

# 05. First Order Confirmatory Factor Analysis To Determine The Influence of Parameters on Land Value

*By I Nyoman Dita Pahang Putra*

## 1 First Order Confirmatory Factor Analysis To Determine The Influence of Parameters on Land Value

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### Abstract

There are varieties of variable and parameter that affect the land value. Therefore, the research focusing on determination of parameters that affect the land value is needed, in which it will give positive contribution for academic and practical. This study begins by identifying the parameters that is based on previous researches. Furthermore parameters are analyzed to result the probability and factor loading based on the questionnaire result from the perspective of experts and institutions related to land valuation. After analyzing factors through first order confirmatory factor analysis with maximum likelihood estimation method, based on questionnaire data entry by academics and practitioners who have a science degree and move on institutions that deal with land valuation, the identification of parameters that affect the value of the land-based conceptual overview as many as 83 parameters to 53 parameters.

**Key word:** land value, variable, parameter

### Introduction

Based on a conceptual overview, the value of land is a function of the relationship between price and quantity of the supply and demand of land. Change function in a region of space due to the increased demand for land, so the impact on the supply of land that are adjusted to their use [1].

The land use change in a zone will affect the market value of land in an area [2]. The tendency of the physical changes associated land use essentially can be divided

into two changes, namely changes in land use and use of building [3]. Changes in land use in the city indicated a change from agricultural land, vacant land and green belt into area of residential, trading, services and residential. This condition will also affect the change in the value of land [4].

Based on the reality of the above conditions, the value of land is expected to accommodate the attributes of the development of physical and urban infrastructures more comprehensively, thus the value of land can represent a reasonable condition and can be estimated according to the development that is influenced by multiple attributes (discrete and continuous), both spatial and non-spatial.

Density and the development of the residential areas and business areas affect the value of the surrounding land. This is particularly relevant to the research that has been done before [5], in the study stated that the land value is strongly influenced by the accessibility, distance to the central business district, land use, zoning, density and spatial gradient effect. Similarly, described by [6] that the value of land is affected with the geographical location. Conditions of Surabaya city is relatively diverse, both from the effect of geographical, social and cultural. The analysis model that considers the geographical effects is important to be applied in the land valuation. Analysis model that considers the geographical effects, need to more attention to the variables that will be used [7].

Based on some conceptual and empirical review above, can be identified various criteria and parameters that can affect the land value. Therefore, research that focuses on the determination of parameters that affect the land value is very necessary, so that can make a positive contribution to the academic and practical.

## **Materials and Methods**

Parameters that influence land value are arranged in the form of tabulations with the criteria of supply, demand and highest best use. The criteria of highest and best use consisting of physical, environmental, legal, social, financial feasibility, economic, productivity and public and private boundaries. Overall there are 83 parameters that affect land value.

The influence of parameters can be categorized with 4 perceptions, namely: (4) very influential, (3) influential, (2) not influential and (1) very not influential. The questionnaire is structured, then distributed to 31 respondents who consist of experts in the assessment of the land, specifically: Academic, Tax Office, Directorate General of Taxation, Agency of Income and Financial Management, Association of Real Estate and Brokerage, Land Office, Center of Accountant Development and Appraiser Services - Ministry of Finance, Office of Public Appraiser Services.

The results of the questionnaire recapitulation, then analyzed with confirmatory factor analysis. In this analysis can be identified parameters that most influence on the value of the land value and the probability factor loading values. The use of factor analysis can see if the specifications are theoretical constructs developed in accordance with the concept underlying construct after the tests in the field. So essentially, factor analysis is an analysis technique for analyzing filters mutual relationship between the grains of the instrument. Through the analysis of the factors

expected to find the dimensions, indicators and grains of the solid form constructs of variables tested. In addition, through the analysis of these factors are expected to find a new set of variables that are fewer in number than the previous variables [8].

Confirmatory approach was used to test whether the number of parameters obtained empirically according to the number of factors that have been developed theoretically or test hypotheses about the existence of the construct. In addition, also to answer the question of whether the number of parameters that have been extracted can be used to explain the relationship between indicators significantly. Through a confirmatory approach can also be obtained suitability goodness of fit test significant [9].

