# Evaluation of Land Indication Value with Principal Component Analysis Method Based on Transaction and Market Data 

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#### Abstract

Land value data in Indonesia has not been transparent and has not been able to reflect the fair value. The fair value of these, in turn, will benefit the entire community to support sustainable development as a reference to the land market, land tax, asset management, land and cost, land policy and other decisions related to land. This paper aims to analyze the value of the land indication by the reports of the Land Certificate Author Officer (LCAO) and the price of real estate agents by using Principal Component Analysis (PCA). The expectation of this research is the reduction of the difference in land value indications derived LCAO reports, real estate agents and market value with the value of land registered in the Land and Building Tax (LBT). The research methodology is by collecting data from the LCAO monthly reports, property agent and the real price in the Subdistrict of Kertajaya Surabaya Indonesia in 2010. Prices in the study area during the period of 2010 to be used as sample data. The monthly reports of LCAO, property agents and the market value that will be used for the analysis of land value indications. Based on the analysis that has been conducted, several conclusions can be taken: 1).PCA method can be used for the calculation of land indication value analysis in addition to the method of averages, 2). Value of land indication with PCA method has a smaller margin with a land tax as stipulated in the LBT than by using the average method in trend by $88.89 \%$, and 3 ). Land Tax contained in the LBT not represents fair value and tend to be higher than the value of the land indication acquired with the method of PCA and the average by $62.96 \%$.


KEY WORD: land indication value, PCA, average method.

## INTRODUCTION

Since 1 January 1986, pursuant to Act No. 12 of 1985 and amended by Act No. 12 of 1994, the following regulations on land and building tax. Under Regulation No. 10 Surabaya in 2010 concerning Urban Land and Building Tax Chapter 1 Article 1, explained that the Land and Building Tax (LBT) is a tax on land and / or buildings which are owned, controlled, and / or used by an individual or agency for the urban sector except areas used for plantation, forestry and mining. The earth is the earth's surface that includes land and inland water and marine areas of the city, and the building is a construction technique is grown or permanently attached to the land and / or inland waters and / or sea. Meanwhile, according to the General Director Regulation of the Tax no. Per-60/PJ/2010 Article 1 states that the Earth is the Earth's surface and the body is in the earth beneath, and that meant building construction techniques that are grown or permanently attached to the land and/or water.

Therefore, the Land and Building Tax based on the Surabaya Regional Regulation No. 10 of 2010 Chapter 1 Article 1 paragraph 5 and the Surabaya Regional Regulation No. 11 of 2010 concerning the Cost of Land and Building Due Chapter 1 Article 1 paragraph 5 included in the Local Tax requiring contributions to the area that are owed by the individual or entity that is enforceable under the Act, to not get rewarded directly and used for the purposes of the Regional for the maximum prosperity of the people.

Understanding Tax Object Sales Value (TOSV) in the land and building tax under Act No. 12 of 1994, Article 1 paragraph 3 states that TOSV is the average price obtained from the sale and purchase transactions, TOSV is determined by comparing the price with other similar objects, or the value of a new acquisition, or a TOSV replacement. Meanwhile, according to the General Director Regulation of the Tax no. Per-60/PJ/2010 Article 1 paragraph 1 and Surabaya Regional Regulation no. 10 of 2010 Chapter 1 Article 1 paragraph 9 and the Surabaya Regional Regulation no. 11 of 2010 Chapter 1 Article 1 paragraph 9 reads Tax Object Sales Value, hereinafter called TOSV is the average price obtained from the sale and purchase transactions that occur naturally, and if there is no sale and purchase transactions, TOSV is determined by comparing the price with other similar objects, or new acquisition value, or a replacement TOSV.

