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ABSTRACT

Regional development of infrastructure affects changes in land values in the region. This is also experienced by Jember Regency. Jember Regency as a region that has experienced rapid progress in infrastructure, has experienced a varied increase in the land value in the main areas on the protocol roads. The main objective of this research is the establishment of a model to estimate the land value that better reflects market prices and can produce more representative land values as the impact of infrastructure development. Land value data was obtained through surveys on perceptions of land price transactions that had occurred in Kaliwates District at Mangli, Kaliwates, Jember Kidul and Tegal Besar Villages, which were passed through the protocol roads. The method of analysis is done by synthesizing land values in each administrative zone of the RW to obtain an AIV as the LIV which is used as a land value in each LVZ. Estimated value of land is obtained through modeling linear and non-linear estimates of land values. The results from modeling become a formulation to estimate the value of land in the future period. Thematic maps of the Land Value Zone are represented by the administrative area of Kaliwates District in 2008 to 2017 in 4 Villages and 65 RWs. The estimation model of land value perception in 65 RW consists of 6 models of land value perception formulation, the model results for 2017 are verified and tested for reliability against the results of real land value perception in the field in 2017 based on the APE value. The results show the largest APE value with a value of 27.21%, namely in the Mangli Village RW 3, 8, 12, 16 and 17. These results prove the results of the model on the results of surveys on real conditions in the field are feasible. Feasibility of the prediction model was also proven and tested based on the APE and MAPE value. In the prediction model of land value in this study MAPE value = 21.73% <30%, so it can be concluded that the model is quite good.

Keyword: infrastructure, land value, prediction model, APE, MAPE

1. Introduction

1.1. Background

Jember Regency is one of the Level II Regional Governments in East Java Province in Indonesia. Jember Regency was established on January 1, 1929 and has been through a long history. Infrastructure development in the form of public facilities in Jember Regency before the enactment of regional autonomy has experienced rapid progress. The enactment of regional autonomy in Kabupaten Jember began on January 1, 2001 as a demand from Law No. 22 of 1999 concerning Regional Autonomy, which brought Jember Regency into a new phase in a decentralized system that has full authority to regulate and manage its own household.

Based on data from the Central Bureau of Statistics in 2009, Jember Regency is divided into 31 sub-districts with a high population density of 658.2 million people / km. The economic condition of Jember Regency is not much different from the economic condition of East Java Province, the economic growth of Jember Regency on average has increased on the basis of the benchmarks used, namely the Gross Regional Domestic Product (GRDP) and per capita income of the population in Jember Regency. On the aggregate side, the GRDP of East Java Province at current prices in 2008 reached Rp. 621.58 trillion, or almost 8% of the total GRDP of East Java Province came from the ex

Karisidenan Besuki Regency. If viewed from the side of its role, as much as 40% is the contribution of Jember Regency to the total GRDP of the former Karisidenan Besuki Regency.

Figure 1. Administrative Map of District Areas in Jember Regency (www.jemberkab.go.id)

31 Districts in Jember Regency have a different area, with the largest area in Tempurejo District with an area of 524.46 km2. The total number of kelurahan / villages is 248, the number of hamlets / neighborhoods is 972, RW is 4,216 and the number of RTs is 14,213. In full can be seen in Figure 1 and Table 1.

Jember Regency can be classified as an area that adheres to an agrarian type because the agricultural sector in Jember Regency is a sector that has a large role (leading sector) or around 44.18% of the total added value created in 2008, while the secondary sector only contributes 11.55% and the tertiary sector contributed 40.45% to the Jember Regency Gross Regional Domestic Product (Badan Pusat Statistik, 2009). The economic structure in Jember Regency is agrarian, but in practice the development of the agricultural sector cannot run on its own without the support of other economic sectors. For this reason, the role of all economic sectors is needed in optimizing and maximizing the output of each sector, which in turn can provide high and competitive added value in both national and international markets [1].

Table 1. The number of sub-districts and government areas below them in Jember Regency (RPJMD Jember Regency 2016 – 2021)

District	Village	Hamlet	RW	RT
Kencong	5	24	123	526
Gumukmas	8	24	159	453
Puger	12	37	288	658
Wuluhan	7	25	126	719
Ambulu	7	27	200	637
Tempurejo	8	29	109	441
Silo	9	41	213	622
Mayang	7	24	109	347
Mumbulsari	7	26	86	463
Jenggawah	8	36	97	536
Ajung	7	33	113	491
Rambipuji	8	42	150	517
Balung	8	27	110	368
Umbulsari	10	28	153	450
Semboro	6	14	114	326
Jombang	6	17	134	402

District	Village	Hamlet	RW	RT
Sumberbaru	10	36	166	599
Tanggul	8	24	140	507
Bangsalsari	11	41	253	569
Panti	7	29	91	423
Sukorambi	5	16	78	258
Arjasa	6	25	64	249
Pakusari	7	26	96	293
Kalisat	12	53	151	473
Ledokombo	10	38	147	422
Sumberjambe	9	58	103	426
Sukowono	12	27	142	403
Jelbuk	6	42	78	236
Kaliwates	7	32	152	490
Sumbersari	7	33	152	505
Patrang	8	38	119	404

1.2. Infrastructure Development

The Jember Regency Government in 2018 is targeting maximum infrastructure development and a top priority. This is done so that the economy can develop well and is expected to improve people's welfare.