#### Confirmatory Factor Analysis

In this study the factor analysis using confirmatory factor analysis through the method of maximum likelihood analysis and regression weight to obtain the suitability of the goodness of fit test. Confirmatory Factor Analysis is a multivariate analysis method that can be used to confirm whether the measurement model is built according to the hypothesized. In confirmatory factor analysis, there is a latent variable and indicator variables. Latent variable is a variable that can not be formed and built directly while the indicator variable is a variable that can be observed and measured directly [10].

A general model of confirmatory factor analysis are:

$$x = \Lambda_x \xi + \delta \quad (1)$$

$x$  is a vector of variables measuring indicators  $q \times 1$

$\Lambda_x$  is the factor loading matrix ( $\lambda$ ) or coefficient that shows the relationship of  $x$  with  $\xi$  sized  $q \times n$

$\xi$  (ksi), a vector of latent variables measuring  $n \times 1$

$\delta$  measurement error vector for measuring  $q \times 1$

#### First Order Confirmatory Factor Analysis

In the First Order Confirmatory Factor Analysis of a latent variable is measured by several indicators that can be measured directly.

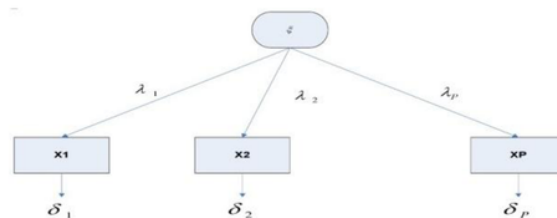


Figure 1: First Order Confirmatory Factor Analysis Model

The variable  $X$  is the standard deviation of each average, so the covariance matrix  $X$  is the expected value of  $XX'$ . Covariance matrix of  $X$  is written as a function of  $\theta$  and represented it as  $\Sigma(\theta)$ .

$$\begin{aligned}
\Sigma(\theta) &= E(XX') \\
&= E[(\Lambda_x \xi + \delta)(\xi' \Lambda_x' + \delta')] \\
&= \Lambda_x E(\xi \xi') \Lambda_x' + \Theta_\delta \\
&= \Lambda_x \Phi \Lambda_x' + \Theta_\delta
\end{aligned} \tag{2}$$

covariance matrix X for a general factor analysis, where:

$\Phi$  is the covariance matrix of the latent factor

$\Theta_\delta$  is the covariance matrix for error

### Goodness-of-Fit

At this step to evaluate the suitability of the model through a review of the criteria to share the goodness-of-fit. The few measurements are important in evaluating these criteria are:

#### A. Probability

Acceptable probability value was  $p < 0.05$

#### B. Reliability Test

Once the suitability of the test model, another evaluation to be done is unidimensionalitas and reliability assessment. Unidimensionalitas is an assumption that is used in calculating the reliability of the model shows that in a one-dimensional models, the indicators used to have a good degree of conformity. The recommended approach in assessing a measurement model is to assess the magnitude of the composite reliability and variance extracted from each construct. Reliability is a measure of the internal consistency of the indicators of a construct that indicates the degree to which each indicator indicates a construct/common latent factors. Limit values are used to assess an acceptable level of reliability (factor loading/fl) is as follows [11].

- factor loading in the range of  $\pm 0.3$  to  $\pm 0.4$  are considered to meet the minimal level for interpretation of structure
- factor loading  $\pm 0.5$  or greater are considered practically significant
- factor loading exceeding 0.7 are considered indicative of well-defined structure and are the goal of any factor analysis

### Results and Discussion

The recapitulation of questionnaires result that have been identified by the 31 respondents who are experts in the land valuation based on the influence of parameters that is categorized with 4 perceptions, namely: (4) very influential, (3) influential, (2) not influential and (1) very not influential is as follows in table 1,