Based the General Director Regulation of the Tax no.Per-60/PJ/2010 Tax No. 3 point 2 of article stated that the TOSV (earth/land) is based on average indication value in a Land Value Zone (LVZ). At the same regulations article 1 number 10 explained that the Average Indication Value (AIV) is the average market value that can represent the value of the land within a zone of land value. Similarly, in article 1 number 11 also

[^0]explained the LVZ is a geographical zone made up of a group of tax objects that have the average indication value bounded by the limits of possession/ownership of tax objects in a single administration area of the villages/wards. Setting the boundaries of the LVZ is not tied to the block boundaries.

So important land indication value determined by the average of the land market value data and the role of the TOSV is the increasingly strategic for the various purposes, clearly requires a quality of the TOSV that can be accounted reasonableness from the all aspects, both formally and materially. To obtain such a state is required a effort by analyzing and determining LVZ and AIV every village with reference to the Technical Instructions and practice established by the Circular of the General Director of Taxation no. SE-55/PJ.6/1999 on Technical Guidelines for Analysis determination of AIV and SE-06/PJ.6/1999 on Implementation Analysis and determination LVZ and AIV as the basis for determining the TOSV of the soil and remain guided by the Decree of General Director of the Tax no. Kep-04/PJ.6/1998 on the Establishment and Maintenance Database TOMIS (Tax Object Management and Information System) and also consider the Circular of the Tax General Director no.SE-25/PJ.6/2006 on the procedures the establishment/improvement LVZ/AIV.

If the implementation of the determination of AIV and making LVZ in the field are in accordance with the instructions as stated in the Decree of the Tax General Director no.KEP-04/PJ.6/1998, the assessment product of the earth (ETOSV) set will reflect appropriate fair value. However, in practice these provisions have not been fully followed so quality of the ETOSV established in every the Service Office of Land and Building Tax (SO LBT) should be increased further through the method of manufacture of the raw and true.

More critical condition tax payers in addressing ETOSV as product assessment through the provision of Article 2 paragraph (2) letter j of Law No. 28 of 2009 on Regional Taxes and Levies, stated that the LBT Rural and Urban districts are kind of city tax and Surabaya Regional Regulation no. 10 and 11 in 2010 produced by the Department of Regional Revenue (DRR Surabaya), are increasingly demanding improved quality ETOSV. The benchmarking for the quality of the product is based on the accuracy of the supporting data, the accuracy of the data analysis and the fairness adhering to the principles of assessment.

Data required in determining the value indicative consists of selling price data as information regarding the transaction price and/or offer price of land and/or buildings. The data mentioned above can be sourced from the secondary data (secondary market) consisting of:
a. The set of the Land Certificate Author Officer (LCAO) reports/notary,
b. Purchase data and information from the chief of sub-district.

The primary data (primary market) consisting of:
a. Data from property agents,
b. Data supply/sale of property through magazines, brochures, directories, exhibitions,
c. Data based on direct observations in the field.

In this study, only focused on analyzing land indication value derived from the LCAO report data, brokerage (property agent) and the real price (obtained from the trader). In previous studies, a trend indicative value of land acquired from the land value average resulting from transactions in the LCAO lower than market value. According to the study, from 18 LVZ the case study, only $8 \%$ have AIV $80 \%$ from the market value (in accordance with the provisions of the Tax General Director no. 09/PJ.6/2003), while $92 \%$ are still not met, the average of 18 LVZ, AIV approximately $56 \%$ from the market value (Leksono et al, 2010).

Land value data in Indonesia has not been transparent and has not been able to reflect the fair value. The fair value of these, in turn, will benefit the entire community to support sustainable development as a reference to the land market, land tax, asset management, land and cost, land policy and other decisions related to land. Therefore, it is necessary the development of the land valuation method (Tamtomo et al, 2008).

This paper aims to analyze the land indication value from the LCAO report, real estate agents and real price (market price) by using principal component analysis (PCA). The expectation of this study is the reduction of the difference land the indication value in derived from LCAO reports, real estate agents and real price with the value of land registered in the Land Tax in the LBT, so this may represent the fair value of land.