In the Jember 2010 RPJMD 2010 - 2015 it has been explained that the building sector is the backbone in the scope of the infrastructure sector. In 2010 there was a strong market optimism, resulting in rapid infrastructure development, which resulted in the construction sector growing by 8.91% and the trade, hotel and restaurant sector experiencing the highest growth of 9.48% (Figure 2). The growth of the infrastructure sector is believed to contribute to the growth of many other business activities. Infrastructure development can also be seen in the development of road infrastructure in Jember Regency (Figure 3).

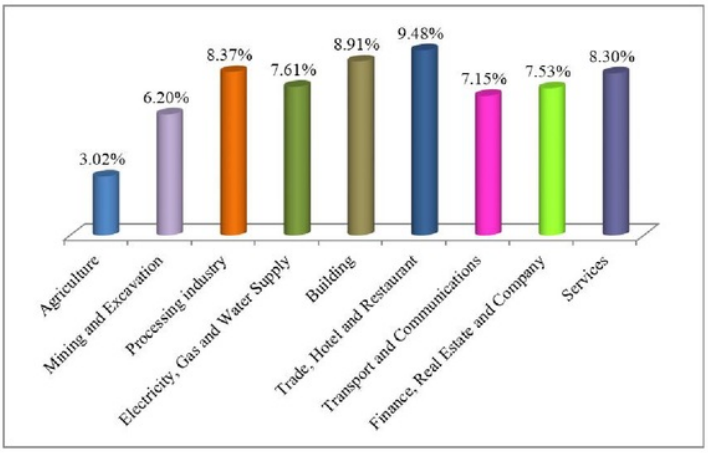

Figure 2. Economic Growth of Sectoral of Jember Regency in 2010 (BPS Jember Regency, 2012).

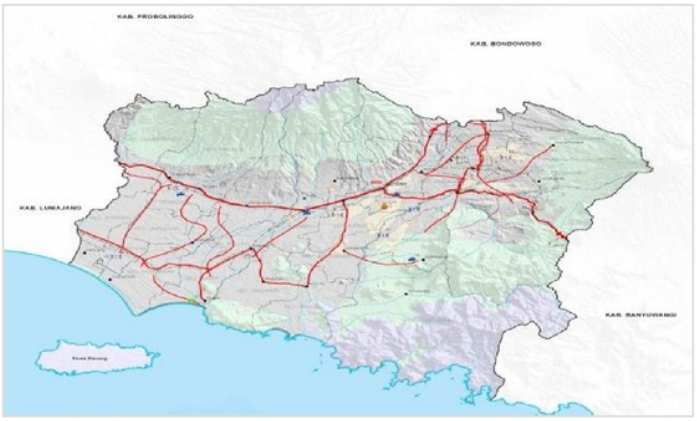

Figure 3. Map of Infrastructure in Jember Regency (Ministry of Public Works, 2014).

The explanation in the paragraph above is in line with one of the strategic issues contained in the 2016-2021 JJD District RPJMD which emphasizes infrastructure development, which includes increasing and increasing the length of inter-village and sub-district roads, accelerating the development of Nortohadinegoro Airport with access to roads, accelerating the construction of Roads South of Jember and accelerated development of the Jember Ring Road. It is also emphasized in one of the strategic programs and policy directions contained in the 2016-2021 JJD District RPJMD namely increasing the availability and quality of infrastructure to develop economic competitiveness and people's welfare in the context of realizing Jember City Tourism.

The consequence of infrastructure development is the need for land or land. This tends to have an impact on land price changes in the land acquisition process. According to Haris [2], one of the reasons for the sudden increase in land prices in Indonesia is that the land market situation is not transparent due to the absence of an institution that has legality to formally announce the value of land periodically. This has resulted in competition in land acquisition, which then reveals information about land values that are not fair, which may be caused by inappropriate information, so that it becomes speculation (the value of land based on subjectivity and interests). It could be that when there is "rumor" about an infrastructure development project in a particular location, land speculators are responded to by immediately buying land that is the location development or around it. Estimated land prices based on the Tax Object Sales Value (TOSV) as a normative measure of land (based on regional autonomy policy) can no longer be used and precisely the market price resulting from competition between sellers applies. In government infrastructure projects funded by the APBN and APBD are often constrained because the price of real land soars far from land valuation in initial construction planning.

Infrastructure development in the form of adding roads and increasing accessibility will increase the land market value in the development and surrounding areas. According to Olawande [3] in his research in the Ikeja City of Nigeria, West Africa concluded that increasing road network accessibility and connectivity has the potential to increase land values. According to Wang and Tsai [4] in their research in Asian cities it was explained that road development would facilitate accessibility between locations. So that locations that have new roads and are easier to access to reach other locations will increase the land market value in the area.