**Table 1: Recapitulation of Questionnaires Result**

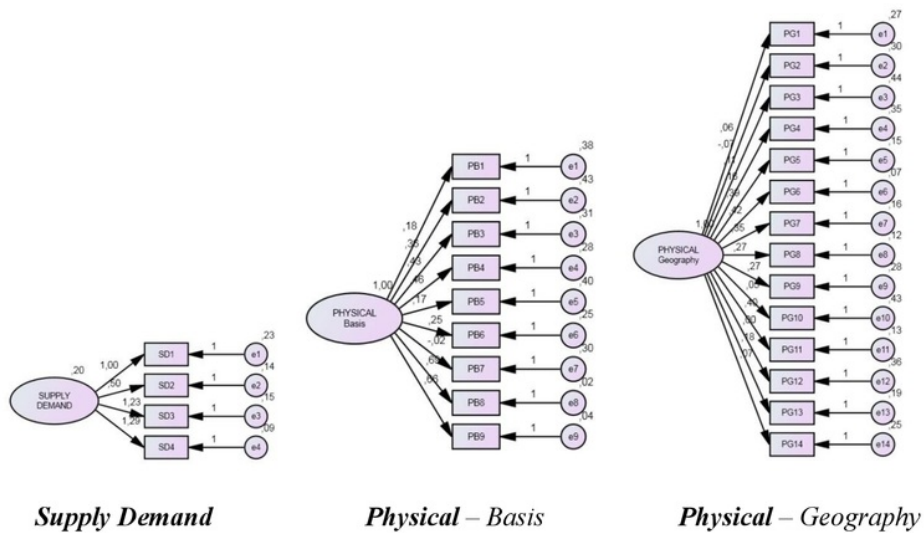
Number	VARIABLE AND PARAMETER		very not influential	not influential	influential	very influential	the number of respondents
			1	2	3	4	
<b>A</b>	<b>SUPPLY AND DEMAND</b>						
<b>1</b>	<b>Supply &amp; Demand</b>						
	Utilit	SD1	1	0	8	22	<b>31</b>
	Scarcity	SD2	0	0	8	23	<b>31</b>
	Desirability - direct demand	SD3	1	0	13	17	<b>31</b>
	Effective Purchasing Power - derived demand	SD4	1	0	17	13	<b>31</b>
<b>B</b>	<b>HIGHEST AND BEST USE</b>						
<b>1a</b>	<b>Physical - Basis</b>						
	size & land area	PB1	1	0	18	12	<b>31</b>
	building floor area	PB2	1	8	16	6	<b>31</b>
	building position	PB3	1	9	17	4	<b>31</b>
	building life time	PB4	2	10	17	2	<b>31</b>
	advertisement	PB5	3	13	15	0	<b>31</b>
	drainage	PB6	0	4	21	6	<b>31</b>
	comparison with the surrounding property	PB7	0	1	17	13	<b>31</b>
	building coverage	PB8	1	3	18	9	<b>31</b>
	floor area ratio	PB9	1	2	18	10	<b>31</b>
<b>B</b>	<b>HIGHEST AND BEST USE</b>						
<b>1b</b>	<b>Physical - Geography</b>						
	geographical location	PG1	0	1	7	23	<b>31</b>
	distance from CBD (Central Business District)	PG2	0	1	10	20	<b>31</b>
	distance from public facility	PG3	1	1	18	11	<b>31</b>
	climate	PG4	2	13	16	0	<b>31</b>
	travel time to CBD	PG5	0	1	17	13	<b>31</b>
	elevation	PG6	0	2	23	6	<b>31</b>
	landform	PG7	0	1	19	11	<b>31</b>
	land condition	PG8	0	0	23	8	<b>31</b>
	fertility	PG9	1	10	19	1	<b>31</b>
	adaptability	PG10	3	7	21	0	<b>31</b>
	topography	PG11	0	2	21	8	<b>31</b>
	geology	PG12	2	7	22	0	<b>31</b>
	land capacity	PG13	0	2	24	5	<b>31</b>
	land orientation	PG14	0	4	23	4	<b>31</b>