## MATERIALS AND METHODS

## Materials

Land Valuation
Values have a different understanding with the price and costs. Value of goods, known as market value is defined as the sale of the property in an average situation, assuming that both sides have complete information and the freedom to make choices. Average situation means that no special circumstances that affect their decisions (Dovring, 1987).

Price is known as a transaction price that is actually paid by the buyer to the seller, an event of the transaction that can be verified truth to a goods or services agreed to be purchased by a buyer for a price and the seller agrees to sell with the requirements of the sale and purchase transactions approved by both parties. Furthermore, the cost is the size of an expense to produce any goods or services (Sidik, 1998).

Estimating the value of land or the land is very important, not only valuating from the empty land but must look at the existing environment (Betts \& Ely, 2001). A piece of land into a land when the land has been improved function and ready to be used for a specific purpose. Land has value because the land could provide a potential usefulness in terms of its structure, can provide recreational facilities, agriculture, and as a means of transportation. Land has a specific purpose means the land has a special value for its users as well. Therefore the assessment of the land needed caution in analyzing and also includes several factors that can be understood by the appraiser (American Institute of Real Estate Appraisers 1987).

The physical characteristics of a piece of land that should be considered by the appraiser including several criteria (American Institute of Real Estate Appraisers, 1987), namely:

1. Location, 5. Land elevation,
2. Accessibility,
3. Land conditions
4. Community and circumstance conditions, 7. Land use and zoning,
5. Land broad, 8. Legal status.

The market value of the land can be viewed either in the type of undeveloped raw land, land ready to build mature, mature land with building thereon to be developed into building a more productive and mature land has been developed in accordance with the applicable land use.

## Land Value

Land value is a measurement of the value of land based on the ability of the land economically in relation to productivity and economic strategies. The value of land can be divided into two categories:

1. Direct land value is a measure of the value of the land ability to directly give the value of productivity and economic capabilities,
2. Indirect land value is a measure of the value of the land capability based on the economic capabilities and productivity of its strategic location in terms of the economy.

## Land Price

The price of land is the valuation of the land measured by the nominal price in terms of money for a specified unit area on the land market.

Land value and land price have a functional relationship that is the price of land will be determined by the land value or land price will reflect the high lower value of the land. Thus, the land price is a function of the land value or the high and low price of the land will be regulated by changes in the land value.

## Multicollinearity

The term multicollinearity was first discovered by Ragnar Frisch meaning a linear relationship is "perfect" or certainly among some or all of the independent variables of the multiple regression models.
Multicollinearity can occur because of:

1. There is a trend of economic variables move together over time. Trend growth factors in the time series can be a cause of multicollinearity.
2. Use of Lag, so there is lag distribution model
$\mathrm{Eg}: \mathrm{Ct}=\mathrm{f}(\mathrm{Yt}, \mathrm{Yt}-1, \ldots . \mathrm{Y} 1)$ There may be a strong correlation between Yt and $\mathrm{Yt}-1$

- multicollinearity is expected to appear in most of the economic relations
- More often appear in the time series data and can also appear in the data cross-sectional.

Therefore, we can use other techniques that can be used to minimize multicollinearity problems without having to remove the independent variables involved collinear relationship, namely the Principal Component Analysis (PCA) method, which is the factor analysis.

PCA procedure is basically aimed to simplify the observed variables by means shrinking (reducing) dimension. This is done by removing the correlations between the independent variables through the transformation of the original independent variables to the new variables that are not correlated at all or commonly referred to as principal component. After a few components of the PCA results that are free multicollinearity obtained, then these components into the new independent variables, then regressed or analyzed its effect on the dependent variable ( Y ) using regression analysis.

## Methods

a. Collecting data from the LCAO/Notary monthly reports, brokerage (real estate agent) and the real price in the Sub-district Kertajaya Surabaya Indonesia in 2010.
b. Prices in the study area during the period to be used as sample data.
c. Confirm to get the sale price.
d. The LCAO/Notary monthly reports, brokerage and real price that will be used for the analysis of the determination of land indication value.
e. Calculating the value of a new indication for a market value using the PCA, and then compared with the carrying land value in the LBT as a land tax, the result is expected to come closer to the land tax contained in the LBT.