The more rapid development of infrastructure has resulted in the density of residential buildings in an area, the more populated the population living in the area, which in turn allows a change in the market value of the land. This is in accordance with research conducted by Kabba and Li [5] in the Sierra Leone region of West Africa, that population density that resides in an area will affect the market value of land in the region.

Based on research conducted in Nigeria, West Africa by Olayiwola et al. [6], changes in land market values coincided with changes in land functions as a result of infrastructure development. The dominance of residential infrastructure activities that occur evenly in all regions in the central and suburban areas, both in the upper middle class and lower middle class such as dense and slum settlements, has a linear (direct proportional) impact on the development of activities business in urban areas. This causes an increase in land use changes. The explanation is in line with the research conducted by Putra, et al. [7] which states that changes in land function in a zone will affect the market value of land in an area.

1.3. Aim

The purpose of this study is to establish a model of land value estimation formulation in the protocol road corridor that receives the impact of infrastructure development more dominantly in Kaliwates District, Jember Regency.

1.4. Benefits and Contribution of Research

This research is very useful because by solving the problems in this study, it can be known and produced a model of the influence of infrastructure development on the estimation of land values, specifically described as follows:

1. A representative model can be identified in estimating the value of land in an area dominated by infrastructure development.
2. Can contribute positively to land valuation in areas that are experiencing more dominant infrastructure development.

2. Materials and Methods

2.1. Individual and Mass Assessment

Assessment is an activity that involves elements of knowledge and art to estimate the economic value of the interests contained in an object or property for a particular purpose, at a predetermined time by considering all the characteristics that exist in the object or property. Assessment can be done individually or en masse in accordance with the type of object, scope and importance [8].

Individual assessment is an assessment carried out for objects that have special characteristics, high economic value, high complexity, involves multi ownership and requires detailed information on the estimated value given, while mass valuation is used for the purpose of evaluating large numbers of objects more fast, cheaper and more efficient [8] [9]. Individual assessment and mass assessment can be done with market data approaches, income approaches and cost approaches [9].

2.2. Land Assessment

Land according to Santoso [10] is the surface of the earth from the bottom to the center of the earth and the upper part is infinite, including everything formed by nature. Appraisal Institute [11], explains that land is not only covering the land surface, but everything that is attached to the earth, whether by natural processes, such as trees and grasses, or man-made, such as houses and other buildings. Land covers not only the surface of the earth but everything that is below it and above it. In legal theory, the earth's surface is only part of the inverted pyramid having its tip or peak at the center of the earth, extending through the earth's surface at the channel's boundary line, and up to the sky (Figure 4).

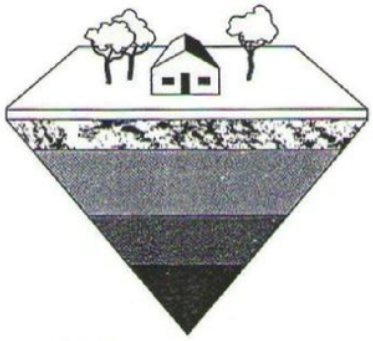

Figure 4. Visualization of the land definition (Appraisal Institute, 2008)

Based on Gwartney's explanation [12], land is defined as all material universe other than society and its products. This includes all natural resources, materials, airwaves and the earth's surface. All air, land, minerals and water are included in the definition of land. Everything that is freely given by nature, and not made by humans, is categorized as land. Land has no production costs and is a gift of nature to mankind, which makes it possible to continue life and achieve prosperity. The uniqueness of the land comes from its steady supply and immobility. Land cannot be produced or reproduced. Land is needed directly or indirectly in the production of all goods and services. Land is the most basic resource and source of all wealth.

Land valuation becomes important because it is not only an assessment of vacant land or that has been developed but considers the surrounding environment well [13].

2.3. Land Value Zone

On land boundaries created to separate each ownership, the bounded land units, according to Hidayati and Harjanto [14], Ratterman [15], Appraisal Institute [11] and Putra et al [16] can be explained by:

a. Metes and Bounds

This method of land is measured and identified through a description of its boundaries

b. Rectangular Survey System

This method sets the starting points that are references for surveyors

c. Lot and Block System

This method is carried out by dividing the land in a rectangle and applying the plot numbers to identify certain sites in each block.

The lot and block systems are used to classify the land market value in each land value zone (LVZ) in this study.

Land value data per year for nine years (2008-2016) in this study are classified in zones that have homogeneous land values by approaching market data through the perception of land prices, which are called sample zones or can be called LVZ which is represented by RW on administrative boundaries region. In this study the sample zone is assumed to independently experience an increase in land value. Furthermore, from the above data, the time series is analyzed by trend method using linear and non-linear regression to obtain the most representative model of land value after the development of infrastructure in the region. According to Makridakis et al. [17] describes time series data is sequential datas in time, and the relationship of functions X and Y to the trend estimation method can be a straight line (linear) and not a straight line (non linear), as a formulation to obtain estimation results more precise than the existing data patterns.

