Reducing Urban Poverty within the Spatial Development (Re-directing Commercial Land use and Accessibility on Bengkulu Municipal)

Harmes[a]*, Bambang Juanda[b], Ernan Rustiadi[c], Baba Barus[d]

[a]Regional and Rural Development Planning Program, Bogor Agricultural University. Campus of IPB Dramaga, Bogor 16680, Indonesia

[b]Faculty of Economics and Management, Department of Economics, Bogor Agricultural University. Campus of IPB Dramaga, Bogor 16680, Indonesia

[c,d]Faculty of Agriculture Bogor Agricultural University. Campus of Dramaga, Bogor 16680, Indonesia

Abstract

Land use, accessibility and poverty are regional and urban development issues which when addressed fragmented in policy and regulation able to negate each other. Land and accessibility can be used to reduce poverty through redistribution of its using in regional or urban spatial plan. Both of them is a permanent input for development. This paper aims to explain the spatial varying relationship among the commercial land use and accessibility on urban poverty in each unit of observation. *Geographically Weighted Regression* (GWR) is a suitable analytical framework in which spatial dependency is taken into account. The model parameter estimate are able to reveal the influence of the independent to the dependent variable at each location of observation, this model known as local regression. The result indicates that the relationship between commercial land use and accessibility on poverty are varied, across the point of estimation. Some location has positive relationship, that means increasing poverty. The negative local regression coeficient means reduce poverty. Policy implementation on regional and urban spatial plan, need to be aware this contradiction. Re-directing commercial land use and accessibility in spatial planning are urgently to reduce poverty and does not induce poverty permanent.

Keywords: commercial land use; accessibility; varying spatial relationship; poverty reduction.

----

* Corresponding author.

1. Introduction

One of the important agenda of the world development as declared in *Sustainable Development Goals* (SDGs) is to alleviate poverty and hunger. Indonesia Central Bureau of Statistic (BPS) reported, percentage of population bellows the poverty line has been successfully reduced from 15,1% in 1990 to 10,96% in 2014. Unfortunately, in March 2015 population of poor people are 28,59 million people (11,22%) or increase 0,86 million people compared to September 2014 or grow up 1,26% [1].

During last decade development approach and poverty alleviation policy generally use monetary approach. Household targeted, aiming for poverty alleviation not noticing Spatial Heterogeneity or Spatial Dependency. Poverty alleviation policies in Indonesia based on Presidential Instruction (Inpres) 15/2010, dominantly initiated by the central government which is *top-down* and *technocratic.* Policy by injection from the outside leads to underdevelopment of initiative, participation, and sensitivity of the local neighborhood and government.

Since 2007 national policy for regional development initiated regionally based approach through the law No. 26/2007, concerned spatial development. This policy are implemented massively since 2011 by regulating the regional spatial development plan (RTRW) for all district/city. In fourth years the regulation implemented substance approval for 33 provinces (97,1%), 339 districts (100%) and 93 cities (100%) [2]. The urgently derivation of this regulation in urban area mandates the regulation of a detailed spatial plan (RDTR) and zoning regulation, whereas explicitly directing urban land use is allowed or permitted use.

The spatial development plan model is a new approach to regional development in Indonesia. The spatial plan arranges land use and accessibility in order to improve regional and local prosperity. Poverty are regional and local development issues, that requires more local development resources to reduce it. Land arrangement increase in market activity, eliminating the cost of transaction in the system of tenure is the key to reduce poverty in urban land usage [3]. Implementation of this idea in urban land use planning is re-allocating and re-location land use will remove the cost of transaction and will reduce poverty. The poor people have less access to development decisions and economic resource. In the spatial development plan, the need of space for the poor people do not accommodate. Land use patterns and accessibility can occur negative impact on the poor, because the limited access to spatial usage.

The urban poor work in the informal sector and agriculture, when the spatial zoning regulations in urban areas implemented, it will directly restrict their activities. Limited ownership of urban land resource led to more difficult establishment for the poor households and individuals, in accordance with the zoning regulation. As a result of derivatives such as lack of access to banking services will occur and the poor welfare become worse if the spatial development policy implemented as done today. On the contrary, spatial planning policy is regional *bottom-up* development approach, but poverty alleviation is *top-down policy.* Although has been the same targeted, but they carried out separately.