## RESULTS AND DISCUSSION

Based on transaction and market data consist of: the average of LCAO data, 2 property agents and the market value then tested eigen analysis of covariance matrix in PCA acquired:

Eigen analysis of the Covariance Matrix

| Eigenvalue | $1.41974 \mathrm{E}+13$ | $3.94252 \mathrm{E}+11$ | $1.38818 \mathrm{E}+11$ | 33860623063 |
| :--- | ---: | :---: | :---: | :---: |
| Proportion | 0.962 | 0.027 | 0.009 | 0.002 |
| Cumulative | 0.962 | 0.988 | 0.998 | 1.000 |

Proportion $=0.962=96.2 \%$
The results of the correlation and significance between the data can be seen in table 1 below. Correlation of 0.923 to 0.989 or $92.3 \%-98.9 \%$ greater than $70 \%$ and a significance of $0.00<0.05$ indicates that the data is very feasible when performed PCA.

Table 1. The Correlations of Average of LCAO data, 2 Property Agents \& Market Value

|  | Average of LCAO <br> data | Property agent 1 | Property agent 2 |
| :--- | ---: | ---: | ---: |
| Property agent 1 | 0.939 |  |  |
| Property agent 2 | 0.000 |  |  |
| Market value | 0.937 | 0.989 |  |
|  | 0.000 | 0.000 |  |

The calculation result with the PCA method obtained the PC (Principal Component) valueis as follows:
Table 2. The result of PC from four variables

| Variable | PC1 | PC2 | PC3 | PC4 |
| :--- | :---: | :---: | :---: | ---: |
| Average of LCAO <br> data | 0.659 | 0.579 | -0.481 | 0.010 |
| Property agent 1 | 0.452 | -0.524 | -0.027 | -0.721 |
| Property agent 2 | 0.462 | -0.554 | -0.019 | 0.693 |
| Market value | 0.385 | 0.289 | 0.876 | -0.002 |

Based on the table 2 above was taken the PC1 values represent the weight of each variable (component). PC 1 results are summed with the following results:

$$
0.659+0.452+0.462+0.385=1.958
$$

PC1 results are then normalized to obtain the actual weight of each variable is as follows:

| Table 3. Normalization results |  |  |
| :--- | ---: | ---: |
| Variable | Normalization PC1 | Weight of normalization results |
| Average of LCAO data | $0.659 / 1.958$ | 0.337 |
| Property agent 1 | $0.452 / 1.958$ | 0.231 |
| Property agent 2 | $0.462 / 1.958$ | 0.236 |
| Market value | $0.385 / 1.958$ | 0.197 |

Based on the results of table 3 above, the weight of the each variable is used to obtain the land indication value by the PCA method. The results of the calculations can be seen in Table 4 below:

Table 4. The result of land indication value with the PCA method and the average method