3. Results and Discussions

3.1. Research Area

The study was conducted in the area of Jember Regency which experienced relatively high infrastructure development, which made it possible to become the study area in this study. It aims to determine the condition of the field and facilitate the preparation of observation strategies in the surrounding area which is expected to have a relatively large influence and the most appropriate analysis method to be developed in decision making in this study. The development center of Jember Regency is predominantly located in Kaliwates, Sumbersari and Patrang Districts (Figure 5), while in this study a study area was established in the Kaliwates District (Figure 6).

Figure 5. Jember Regency Tourism Map (www.eastjava.com)

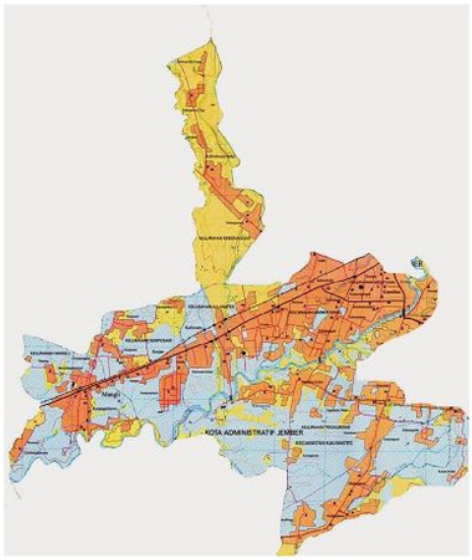

Figure 6. Map of Kaliwates District Administration Area (www.jemberkab.go.id)

The research area was carried out in detail in Kaliwates Subdistrict in the areas of Mangli, Kaliwates, Jember Kidul and Tegalbesar in 65 RW (Figure 7).

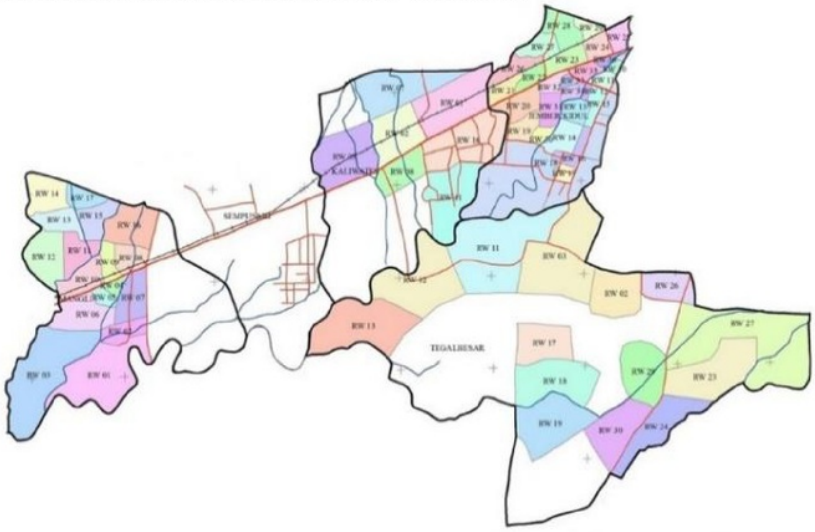

Figure 7. Research Area Map

3.2. Scale Engineering

In this study using a measurement scale that is numerical scale. According to Gujarati and Porter [18] and Sugiyono [19], numerical scale is a scale that uses numbers, can be calculated in number and can be represented in integers or real numbers.

3.3. Land Price Data Research Area

According to Harjanto [8], information sources on selling prices or land transactions can be obtained from notary / PPAT reports, Land Offices, City Planning Offices, State Auction Offices, Lurahs, Camats or other relevant agencies, and from direct sellers or buyers, print media or electronics, developers and brokeradge. According to Sukada [20], the source of market price data in land valuation can be through buyers or sellers, print / electronic advertisements, brokers (brokers / brokers), developers, PPAT notary reports and Village / Village Chiefs as well as in this study also explained, to determine the average indication value (AIV) of the land can be through the market price of the land where the source of the information can be obtained from the village area apparatus, so that the AIV is determined according to the field conditions. Özdilek [21] also explained that information on land market prices can be obtained from the government, developers, institutional tenants, sellers and buyers, intermediaries and others.

Based on the explanation in the paragraph above, in this study land price data collection techniques from 2008 to 2016 with a method of mass assessment through market data approaches through unstructured interviews and observations in the study area.

The source of data collection is a category of secondary data with sampling techniques determining respondents to obtain secondary data on land prices in the study area, in a non-probability manner with purposive sampling or judgmental sampling technique. Data collection arrangements are carried out through permission to the Village Office that is disposed to the Chairperson of the RW and Chairperson of the RT. Data collection was carried out at home with the RW Chair and the RT Chair

who were willing and could be met to discuss the perception of land prices based on information on land transactions that had occurred in the administrative areas of RW and RT, and respondents were also determined according to their understanding of land prices that had occurred in the study area.