<b>1c</b>	<b>Physical - Infrastructure</b>						
	accessibility	PI1	1	0	4	26	<b>31</b>
	road class	PI2	0	0	15	16	<b>31</b>
	network utility	PI3	0	2	19	10	<b>31</b>
	vehicle volume	PI4	0	5	20	6	<b>31</b>
	gutter	PI5	1	4	24	2	<b>31</b>
<b>1d</b>	<b>Physical - Facility</b>						
	education place	PF1	1	3	21	6	<b>31</b>
	market and shops	PF2	0	0	21	10	<b>31</b>
	park	PF3	0	6	23	2	<b>31</b>
	worship place	PF4	0	10	18	3	<b>31</b>
	hospital	PF5	1	9	18	3	<b>31</b>
	entertainment place	PF6	1	8	20	2	<b>31</b>
	government offices	PF7	0	11	18	2	<b>31</b>
	public transportation	PF8	0	2	14	15	<b>31</b>
<b>1e</b>	<b>Physical - Land Improvement on-site &amp; off-site</b>						
	leveling	PL1	0	2	25	4	<b>31</b>
	filling	PL2	0	2	23	6	<b>31</b>
	compaction	PL3	0	4	24	3	<b>31</b>
	paving	PL4	1	7	21	2	<b>31</b>
	pedestrian	PL5	1	5	24	1	<b>31</b>
	street light	PL6	1	12	18	0	<b>31</b>
	parking place	PL7	1	5	22	3	<b>31</b>
<b>2</b>	<b>Environment</b>						
	water contamination	EN1	0	4	15	12	<b>31</b>
	air contamination	EN2	0	5	16	10	<b>31</b>
	noise pollution	EN3	1	4	19	7	<b>31</b>
	environmental	EN4	0	2	15	14	<b>31</b>
	environmental hygiene	EN5	0	3	20	8	<b>31</b>
	scenery	EN6	0	4	23	4	<b>31</b>
	building density	EN7	1	3	17	10	<b>31</b>
	population density	EN8	0	4	20	7	<b>31</b>
	population characteristic	EN9	0	7	18	6	<b>31</b>
	flood	EN10	1	0	10	20	<b>31</b>
	earthquake	EN11	1	4	17	9	<b>31</b>
	storm	EN12	1	6	18	6	<b>31</b>
<b>B</b>	<b>HIGHEST AND BEST USE</b>						
<b>3</b>	<b>Legal</b>						
	zoning	L1	1	1	8	21	<b>31</b>
	heritage regulation	L2	1	1	13	16	<b>31</b>
	land use	L3	0	0	6	25	<b>31</b>
	taxes	L4	1	4	22	4	<b>31</b>
	law status	L5	0	0	8	23	<b>31</b>

	amount of tax	L6	1	3	22	5	<b>31</b>
	regulation	L7	0	0	17	14	<b>31</b>
	public restriction	L8	1	0	21	9	<b>31</b>
	property tax	L9	1	3	20	7	<b>31</b>
	private restriction	L10	1	1	20	9	<b>31</b>
<b>4</b>	<b>Social</b>						
	population growth	S1	0	5	18	8	<b>31</b>
	age	S2	1	10	19	1	<b>31</b>
	law behavior	S3	0	7	20	4	<b>31</b>
	discipline	S4	0	6	17	8	<b>31</b>
	dignity	S5	0	7	21	3	<b>31</b>
	level of crime	S6	0	5	14	12	<b>31</b>
	level of education	S7	1	9	16	5	<b>31</b>
<b>5</b>	<b>Economy</b>						
	rate of return	EC1	0	1	11	19	<b>31</b>
	net operating income	EC2	0	2	12	17	<b>31</b>
	lease price	EC3	0	0	9	22	<b>31</b>
	level of income	EC4	0	2	11	18	<b>31</b>
	region growth	EC5	0	2	8	21	<b>31</b>
	construction trend	EC6	1	1	19	10	<b>31</b>
	productivity level	EC7	1	3	17	10	<b>31</b>
	<b>Physical - Land Improvement on-site &amp; off-site</b>						