| LVZ | Average of LCAO data (Rp) | Property agent 1 $(\mathbf{R p})$ | $\begin{gathered} \hline \text { Property agent } \\ \mathbf{2} \\ (\mathbf{R p}) \\ \hline \end{gathered}$ | Market value (Rp) | $\begin{aligned} & \text { PCA method } \\ & (\mathbf{R p}) \end{aligned}$ | Average method (Rp) |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 1 | 6,805,000 | 4,500,000 | 4,700,000 | 5,000,000 | 5,421,295 | 5,251,250 |
| 2 | 7,455,000 | 6,500,000 | 6,300,000 | 5,000,000 | 6,479,288 | 6,313,750 |
| 3 | 6,803,000 | 5,000,000 | 4,900,000 | 5,000,000 | 5,583,236 | 5,425,750 |
| 4 | 7,457,000 | 6,400,000 | 6,800,000 | 6,000,000 | 6,771,483 | 6,664,250 |
| 5 | 1,274,000 | 1,500,000 | 1,700,000 | 1,500,000 | 1,471,127 | 1,493,500 |
| 6 | 6,803,667 | 6,000,000 | 6,400,000 | 5,000,000 | 6,168,241 | 6,050,917 |
| 7 | 1,273,000 | 2,000,000 | 2,500,000 | 1,500,000 | 1,774,978 | 1,818,250 |
| 8 | 6,806,000 | 4,800,000 | 4,600,000 | 5,000,000 | 5,467,290 | 5,301,500 |
| 9 | 1,414,667 | 2,000,000 | 2,400,000 | 2,000,000 | 1,897,378 | 1,953,667 |
| 10 | 1,146,667 | 900,000 | 850,000 | 1,300,000 | 1,049,874 | 1,049,167 |
| 11 | 6,802,667 | 5,200,000 | 5,000,000 | 5,000,000 | 5,652,889 | 5,500,667 |
| 12 | 1,416,000 | 2,200,000 | 2,000,000 | 3,000,000 | 2,046,243 | 2,154,000 |
| 13 | 918,000 | 700,000 | 750,000 | 1,000,000 | 844,158 | 842,000 |
| 14 | 1,148,333 | 1,200,000 | 1,100,000 | 1,300,000 | 1,178,678 | 1,187,083 |
| 15 | 2,176,000 | 1,500,000 | 2,000,000 | 3,000,000 | 2,140,441 | 2,169,000 |
| 16 | 2,009,333 | 2,300,000 | 2,500,000 | 2,500,000 | 2,288,688 | 2,327,333 |
| 17 | 3,373,667 | 2,600,000 | 2,700,000 | 3,000,000 | 2,962,639 | 2,918,417 |
| 18 | 2,007,667 | 2,500,000 | 2,200,000 | 2,500,000 | 2,263,510 | 2,301,917 |
| 19 | 3,377,000 | 2,600,000 | 2,400,000 | 3,000,000 | 2,892,974 | 2,844,250 |
| 20 | 1,145,667 | 1,000,000 | 900,000 | 1,300,000 | 1,084,420 | 1,086,417 |
| 21 | 2,175,000 | 1,200,000 | 1,100,000 | 3,000,000 | 1,858,491 | 1,868,750 |
| 22 | 2,352,667 | 2,700,000 | 2,600,000 | 3,000,000 | 2,618,492 | 2,663,167 |
| 23 | 2,773,333 | 2,700,000 | 2,600,000 | 3,000,000 | 2,760,075 | 2,768,333 |
| 24 | 1,721,667 | 2,300,000 | 2,400,000 | 2,500,000 | 2,168,273 | 2,230,417 |
| 25 | 2,012,667 | 2,300,000 | 2,400,000 | 3,000,000 | 2,364,529 | 2,428,167 |
| 26 | 6,805,000 | 4,000,000 | 4,500,000 | 5,000,000 | 5,258,680 | 5,076,250 |
| 27 | 6,768,333 | 4,000,000 | 4,500,000 | 5,000,000 | 5,246,339 | 5,067,083 |

In Table 4 above it can be seen the results the land indication value on each zone by PCA method and the Average method. To determine the closeness of indication value by the two methods against the land tax as stipulated in the LBT can be seen in Table 5 and Figure 1 below.