Land price data from 2008 to 2016 is a perception of land prices from land transactions that have occurred with the assumption that they have met six factors of reasonableness, namely: sellers who are willing and have the right to sell their assets, buyers who are able and willing to buy the property, there are sufficient time to make an offer, there is sufficient time to show assets sold to the market, not to consider special offers such as between father and son, between parent and subsidiary, so that the price of the land can be categorized as a fair market value of land or value the land market or the fair value of land, which is then referred to in this research as land value.

Data from the time series in 2008 to 2016, each on average in each zone that has almost the same land value, which is oriented to the administrative boundary of the RW. The average yield is the AIV of land in each LVZ. Determination of zones using lot and block systems, which is a system for distributing land in a rectangular survey and applying numbering to each plot to identify certain sites contained in each block [11] [14] [15] [16]. In this study the land value zone is marked as fixed with the name RW in accordance with the administrative boundary.

3.4. Linear and Non Linear Regression Analysis

Estimates of land price predictions in each LVZ were analyzed by linear regression and non-linear to obtain the best predictive model with the indication R^2 (determination coefficient) equal to or close to 1. R value is an indicator of reliability or reliability of the prediction model. If there are more than one model with a high R^2 value, it is recommended to use the simplest model.

The estimation result of land value in 2017 is the result of the analysis using trend estimation method in linear regression and non-linear land price data from 2008 to 2016 to get the most representative land value model in 2017. Trend estimation method can be linear and non-linear linear to get more precise estimation results from existing data patterns [17]. In line with the research conducted by Putra et al. [16], that estimation of land value prediction estimation in LVZ can use polynomial order 2, exponential, linear regression and use other regression types.

3.5. Modeling Accuracy Analysis

The accuracy of modeling the estimation of land values in this study was analyzed with the coefficient of determination.

$$APE_t = \left|\frac{Yt-Ft}{Yt}\right| x100$$

Y_t = survey result datas
F_t = estimation datas

$$MAPE = \frac{1}{n} \sum_{t=1}^{n} |APE_t|$$

n = amount of data

3.6. Results of Land Value Perception

The value of land in each LVZ represented by RW based on the average perception of land values from the survey in the RT administration area in 2008 to 2016 in Kaliwates Sub-district in Jember Kidul Village, Mangli, Tegal Besar and Kaliwates is presented in Table 2.

Table 2. Recapitulation of Results of Perception The average value of land in Kaliwates District in 2008 - 2016.

District	Village	RW	Perception of Land Value Average / m^2 (in thousand rupiah)								
			Year								
			2008	2009	2010	2011	2012	2013	2014	2015	2016
			1	2	3	4	5	6	7	8	9
		10	350	450	550	650	750	850	983	1,117	1,267
		11	383	500	600	700	833	967	1,100	1,233	1,367
		12	283	350	467	567	700	850	1,000	1,133	1,283
		13	300	400	517	633	717	817	917	1,050	1,217

District	Village	RW	Perception of Land Value Average / m^2 (in thousand rupiah)								
			Year								
			2008	2009	2010	2011	2012	2013	2014	2015	2016
			1	2	3	4	5	6	7	8	9
Kaliwates	Jember Kidul	20	600	750	800	900	1,100	1,300	1,600	1,900	2,000
		21	450	500	600	700	800	900	1,000	1,100	1,300
		22	200	250	300	500	700	800	900	1,000	1,250
		23	300	400	500	700	800	900	1,200	1,400	1,550
		24	450	500	600	700	800	900	1,000	1,100	1,300
		25	450	500	600	700	800	900	1,000	1,100	1,300
		26	200	400	500	600	700	800	1,000	1,100	1,200
		27	400	500	650	900	1,200	1,400	1,700	1,800	1,900
		28	300	400	500	700	900	1,100	1,300	1,500	1,600
		29	450	600	750	900	950	1,000	1,100	1,300	1,550
		30	200	300	450	650	700	800	900	1,000	1,100
		31	200	300	450	560	750	800	900	1,000	1,100
		32	200	300	450	560	750	800	900	1,000	1,100
		33	300	400	500	700	900	1,100	1,300	1,500	1,600
		34	300	400	550	650	790	900	1,200	1,300	1,400
		35	367	483	567	767	900	1,133	1,333	1,500	1,617
		36	233	367	467	586	700	900	1,033	1,183	1,317
Kaliwates	Mangli 1	1	225	275	338	388	450	500	563	725	900
		2	281	344	406	450	519	569	713	831	963
		4	533	633	750	867	1,033	1,100	1,317	1,550	1,900
		5	563	650	731	831	913	1,063	1,313	1,575	1,813
		6	433	517	558	600	683	733	783	867	1,100
		7	333	367	398	433	500	617	700	800	933
		9	367	517	583	650	717	850	1,000	1,117	1,217
		10	663	850	1,000	1,163	1,363	1,438	1,588	1,725	1,863
		11	550	713	825	938	1,138	1,263	1,425	1,563	1,688
		13	500	675	825	925	1,075	1,225	1,425	1,625	1,800
		14	600	750	900	1,000	1,200	1,350	1,500	1,700	1,800
		15	550	725	900	1,000	1,200	1,400	1,550	1,725	1,825
	Mangli 2	3	67	92	108	125	158	158	183	200	225
		8	220	275	319	350	388	425	475	556	619
		12	300	350	417	467	550	617	667	750	833
		16	77	105	133	167	200	242	283	323	355
		17	275	375	450	513	538	575	595	613	625
Kaliwates	Tegal Besar	2	100	113	140	223	257	343	433	533	650
		11	38	55	100	175	275	325	365	410	445
		13	56	80	125	238	350	463	538	675	763
		17	90	138	168	218	275	338	425	525	625
		18	87	130	147	225	367	408	508	642	767
		19	77	123	167	221	286	343	457	543	621
		23	106	160	213	263	308	380	468	558	690
		24	93	168	200	255	325	420	500	568	670
		25	96	130	160	205	278	320	380	460	520
		26	94	128	173	238	310	408	500	575	698
		27	105	123	193	257	287	453	520	627	757
		28	97	123	150	200	227	277	323	357	423
		29	95	115	203	243	310	357	403	450	500
		30	95	123	160	223	260	307	350	400	460
Kaliwates	Kaliwates I	1	1,125	1,438	2,000	2,313	2,625	3,063	4,000	4,438	4,875
		2	538	650	825	1,013	1,225	1,513	1,675	1,963	2,125
		3	2,000	2,300	2,700	3,300	4,000	5,000	5,500	6,500	7,000
		8	2,000	2,300	2,700	3,300	3,933	5,333	5,383	6,083	7,283
		10	2,000	3,150	4,350	5,650	7,250	9,000	10,250	11,750	12,750
Kaliwates	Kaliwates II	7	50	100	150	175	200	250	300	400	500
		11	70	120	190	225	312	413	530	700	900