As development resource, urban area can be used as an input to poverty reduction permanently and sustainable. Local resource is more effective and efficient if directed properly in regional development, especially in poverty

alleviation policy. Regional development study usually uses spatial data, while poverty reduction use a-spatial or a tribute data. The integration through this paper requires the same scale data. The compatible of high-resolution raster data from *Ikonos Imagery* in detail scale (1:5.000) with integrated poverty database (BDT) need more effort to communicate both on it. The studied aid to build spatial data of poverty and make it interoperable with land use data.

The cause of poverty from the economics, *First* by micro, poverty comes from inequality of resource ownership, which lead to unequal income distribution. The poor only have a limited number of resources with low quality. *Second*, poverty comes from difference in *the quality of human resource*. Low quality human resource means low productivity, which in turn lower wages. The low quality of human resource is due to lack of education, less fortunate, discrimination, and heredity. *Third*, poverty arises from differences in access to funds [4].

Explanation of the third point above is poverty occurring due to difference access to fund/capital, both physical or non-physical capital.

The poor described as a group with limited access to resource, either in the form of financial capital, physical capital, or social capital.

Poverty caused by social exclusion, i.e. limited access to property and income. Spatial development approach caused marginalization and revocation of fundamental economic rights to the poor is worse. This contribution involves spatial exclusion.

Further, the effort to reduce poverty can be accelerated when spatial planning included poverty concern in plan substances, these improvements by expanding the land use and accessibility allocation in positive effect and eliminate the negative effect of land use and accessibility to poverty reduction [5].

2. Materials and Method

2.1 Material

Spatial data contain both geo-references and attribute information. Non spatial data only involving attribute information. The tools and materials related to spatial data consist of hardware, software, systems and spatial data management procedures, geo-references data, and attribute information. The hardware includes *Global Position system* (GPS) and laptop. The software includes *Operating System* (OS) and any particular application for spatial statistic analysis. Spatial data management procedures used in the preparation of spatial data, processing and analysis and running Geographycal Weighted Regression (GWR) model.

2.1.1 Spatial Data

The source of the data used in this study gathered from spatial and attribute/non-spatial data. The spatial data using raster high resolution satellite imagery of the Bengkulu municipality in 2011th. The other thematic vector maps scale of 1 : 5.000. The data gathered from Bengkulu Municipality Government, Geospatial Information Agency (BIG) and field surveys. The unit of analysis is the 67 urban villages of the Bengkulu municipal, with
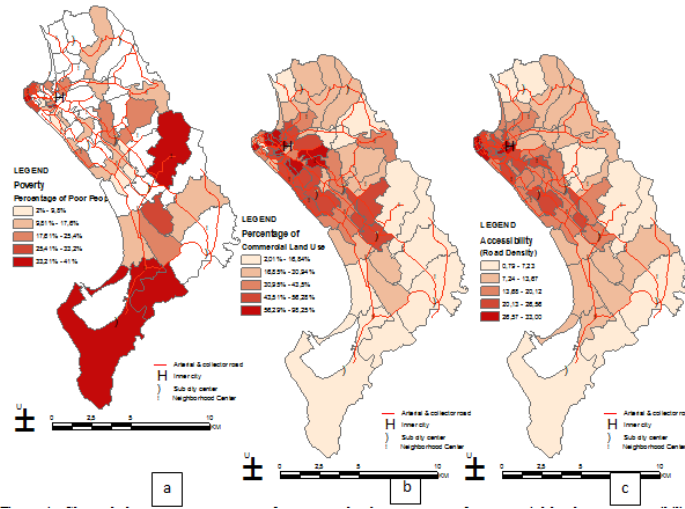
administrative boundary.

Figure 1: Choropleth map*: a percentage of poor people; b percentage of commercial landuse; c accessibility (road density) in Bengkulu Municipal*

2.1.2 Poverty data

Poverty variable is the number of poor people published by Indonesia Central Bureau of Statistic (BPS), and proxied from the unified poverty database (BDT) published by National Team for the Acceleration of Poverty Reduction (TNP2K) base on welfare stage of the poor people in Bengkulu City [6]. The unit of observation is the urban villages of Bengkulu City. These data focus on basic information about level of individuals and households prosperity.

