphery, closed to the community nearby area such as Bangkok University. This area also facilitated by high quality transportations, good infrastructures and utilities. However, the aforementioned reasons influence the land price's variation, and obstruct the appraisers to find out the land's value precisely.**

The authors considered on setting the concrete valuation model based on statistic techniques to properly appraise the vacant residential land parcels. This study started with the extensive literature reviews on the land valuation approaches, the appropriate appraisal techniques/statistics for assessing the land value, included some case studies that employed the statistic models to appraise the property's value. The authors collected 100 land parcels being announced to sell or sold land parcels in the aforesaid studied area as the raw data, followed by the Multiple Regression Analysis (MRA). The authors identified 12 factors that impact on the value of land plots as the independent variables, and the selling price as the dependent variable. The MRA model that suitable for pricing structure of land value in the mentioned perimeters was expected to be formulated. Then, the method to test the capability of the model in order to apply this model efficiently and suit for the lands that had different contexts has been suggested in the final part of this paper.

***Index Terms*— Fair Market Value (FMV) Residential land parcels ("land"), Market Comparison Approach, Multiple Regression Analysis (MRA), Residential land parcels.**

I. Introduction

Klong Nueng sub-district is located in Klong Luang district, Pathumtani Province, that containing the various types of land utilization, whether residential projects (high rise, low rise), commercial and retails, or industrial estate, particularly, the area between Soi Klong Luang 23 or (km. 36+800) at the frontage of Thammasat University Rangsit Campus to Km. 41 alongside Paholyothin Road (Highway No.1). It was found that there are an emergence of residential projects that developed to suit the higher demand from Bangkok Central Business District as well as to support the increasing number of students from 2 major universities in this area, which are Thammasat University, Rangsit campus and Bangkok University, respectively [1].

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The land values in this area are highly fluctuating, due to the diversity of physical attributions, land utilisation, infrastructures and relevant legal. However, the land appraisers currently use their own intuitions or experience to assess the value of residential land parcels, but these are subjectively and independently opinions. In this regard, the current valuation practices are consisted of opinions and perspectives towards land's contexts and surrounding market conditions. This issue affects to an appraisal of the land value in the real business case [2], [1], as well as the difficulty to establish the systematic structure of the land parcels, and to predict the fair market value of land parcels.

According to the mentioned background and problems in in the studied area, the researchers aim to create the statistic model to predict the fair market value (FMV) of the residential land parcels in the studied area. This model contributes as the decision making supporting tool for the appraiser to issue the fair market value of land parcels, and the authors expect that this model would be applicable to value the residential land parcels in other area, which contain quite similar context to the studied area. In addition, the researchers suggest the validation technique for the established model, in order to minimise the defaults while applying this model to other area.

II. Objectives

The researchers aim to introduce the effective statistical model to predict the FMV of the residential land parcels in Klong Nueng sub-district, Klong Luang district, Pathumtani Province. We also suggest the validation technique to minimize some errors, which would be occurred while applying the aforesaid model in the other areas.

III. Methods

The authors specified the scopes of this research as follows: Geographic area, we denoted that the area distances from Km.36+800 of Highway No.1 to Km. 41 of Highway No.1 are our studied area; the landmarks in the studied area are Thammasat University and Bangkok University. The perimeter of the area is easterly bordered from Highway No.1 to Klong Nueng Canal's bank, and 500 metres westerly from Highway No.1, respectively (see Appendix I). Moreover, the studied land parcels must have at least one legal access route.

1) The authors reviewed the statistical modelling methods, , the related physical factors impact to the land's value, the current land valuation approach, including any environmental factors that affect to the value of land.
2) The vacant land parcels in the studied area, whether the landowners willing to sell, or the sold land parcels were

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used as the samples of this study.

3) The authors employ the observation checklists to collect the data of samples (vacant land parcels) as well as the tele-conversation with the land owners or Department of land, in order to collect the physical characteristics (independent variables) of the said land parcels.
4) The statistic techniques to predict the price structure comprised the descriptive statistics, Pearson's correlation, followed by multiple regression analysis.

We started reviewing an examination of the physical factors that influence the value of the vacant land, therefore these factors had been categorised into 12 variables (see Table 1), it was also pointed that Thai appraisers presently employing the market comparison approach, using the invented tools, such as Weighted Quality Scores (WQS), together with their own experience and intuitions [3].

In regard to a development of statistical model, the multiple regression analysis (MRA) technique was selected to set up the prediction model. This technique can be applied as a mass valuation technique, used with large number of land, but it must have adequate sets of data in order to perform this technique effectively [4].