Table 3. The average recapitulation of the results of the perception of land value and the model of land value estimation

District	Village	Perception of Land Value Average / m^2 (in thousand rupiah)									Model	R^2
		Year										
		2008	2009	2010	2011	2012	2013	2014	2015	2016		
		1	2	3	4	5	6	7	8	9		
Kaliwates	Jember Kidul	353	456	564	697	835	964	1,130	1,275	1,415	$y = 3.3642x^2 - 101.48x + 240.24$	0.9994
	Mangli 1	466	585	685	770	899	1,009	1,156	1,317	1,483	$y = 5.3568x^2 - 70.533x + 407.74$	0.9987
	Mangli 2	188	239	285	324	367	403	441	488	531	$y = -0.304x^2 + 44.906x + 148.11$	0.9987
	Tegal Besar	88	122	164	227	294	367	441	523	613	$y = 3.5997x^2$ 30.647x + 48.256	0.9995
	Kaliwates 1	1,533	1,968	2,515	3,115	3,807	4,782	5,362	6,147	6,807	$y = 18.296x^2 - 500.27x + 922.96$	0.9970
	Kaliwates 2	60	110	170	200	256	332	415	550	700	$y = 7.6456x^2 - 1.4306x - 75.321$	0.9928

Table 4. 2017 Land Value Modeling Results, Results of Land Value Survey in 2017, APE and MAPE