Table 5. Land value with PCA method, Average method and Land tax

| LVZ | $\underset{(\mathbf{R p})}{\text { PCA Method }}$ | Average Method ( $\mathbf{R p}$ ) | $\begin{gathered} \text { Land tax } \\ (\mathbf{R p}) \end{gathered}$ |
| :---: | :---: | :---: | :---: |
| 1 | 5,421,295 | 5,251,250 | 6,805,000 |
| 2 | 6,479,288 | 6,313,750 | 7,455,000 |
| 3 | 5,583,236 | 5,425,750 | 6,805,000 |
| 4 | 6,771,483 | 6,664,250 | 7,455,000 |
| 5 | 1,471,127 | 1,493,500 | 1,274,000 |
| 6 | 6,168,241 | 6,050,917 | 6,805,000 |
| 7 | 1,774,978 | 1,818,250 | 1,274,000 |
| 8 | 5,467,290 | 5,301,500 | 6,805,000 |
| 9 | 1,897,378 | 1,953,667 | 1,416,000 |
| 10 | 1,049,874 | 1,049,167 | 1,147,000 |
| 11 | 5,652,889 | 5,500,667 | 6,805,000 |
| 12 | 2,046,243 | 2,154,000 | 1,416,000 |
| 13 | 844,158 | 842,000 | 916,000 |
| 14 | 1,178,678 | 1,187,083 | 1,147,000 |
| 15 | 2,140,441 | 2,169,000 | 2,176,000 |
| 16 | 2,288,688 | 2,327,333 | 2,013,000 |
| 17 | 2,962,639 | 2,918,417 | 3,375,000 |
| 18 | 2,263,510 | 2,301,917 | 2,013,000 |
| 19 | 2,892,974 | 2,844,250 | 3,375,000 |
| 20 | 1,084,420 | 1,086,417 | 1,147,000 |
| 21 | 1,858,491 | 1,868,750 | 2,176,000 |
| 22 | 2,618,492 | 2,663,167 | 2,352,000 |
| 23 | 2,760,075 | 2,768,333 | 2,779,000 |
| 24 | 2,168,273 | 2,230,417 | 1,722,000 |
| 25 | 2,364,529 | 2,428,167 | 2,013,000 |
| 26 | 5,258,680 | 5,076,250 | 6,805,000 |
| 27 | 5,246,339 | 5,067,083 | 6,805,000 |



Figure 1. Land value with PCA method, Average method and Land tax
According to the table 6 below can be seen that is with the PCA method, 24 LVZ from 27 LVZ (88.89\%) had a value that is closer to the land tax rather than average method. This suggests that PCA method can better represent fair value.Land tax as stipulated in the LBT is still not represents fair value and tend to be higher than the land indication value acquired with the PCA method and the average method by $62.96 \%$ ( 17 LVZ from 27 LVZ).

Table 6. Land tax difference by PCA method and average method

| $\begin{gathered} \hline \text { Land tax - PCA method } \\ (\mathrm{Rp}) \\ \hline \end{gathered}$ | Land tax - average method (Rp) |
| :---: | :---: |
| 1,383,705 | 1,553,750 |
| 975,712 | 1,141,250 |
| 1,221,764 | 1,379,250 |
| 683,517 | 790,750 |
| $(197,127)$ | $(219,500)$ |
| 636,759 | 754,083 |
| $(500,978)$ | $(544,250)$ |
| 1,337,710 | 1,503,500 |
| $(481,378)$ | $(537,667)$ |
| 97,126 | 97,833 |
| 1,152,111 | 1,304,333 |
| $(630,243)$ | $(738,000)$ |
| 71,842 | 74,000 |
| $(31,678)$ | $(40,083)$ |
| 35,559 | 7,000 |
| $(275,688)$ | $(314,333)$ |
| 412,361 | 456,583 |
| $(250,510)$ | $(288,917)$ |
| 482,026 | 530,750 |
| 62,580 | 60,583 |
| 317,509 | 307,250 |
| $(266,492)$ | $(311,167)$ |
| 18,925 | 10,667 |
| $(446,273)$ | $(508,417)$ |
| $(351,529)$ | $(415,167)$ |
| 1,546,320 | 1,728,750 |
| 1,558,661 | 1,737,917 |

## CONCLUSION

Based on the discussion that has been done before, some conclusions can be drawn as follows:

1. PCA method can be used as the calculation to analyze land indication value in addition with the average method.
2. The land indication value with the PCA method has a smaller difference with a land tax as stipulated in the LBT compared with using the average method with the trend of $88.89 \%$.
3. Land tax as stipulated in the LBT is still not represents fair value and tend to be higher than the land indication value acquired with the PCA method and the average by $62.96 \%$.

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