A. An Establishment of Evaluation Criteria (Physical elements)

The results of an extensive literature review above given the number of independent variables, as earlier mentioned, the independent variables of this study are regard to the physical characteristics of the land parcels. The dependent variable is set as the Fair Market Value of the residential land parcel in Klong Nueng Sub-district, Klong Luang District, Pathumtani Province. All independent variables (physical factors) are summarised in Table 1 (see Appendix II).

TABLE I: THE LAND VALUATION CRITERIA

Variables Name	Physical	Unit	Meaning	References
Area	Land size	W^2 1 W^2 = 4 m^2	The size of samples	[7] [14]
Frontage	Length of frontage	m.	Length of land frontage, adjacent to the access road	[7]. [1], [8]
Shape	Shape of the land pieces	Geometrical shape	Geometrical land shape (Given : Rectangular = 1, other shape =0)	[1], [8]
User	Highest and best use of land	Use / not	Highest and best use of the land parcels, assumed that lands adjacent to main road are commercially used. (Given : Commercially used = 1, other usages =)	[9], [1],
Depth	Land depth	m.	The depth of land parcels, measuring from the frontage to the border	[2]
Site	Access road faced.	Boundary of land's edge face with access road	Number of land's edge face with access road	[1],
Dist	Distance to the main road	Km.	Distance from the land parcels to Highway No.1	[10]
Width	Road Width	m.	Access road width (include the road's shoulder) (Given : 35 m. = 4, 8 m. = 3, 5 m. = 2, less than 4 m. = 1)	[1]
Surface	Quality of road surface	Road surface materials	The quality of access road's surface. (Given : Reinforcement concrete = 1, other = 0)	[8], [11]
Infra	Infrastructure and utilities	Readiness/ promptness	The promptness of infrastructures and utilities in the samples' area. (Given : if there are any additional utilities = 1, if there are based utilities (electricity, water) only = 0	[9], [14], [15]
Locate	Distance to nearest community	m.	Assumed that the Bangkok University's area is the highest density area in the studied area	[1]
Zoning	Urban Planning, land utilisation zone	Land utilisation	Assume the colours shade in Urban Planning Zone. (Given : if the land located in the middle density residential; orange = 1, other colours = 0)	[1], [2]

B. Field Study

The authors conduct the surveys on the studied area, purposed to observe the physical attributions and price of land parcels (being announced to sell). The field surveys were facilitated by the observation checklists of the land attributions that include the shortlists of land price, location, and photographs). Finally, the authors obtain 100 sets of data from this field study.

C. Develop the land valuation model

Firstly, the authors employed the descriptive statistic techniques to minimise the outlier sets of data [5], in this regard, it was considered that the outlier's deduction by comparing errors between the actual value and the predicted value, then cut the highly inaccurate outliers off the data set as [5]. It is recommend to exclude some independent variables (physical factors), which have the high correlation coefficients off, due to these may have the significant correlation to other variables, and cause some deformations to an estimation of regression analysis' results [6]. Therefore, the Pearson' s Correlation technique has been used to find out the relationship between each variable, in order to deduct the significant correlated factors, the researcher specified that the independent variables that contain the Pearson's correlation greater than 0.50 (Pearson > 0.5) shall be removed of the model (See Figure 3).

D. Application of Statistical Model

The Multiple Regression Analysis (MRA) technique was used to analyse the raw data, and outcomes of each independent variable, in order to predict the structure of land parcels 'value in Klong Nueng Subdistrict, Klongluang District, Pathumthani. The authors recommended the testing procedure to test the effectiveness of the model, this is order to minimise some errors, which cause while applying this model in the studied area. Overall research process is summarised and illustrated in figure 1, below.