District	Village	RW	Model	R^2	Perception of Land Value Average / m^2 (in thousand rupiah) 2017		APE (Absolute Percentage Error)	MAPE (Mean Absolute Percentage Error)
					Model result	Survey result		
Kaliwates	Jember Kidul	10	$y = 3.3642x^2 + 101.48x + 240.24$	0.9994	1,591	1,367	16.45%	13.55%
		11	$y = 3.3642x^2 + 101.48x + 240.25$	0.9994	1,591	1,500	6.10%	
		12	$y - 3.3642x^2 + 101.48x + 240.26$	0.9994	1,591	1,433	11.03%	
		13	$y = 3.3642x^2 + 101.48x + 240.27$	0.9994	1,591	1,300	22.42%	
		14	$y = 3.3642x^2 + 101.48x + 240.28$	0.9994	1,591	1,525	4.36%	
		15	$y = 3.3642x^2 + 101.48x + 240.29$	0.9994	1,591	1,525	4.36%	
		16	$y = 3.3642x^2 + 101.48x + 240.30$	0.9994	1,591	1,767	9.92%	
		17	$y - 3.3642x^2 + 101.48x + 240.31$	0.9994	1,591	1,545	3.01%	
		18	$y = 3.3642x^2 + 101.48x + 240.32$	0.9994	1,591	2,000	20.43%	
		19	$y = 3.3642x^2 + 101.48x + 240.33$	0.9994	1,591	1,750	9.06%	
		20	$y \quad 3.3642x^2 + 101.48x + 240.34$	0.9994	1,591	2,500	36.34%	
		21	$y = 3.3642x^2 + 101.48x + 240.35$	0.9994	1,591	1,400	13.68%	
		22	$y = 3.3642x^2 + 101.48x + 240.36$	0.9994	1,591	1,500	6.10%	
		23	$y \quad 3.3642x^2 + 101.48x + 240.37$	0.9994	1,591	1,600	0.53%	
		24	$y = 3.3642x^2 + 101.48x + 240.38$	0.9994	1,591	1,400	13.68%	
		25	$y = 3.3642x^2 + 101.48x + 240.39$	0.9994	1,591	1,400	13.68%	
		26	$y - 3.3642x^2 + 101.48x + 240.40$	0.9994	1,591	1,350	17.89%	
		27	$y = 3.3642x^2 + 101.48x + 240.41$	0.9994	1,591	2,000	20.43%	
		28	$y = 3.3642x^2 + 101.48x + 240.42$	0.9994	1,591	1,750	9.06%	
		29	$y = 3.3642x^2 + 101.48x + 240.43$	0.9994	1,591	1,500	6.10%	
		30	$y = 3.3642x^2 + 101.48x + 240.44$	0.9994	1,591	1,250	27.32%	
		31	$y - 3.3642x^2 + 101.48x + 240.45$	0.9994	1,591	1,200	32.62%	
		32	$y = 3.3642x^2 + 101.48x + 240.46$	0.9994	1,591	1,200	32.62%	
		33	$y = 3.3642x^2 + 101.48x + 240.47$	0.9994	1,591	1,750	9.06%	
		34	$y \quad 3.3642x^2 + 101.48x + 240.48$	0.9994	1,591	1,600	0.53%	
		35	$y = 3.3642x^2 + 101.48x + 240.49$	0.9994	1,591	1,683	5.46%	
		36	$y = 3.3642x^2 + 101.48x + 240.50$	0.9994	1,591	1,400	13.68%	

District	Village	RW	Model	R^2	Perception of Land Value Average / m^2 (in thousand rupiah)		APE (Absolute Percentage Error)	MAPE (Mean Absolute Percentage Error)
					2017			
					Model result	Survey result		
Kaliwates	Mangli 1	1	$y = 5.3568x^2 + 70.533x + 407.74$	0.9987	1,649	1,075	53.37%	23.67%
		2	$y = 5.3568x^2 + 70.533x + 407.75$	0.9987	1,649	1,238	33.23%	
		4	$y = 5.3568x^2 + 70.533x + 407.76$	0.9987	1,649	2,083	20.86%	
		5	$y = 5.3568x^2 + 70.533x + 407.77$	0.9987	1,649	2,125	22.41%	
		6	$y = 5.3568x^2 + 70.533x + 407.78$	0.9987	1,649	1,500	9.92%	
		7	$y = 5.3568x^2 + 70.533x + 407.79$	0.9987	1,649	1,167	41.32%	
		9	$y = 5.3568x^2 + 70.533x + 407.80$	0.9987	1,649	1,333	23.66%	
		10	$y = 5.3568x^2 + 70.533x + 407.81$	0.9987	1,649	2,000	17.56%	
		11	$y = 5.3568x^2 + 70.533x + 407.82$	0.9987	1,649	1,813	9.03%	
		13	$y = 5.3568x^2 + 70.533x + 407.83$	0.9987	1,649	2,000	17.56%	
		14	$y = 5.3568x^2 + 70.533x + 407.84$	0.9987	1,649	2,000	17.56%	
		15	$y = 5.3568x^2 + 70.533x + 407.85$	0.9987	1,649	2,000	17.56%	
	Mangli 2	3	$y = -0.304x^2 + 44.906x + 148.11$	0.9987	567	650	12.80%	27.21%
		8	$y = -0.304x^2 + 44.906x + 148.12$	0.9987	567	708	19.89%	
		12	$y = -0.304x^2 + 44.906x + 148.13$	0.9987	567	917	38.17%	
		16	$y = -0.304x^2 + 44.906x + 148.14$	0.9987	567	380	49.15%	
		17	$y = -0.304x^2 + 44.906x + 148.15$	0.9987	567	675	16.03%	
Kaliwates	Tegal Besar	2	$y = 3.5997x^2 + 30.647x + 48.256$	0.9995	715	767	6.78%	18.45%
		11	$y = 3.5997x^2 + 30.647x + 48.257$	0.9995	715	480	48.90%	
		13	$y = 3.5997x^2 + 30.647x + 48.258$	0.9995	715	900	20.59%	
		17	$y = 3.5997x^2 + 30.647x + 48.259$	0.9995	715	700	2.10%	
		18	$y = 3.5997x^2 + 30.647x + 48.260$	0.9995	715	808	11.58%	
		19	$y = 3.5997x^2 + 30.647x + 48.261$	0.9995	715	700	2.10%	
		23	$y = 3.5997x^2 + 30.647x + 48.262$	0.9995	715	825	13.37%	
		24	$y = 3.5997x^2 + 30.647x + 48.263$	0.9995	715	750	4.71%	
		25	$y = 3.5997x^2 + 30.647x + 48.264$	0.9995	715	638	12.11%	
		26	$y = 3.5997x^2 + 30.647x + 48.265$	0.9995	715	775	7.78%	
		27	$y = 3.5997x^2 + 30.647x + 48.266$	0.9995	715	850	15.92%	
		28	$y = 3.5997x^2 + 30.647x + 48.267$	0.9995	715	483	47.87%	
		29	$y = 3.5997x^2 + 30.647x + 48.268$	0.9995	715	567	26.12%	
		30	$y = 3.5997x^2 + 30.647x + 48.269$	0.9995	715	517	38.33%	
Kaliwates	Kaliwates I	1	$y = 18.296x^2 + 500.27x + 922.96$	0.9970	7,755	5,500	41.00%	21.55%
		2	$y = 18.296x^2 + 500.27x + 922.96$	0.9970	7,755	7,300	6.24%	
		3	$y = 18.296x^2 + 500.27x + 922.96$	0.9970	7,755	9,000	13.83%	
		8	$y = 18.296x^2 + 500.27x + 922.96$	0.9970	7,755	8,000	3.06%	
		10	$y = 18.296x^2 + 500.27x + 922.96$	0.9970	7,755	13,750	43.60%	
	Kaliwates II	7	$y = 7.6456x^2 - 1.4306x + 75.321$	0.9928	826	650	27.01%	25.98%
		11	$y = 7.6456x^2 - 1.4306x + 75.321$	0.9928	826	1,100	24.95%	
MAPE (Mean Absolute Percentage Error)								**21.73%**