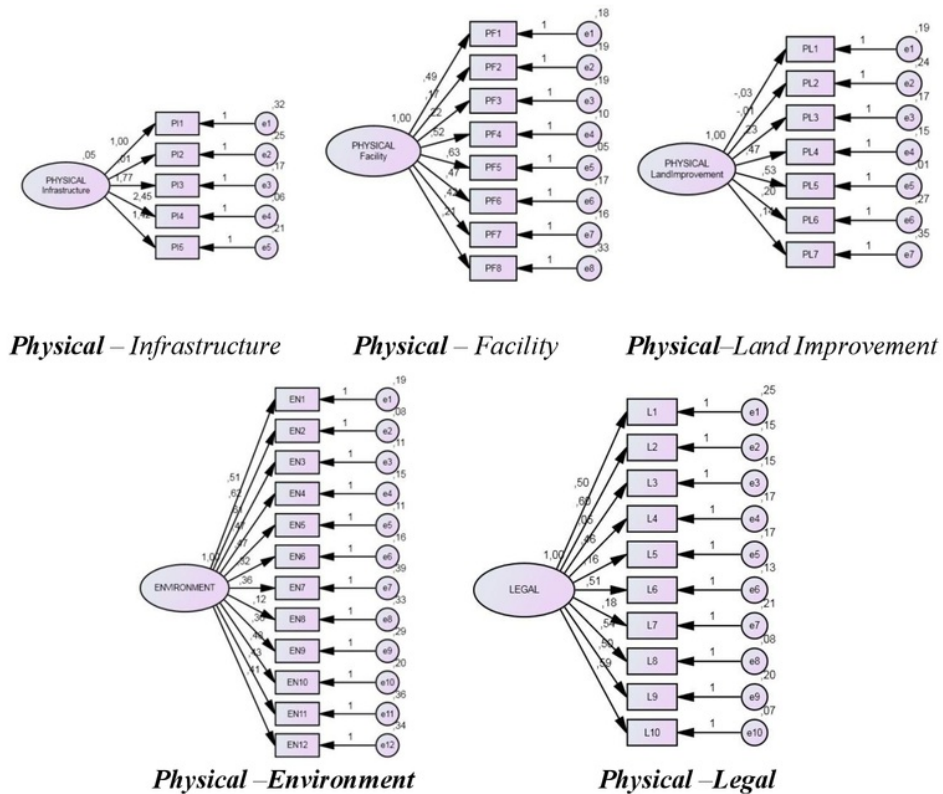
Identification of the model in First Order Confirmatory Factor Analysis on each variable can be explained in the following figure 2,

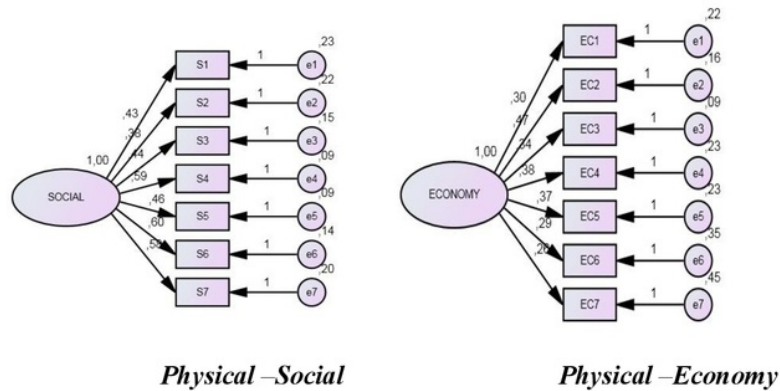




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Figure 2: First Order Confirmatory Factor





**Figure 2:** First Order Confirmatory Factor (extension)

Referring to the formulation of the First Order Confirmatory Factor Analysis used in this study, it can be seen recapitulation smallest probability value and the greatest value factor loading on each parameter in each variable (table 2),