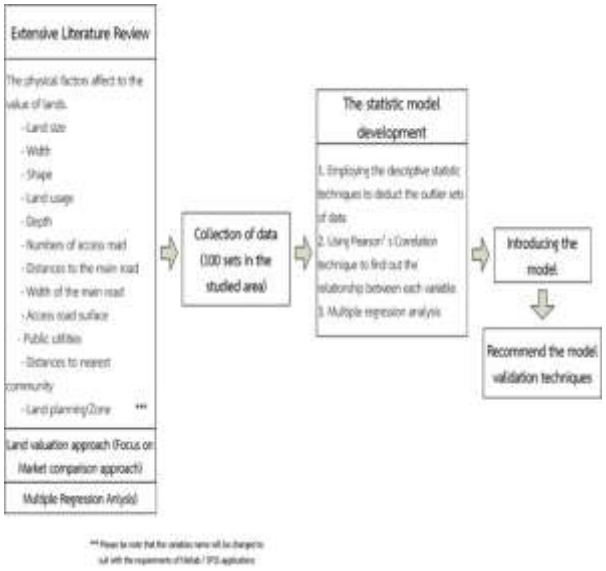


Figure 1 Overall research process

IV. RESULTS

After the outliers were deducted, and the Pearson' correlation was performed, 100 sets of data had been input into the established MRA model, the stepwise multiple analysis has been drawn to derive the R Square and Adjusted R Square value, as these indicate the appropriateness of the multiple regression model.

The value of R Square, and Adjust R Square are derived at 0.92 and 0.91, respectively (see Table II). They indicate that the multiple regression analysis is reliable enough to be performed in the equation form, in order to identify the variances and deviations of land prices being announced to sell.

TABLE I: THE R SQUARE OF THE VALUATION MODEL

Regression Statistics	
Multiple R	0.96
R Square	0.92
Adjusted R Square	0.91
Standard Error	3177.46
Observations	100

Then, the Stepwise analysis was performed to find out The F value ratio, degree of freedom (DF), the F value is regarded as test statistic used to decide whether the model as a whole has statistically significant predictive capability [13].

The F Value was derived at 175.53 and Significant F value is smaller than 0.05. Thus, there are at least one independent variable in the MRA model has a strong impact to the land price (whether, sold or announced to sell), and its statistic significant shall be 0.05 (95 % of confident).

TABLE II: F VALUE, DF AND SIGNIFICANT OF THE MODEL

	Df	Sum of Squares	Mean Square	F Value	Sig. F
Regression	6	10623497514.98	1770582919.16	175.37*	0.00
Residual	93	938949985.02	10096236.40		
Total	99	11562447500.00			

In order to validate the MRA model, as well as its applicability while using with other case studies. The authors conducted the MRA coefficient' analysis together with coefficients' standard of error, by indicating the significant 's confident at 95% for testing both MRA coefficients and correlation as shown in Table III

TABLE III: MRA'S COEFFICIENTS AND CORRELATIONS

Variable name	Represent	Coefficients	t	Sig.	Correlation
Intercept		34922.72	23.99*	0.00	
Area	Land size	4.33	8.37*	0.00	0.51
User	Highest and best use of land	7071.70	6.55*	0.00	0.44
Width	Road Width	2409.66	5.90*	0.00	0.35
Surface	Quality of road surface	10826.10	10.36*	0.00	0.28
Locate	Distance to nearest community	-4.82	-10.67*	0.00	-0.61
Zoning	Land utilisation zone	-15842.43	-19.09*	0.00	-0.49

It is found that the significant (Sig.) of every variables is lesser than 0.05 (Sig < 0.05), thus these indicated that the independent variables set of Area, User, Width , Surface , Locate, and Zoning are all affect to the land prices (whether, announced to sell or sold) in the studied area with the significant at 0.05. The R Square value derived by the MRA is 0.92 means the MRA equation can narrate the deviation of land prices' range at 92% [6], [13]. The final step is to set up the model using MRA techniques to predict the value of residential vacant land in the studied area, the MRA equation stated herein as:

$$Y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \ldots\ldots + \beta k X k + e \quad (1)$$

Where Y means value of dependent variable
X means value of independent variables
β means Constants and,
e means coefficient Errors of the samples

Then, we placed the values of the selected samples into an MRA's equation, in order to formulate a model to predict the land prices in the studied area. Thus the MRA model of this case is derived as:

Land price = 34922.72 + 4.33 (Area) + 7071.70 (User) + 2409.66 (Width) + 10826.10 (Surface) – 4.82 (locate) – 15842.43 (Zoning)

According to the results of multiple regression analysis, the significant factors/variables affect to the land price are listed as:

1) *"Locate"* or the distance to nearest community, this factor has the most influence to the land price, but it varies inversely from the land price. The longer distance (from land parcel to nearest community) means the decrement of announced land prices.
2) *"Area"* or the land size, this is the second significant factor to form the model. In this case, the variation of these variables is in the direct order to the amount of land area. The larger land size, means the higher selling price.
3) *"Zoning"* or the utilisation of land in accordance with urban planning law/act. It is the third signification factors to the land price, however, if the land locates in the other colour zone (not "orange"), the price of land is lower than the land locate in the "orange" zone.
4) *"User"* or the highest and best use of land, this is the fourth significant factors to land price, it is directly varied to the land price, if the land can be developed in various real estate types, the announced price will be increased, consequently.
5) *"Width"* or the width of the access road to the land, the road width is varied in same direction as land price. In the case of wider access road, the land price shall be more expensive.
6) "*Surface"* this is the least significant factor to land price, but it varied in the same direction as land price. More durable of access road surface such as reinforced concrete, or concrete asphalt road, increase the selling price of the lands