Based on the results of the survey, which are subsequently averaged in each of 2008 - 2016 are shown in Table 3 above. The average perception of land values in each RW in each Kelurahan has increased from 2008 - 2016. These results show the value of land in Kaliwates Sub-district in Jember Kidul Village, Mangli, Tegal Besar and Kaliwates has increased in line with the development of relatively fast infrastructure in Kaliwates District area.

Estimation of land value for year n, for each Kelurahan can be modeled through nonlinear polynomial regression of order 2 which has a coefficient of determination (R^2) > 0.99 (99%) which is presented in Table 4. These results show the results of the model are very good and close to the results of the survey of land values that occur significantly.

The implementation of the model in each RW in each kelurahan produces modeled land values as shown in Table 4. Absolute percentage error (APE) in each RW in each village has a very varied value, then the average is calculated which represents the mean absolute percentage error (MAPE) in each village. In Jember Kidul Village, the closeness of the value between the value of the land from the survey results with a model of 13.55%. Mangli 1 and Mangli 2 differentiated in Mangli Village, which distinguishes real conditions, because in the Mangli District area the value of riel land does not accelerate rapidly towards the development of infrastructure and has different characteristics of land value development between the two regions. In Mangli 1 region, the value close between the land values of the survey results with the model results of 23.67%, in the mangli area 2 was 27.21%. In the Tegal Besar Village, the value of the land between the survey results and the model results is 18.45%. In Kaliwates, Kaliwates 1 and Kaliwates 2 are distinguished, which distinguishes real conditions, because in the region of Kaliwates 2 the value of riel land does not accelerate rapidly to the development of infrastructure and both regions have different characteristics of land value development between the two regions. In the Kaliwates 1 region, the value of the land between the survey results and the model results was 21.55%, in the Kaliwates 2 area of 25.98%. In general, in all Kelurahan, the study area in Kaliwates Subdistrict had a close value between the land values of the survey results with the average model results (MAPE) of 21.73%.

4. Conclusions

The model of land value estimation formulation in the protocol road corridor that receives the impact of infrastructure development is more dominant in Kaliwates Sub-district, Jember Regency, in the study area in Jember Kidul Village is $y = 3.3642x2 + 101.48x + 240.24$ with $R^2 = 0.9994$ (99.94%) and the MAPE value is 13.55%, Mangli 1 Village is $y = 5.3568x2 + 70.533x + 407.74$ with $R^2 = 0.9987$ (99.87%) and the MAPE value is 23.67%, Mangli 2 Village is $y = -0.304x2 + 44.906x + 148.11$ with $R^2 = 0.9987$ (99.87%) and MAPE value of 27.21%, Tegal Besar Village is $y = 3.5997x2 + 30.647x + 48.256$ with $R^2 = 0.9995$ (99.95%) and MAPE value at 18.45%, Kaliwates 1 Village is $y = 18.296x2 + 500.27x + 922.96$ with $R^2 = 0.997$ (99.7%) and MAPE value is 21.55% and Kaliwates 2 Village is $y = 7.6456x2 - 1.4306x + 75,321$ with $R^2 = 0.9928$ (99.28%) and the MAPE value of 25.98%. In general, the value closeness between the land values from the survey results with an average model result of 21.73%.

The MAPE results produce values between 13% - 28%, this result can be concluded that it requires non-parametric multiple regression analysis in determining the land valuation model which is influenced by predictor variables that can affect the value of the land. Modeling like this can be a recommendation for further research in the same area as this study.

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