2.2 Methods

2.2.1 Hypothesis

There are positive and negative measure of the influences that urban land use, accessibility and poverty data have on each other in geographic space, its called spatial autocorrelation. Positive spatial autocorrelation indicates that similar values of the observed variable are clustered. Negative spatial autocorrelation indicates that similar values are dispersed or dissimilar values are clustered. No spatial autocorrelation means that the values un patterned, or random across space. Hypothesis for these spatial autocorrelation measured using Moran's Index (MI).

Table 1: Spatial Autocorrelation Hypothesis

	Variable Names	**Spatial Autocorrelation**
Y	Poverty (p_m)	(+) / clustered
X1	Commercial (l_kj)	(+) / clustered
X_2	Accessibility (a_pk)	(+) / clustered

Table 2: Independent and Dependent Variables Relationship

	Variable Names	**Poverty (p_m) / Y**
X_1	Commercial (l_kj)	(- / +) Varying spatial relationship
X_2	Accessibility (a_pk)	(- / +) Varying spatial relationship

To see much more and detail the relationship between predictor and response variable, we use spatial econometric modelling or local regression model.

2.2.2 Research Location

Research Location is Bengkulu municipal covers 9 sub-districts and 67 urban villages.

Table 3: List of Sub-districts and Villages Research

Sub-district/village	Sub-district/village	Sub-district/village
Teluk Segara : 1. Malabero Vil. 2. Kebun Ros Vil. 3. Pasar Melintang Vil. 4. Pintu Batu Vil. 5. Kebun Keling Vil. 6. pondok Besi Vil. 7. Berkas Vil. 8. Sumur Meleleh Vil. 9. Pasar Baru Vil. 10. Jitra Vil. 11. Bajak Vil. 12. Tengah Padang Vil. 13. Kampung Bali Vil	Ratu Agung : 1. Lempuing 2. Kebun Tebeng 3. Tanah Patah 4. Nusa Indah 5. Kebun Beler Vil. 6. Kebun Kenanga Vil. 7. Sawah Lebar Vil. 8. Sawah Lebar Baru Vil.	Ratu Samban : 1. Penurunan Vil. 2. Kebun Dahri Vil. 3. Belakang Pondok Vil. 4. Anggut Dalam Vil. 5. Kebun Geran Vil. 6. Pengantungan Vil. 7. Anggut Bawah Vil. 8. Padang Jati Vil. 9. Anggut Atas Vil.
Gading Cempaka : 1. Padang Harapan 2. Panorama 3. Jembatan Kecil 4. Jalan Gedang 5. Lingkar Barat 6. Cempaka Permai	Sungai Serut : 1. Kampung Kelawi Vil. 2. Semarang Vil. 3. Tanjung Agung Vil. 4. Tanjung Jaya Vil. 5. Surabaya Vil. 6. Pasar Bengkulu Vil. 7. Sukamerindu Vil.	Muara Bangkahulu: 1. Bentiring Vil. 2. Bentiring Permai Vil. 3. Rawa Makmur Vil. 4. Rawa Makmur Permai Vil. 5. Kandang Limun Vil. 6. Beringin Raya Vil. 7. Pematang Gubernur Vil.
Selebar : 1. Suka Rami Vil. 2. Bumi Ayu Vil. 3. Pagar Dewa Vil. 4. Sumur Dewa Vil. 5. Bentungan Vil. 6. Pekan Sabtu Vil.	Kp. Melayu : 1. Kandang Vil. 2. Kandang Mas Vil. 3. Teluk Sepang Vil. 4. Sumber Jaya Vil. 5. Padang Serai Vil. 6. Muara Dua Vil.	Singaranpati : 1. Dusun Besar Vil. 2. Padang Nangka Vil. 3. Timur Indah Vil. 4. Sidomulyo Vil. 5. Lingkar Timur Vil.

2.2.3 Data Analysis Technique

Geo Database Development

The spatial database development conducted by several reasons such as:

1. The research used the spatial and a-spatial data. Spatial data are still lacking in quantity and quality. The main source of spatial data is IKONOS satellite imagery of 2011.