V. CONCLUSIONS

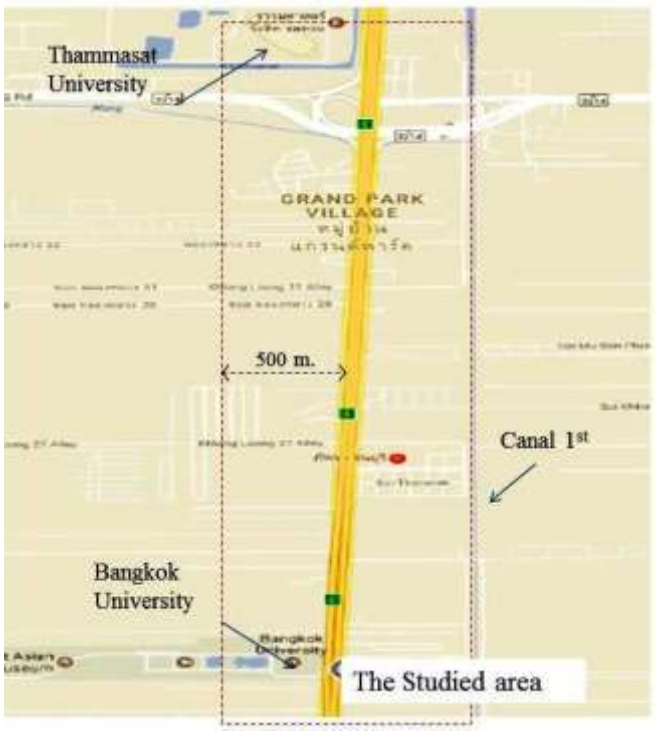
According to the development of statistical model to assess the land value in the studied area, it was established that there are 6 physical factors, which are ordered accordingly by their priorities, constant values and their coefficients. These variables therefore collaborated to form a prediction model, and were listed as 1) "*Locate*" or the distance to the nearest community, 2) "*Area*" or the size of land parcel, 3) "*Zoning*" or the utilisation, 4) "*User*" or the development potential of that land piece, 5) "*Width*" the width of frontal road, and 6) "*Surface*" the surface of frontal road. It is also confirmed with the previous researches [7], [2] that the accessibility to land (in terms of number of accessibility, legal, width, surface) is a substantial factor to the price of real estate properties, as well as the location factor (Distance to community) is regard as a key factor to determine the property's value [3], [14].

Since this study was limited by the shortage of time, we did not perform the validity, reliability test of the final land value prediction model. However, the testing procedures to validate the model for the further researchers are suggested. In this regard, this model can be tested by 2 following procedures [12], which are:

1) Re-test this model in the same studied area, or someplace nearby the aforementioned studied area. It is recommended searching for 3 pieces of land, where the owners announce to sell. Then, the researcher collects as much information as possible in order to set up the land database, the researcher may conduct a survey to those lands to assess the physical attributions of land, using 12 variables as mentioned in this paper, and trial place the collected data value into the Equation 2. If the calculated land price is nearly similar or slightly differ from the selling price of the land. Therefore, this model can be applied to predict the land value in the studied area.
2) In the case of testing this model in other areas, because of the environment and context of each particular area are enormously different from the mentioned studied area, it is recommended to collect the independent variables (factors) or selected the appropriate variables that suit with the specific area's context. The researchers may collect more samples and the actual price of the land being sold to enhance more validity and reliability of model.

The authors recommend the testing of this model with other type of real estate properties, however, the independent variables in that particular case must be clarified to suit with the characteristics of properties (for example, housing projects, condominiums, shop houses etc.). In this regard, the mandatory factor that involve with each model is "*location*" factor, as the price/value of property is varied in accordance with the quality of location (included the accessibility, environment, and community). To identify the independent variables, we recommend that each independent variable must contain a clearly definition, it must not have the same meaning with another, in order to prevent the high correlation between each variable, as this would affect to the further Correlation and Multiple Regression analysis.

APPENDIX



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