**Table 2:** Recapitulation of The Probability and Factor Loading Result

Variable and Parameters	Results	
	Probability	factor loading
<b>Supply Demand</b>		
Effective Purchasing Power	***	0,881
Desirability	***	0,818
Utility	***	0,680
Scarcity	0,012	0,508
<b>Physical – Basis</b>		
building coverage	***	0,979
floor area ratio	***	0,955
building life time	***	0,653
building position	***	0,608
building floor area	0,006	0,484
Drainage	0,011	0,449
size & land area	0,123	0,280
Advertisement	0,15	0,262
comparison with the surrounding property	0,864	-0,032
<b>Physical – Geography</b>		
Elevation	***	0,848
Topography	***	0,749
travel time to CBD	***	0,716
Landform	***	0,662

<i>land condition</i>	***	0,627
<i>Fertility</i>	0,015	0,457
<i>land capacity</i>	0,046	0,376
<i>Climate</i>	0,201	0,254
<i>distance from public facility</i>	0,42	0,161
<i>land orientation</i>	0,513	0,132
<i>geographical location</i>	0,566	0,113
<i>Adaptability</i>	0,694	0,080
<i>Geology</i>	0,984	-0,004
<i>distance from CBD</i>	0,511	-0,131
<b><i>Physical – Infrastructure</i></b>		
<i>Gutter</i>	***	0,918
<i>Accessibility</i>	***	0,896
<i>vehicle volume</i>	0,002	0,767
<i>network utility</i>	0,036	0,608
<i>road class</i>	0,832	0,069
<b><i>Physical – Facility</i></b>		
<i>Hospital</i>	***	0,943
<i>worship place</i>	***	0,851
<i>education place</i>	***	0,763
<i>entertainment place</i>	***	0,755
<i>government offices</i>	***	0,719
<i>Park</i>	0,012	0,455
<i>market and shops</i>	0,051	0,358
<i>public transportation</i>	0,056	0,349
<b><i>Physical – Land Improvement</i></b>		
<i>Pedestrian</i>	***	0,988
<i>Paving</i>	***	0,770
<i>Compaction</i>	0,005	0,487
<i>street light</i>	0,084	0,367
<i>parking place</i>	0,242	0,227
<i>Filling</i>	0,929	-0,019
<i>Leveling</i>	0,678	-0,080
<b><i>Environment</i></b>		
<i>air contamination</i>	***	0,913
<i>noise pollution</i>	***	0,875
<i>environmental hygiene</i>	***	0,814
<i>Environmental</i>	***	0,769
<i>water contamination</i>	***	0,760
<i>Flood</i>	***	0,733
<i>Scenery</i>	***	0,622
<b><i>Environment</i></b>		
<i>Earthquake</i>	***	0,581

<i>Storm</i>	***	0,574
<i>population characteristic</i>	0,002	0,550
<i>building density</i>	0,005	0,500
<i>population density</i>	0,281	0,202
<b>Legal</b>		
<i>private restriction</i>	***	0,917
<i>public restriction</i>	***	0,889
<i>heritage regulation</i>	***	0,842
<i>amount of tax</i>	***	0,820
<i>property tax</i>	***	0,744
<i>Taxes</i>	***	0,743
<i>Zoning</i>	***	0,703
<i>Regulation</i>	0,041	0,371
<i>law status</i>	0,045	0,363
<i>land use</i>	0,502	0,127
<b>Social</b>		
<i>Discipline</i>	***	0,889
<i>level of crime</i>	***	0,850
<i>Dignity</i>	***	0,840
<i>level of education</i>	***	0,793
<i>law behavior</i>	***	0,747
<i>population growth</i>	***	0,666
<i>Age</i>	***	0,631
<b>Economy</b>		
<i>net operating income</i>	***	0,763
<i>lease price</i>	***	0,752
<i>level of income</i>	***	0,618
<i>region growth</i>	0,002	0,609
<i>rate of return</i>	0,006	0,546
<i>construction trend</i>	0,035	0,440
<i>productivity level</i>	0,083	0,360

\*\*\* = 0,000

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In the confirmatory factor analysis with maximum likelihood estimation method, the parameters that affect the indicated variable from the smallest probability value <0.05 and the biggest factor loading values > 0.5 in each parameter in each variable can be seen in Table 3,

**Table 3:** Recapitulation of The Probability < 0.05 And Factor Loading Result > 0.5

No	Variable and Parameters	Results	
		Probability	factor loading
	<b><i>Supply Demand</i></b>		
1	<i>Effective Purchasing Power</i>	***	0,881
2	<i>Desirability</i>	***	0,818
3	<i>Utility</i>	***	0,680
4	<i>Scarcity</i>	0,012	0,508
	<b><i>Physical – Basis</i></b>		
1	<i>building coverage</i>	***	0,979
2	<i>floor area ratio</i>	***	0,955
3	<i>building life time</i>	***	0,653
4	<i>building position</i>	***	0,608
	<b><i>Physical – Geography</i></b>		
1	<i>Elevation</i>	***	0,848
	<b><i>Physical – Geography</i></b>		
2	<i>Topography</i>	***	0,749
3	<i>travel time to CBD</i>	***	0,716
4	<i>Landform</i>	***	0,662
5	<i>land condition</i>	***	0,627
	<b><i>Physical - Infrastructure</i></b>		
1	<i>Gutter</i>	***	0,918
2	<i>Accessibility</i>	***	0,896
3	<i>vehicle volume</i>	0,002	0,767
4	<i>network utility</i>	0,036	0,608
	<b><i>Physical – Facility</i></b>		
1	<i>Hospital</i>	***	0,943
2	<i>worship place</i>	***	0,851
3	<i>education place</i>	***	0,763
4	<i>entertainment place</i>	***	0,755
5	<i>government offices</i>	***	0,719
	<b><i>Physical – Land Improvement</i></b>		
1	<i>Pedestrian</i>	***	0,988
2	<i>Paving</i>	***	0,770
	<b><i>Environment</i></b>		
1	<i>air contamination</i>	***	0,913
2	<i>noise pollution</i>	***	0,875
3	<i>environmental hygiene</i>	***	0,814
4	<i>Environmental</i>	***	0,769
5	<i>water contamination</i>	***	0,760
6	<i>Flood</i>	***	0,733
7	<i>Scenery</i>	***	0,622
8	<i>Earthquake</i>	***	0,581

9	<i>Storm</i>	***	0,574
10	<i>population characteristic</i>	0,002	0,550
	<b><i>Legal</i></b>		
1	<i>private restriction</i>	***	0,917
2	<i>public restriction</i>	***	0,889
3	<i>heritage regulation</i>	***	0,842
4	<i>amount of tax</i>	***	0,820
5	<i>property tax</i>	***	0,744
6	<i>Taxes</i>	***	0,743
7	<i>Zoning</i>	***	0,703
	<b><i>Social</i></b>		
1	<i>Discipline</i>	***	0,889
2	<i>level of crime</i>	***	0,850
3	<i>Dignity</i>	***	0,840
4	<i>level of education</i>	***	0,793
5	<i>law behavior</i>	***	0,747
6	<i>population growth</i>	***	0,666
7	<i>Age</i>	***	0,631
	<b><i>Economy</i></b>		
1	<i>net operating income</i>	***	0,763
2	<i>lease price</i>	***	0,752
3	<i>level of income</i>	***	0,618
4	<i>region growth</i>	0,002	0,609
5	<i>rate of return</i>	0,006	0,546

\*\*\* = 0,000

## Conclusion

Based on the analysis of the factors mentioned above, only the variable supply and demand are not experiencing a reduction parameters because all parameters have a probability value > 0.05 and factor loading < 0.5, the result is consistent with that expressed by [12] and [13], as well as [14] that the value of the land is affected by supply (utility and scarcity) and demand (desirability and effective purchasing power). After analyzing factors through first order confirmatory factor analysis with maximum likelihood estimation method, based on questionnaire data entry by academics and practitioners who have a science degree and move on institutions that deal with land valuation, the identification of factors that affect the value of the land-based conceptual overview as many as 83 parameters to 53 parameters.

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