2. There are no spatial vector data available, especially in the context of research proposed. The spatial data based built through digitization, normalization and standardization of data. Normalization is intended to compile the data structure to prevent problems in the processing of the database. Standardization is intended to equalize the database used to be inter-connected spatial and non spatial data.

3. Preparation of spatial database is intended to prepare spatial poverty data, land use and accessibility data attribute to be used in the spatial descriptive (mapping) and non-spatial analysis (geographycally weighted regression).

Spatial Data Analysis

Processing and analysis of data using spatial data processing software based on Geographic Information System (GIS). Some types of analysis used are:

1. Overlaying

Spatial thematic map overlayed with poverty maps to produce a map of the characteristic relationship between commercial land use and poverty. Overlaying describe the varying relationship between the variables among the location of observation.

2. Spatial Pattern Analysis

There are several tests used to detect the presence of spatial dependencies or spatial autocorrelation Based on many literatures and paper this model is dominated by Moran's I, formulated :

$$I = \frac{N \sum_{i=1}^{n} \sum_{j=1}^{n} w_{ij}(x_i - \overline{x})(x_j - \overline{x})}{(\sum_{i=1}^{n} \sum_{j=1}^{n} w_{ij}) \sum_{i=1}^{n} (x_i - \overline{x})^2} \tag{1}$$

I   : Moran's Index

N   : Number of observation location

Xi   : Number of events in local variable i

Xj   : Number of events in local variable j

$\overline{x}$: Average number of event in local variable x

Wij   : Element in the weight matrix between i and j,

"The coefficient of Moran's I used to test the spatial dependency or autocorrelation between observations or location" [7]. The hypothesis is:

H0   : I = 0 (no autocorrelation between locations)

H1   : I $\neq$ 0 (autocorrelation between locations)

$$Z_{hitung} = \frac{I - I_o}{\sqrt{var(I)}} \sim N(0,1) \tag{2}$$

The statistic test used is as follows:

The conclusion reject H0 if $\left| Z_{value} \right| > Z_{\alpha/2}$. The value of the MI is between -1 and 1. If I > I0, the data has a positive autocorrelation, if I < I0, the data has negative autocorrelation. The Morran Index close to 1 indicates there is a strong positive autocorrelation, otherwise if approached - 1 there is a negative autocorrelation. If the value close to -1/(n-1) indicates the distribution of variable values are random [8].

$$C_i = \sum Cij \tag{3}$$

c_i = total value of the i-th row

c_{ij} = Value of row *i*-th column *j*-th

A value of 1 is given if the area-i is adjacent to the area-j, whereas a value of 0 is given if the area-i is not adjacent to the area-j. Lee and Wong in Syafitri et.al (2008) refer to this matrix with binary matrix, and also called connectivity matrix, denoted by C, and cij is the value in the matrix of the i-th row and j-th column. The matrix C has several characteristics. First, the diagonal elements of the matrix C is 0, because it is assumed that an area is not adjacent to itself. Second, the matrix C is a symmetrical matrix, an upper triangular matrix is a reflection of lower triangular matrix. Third, the number of values in the *i*-th row is the number of neighbors that are owned by the *i*-th area. Notation addition line:

Binary matrix is used to determine the spatial weights that describe the interaction strength between points of observation. To see how much influence each neighbor to an observation point (i) can be calculated from the ratio between the value in certain areas (i) the total value of its neighbors. The result is the value of the weighting (w_{ij}) for each neighbors connection. The formulation is: $w_{ij} = c_{ij}/c_i$ (4)

w_{ij} : Elements in the matrix weight between regions i and j

3. Cluster Mapping Analysis

The cluster analysis used is the clustering based on the modeling results GWR, cluster mapping is made from

the results of modeling the GWR. Some mapping clusters composed of coefficients of each variables predictor, residuals, and clustering based on the analysis of spatial patterns.

3. Statistical Analysis

3.1 Geographically Weighted Regression (GWR)

Geographically Weighted Regression (GWR) is a development model of the usual regression. GWR produces parameter estimator models that are locally. Spatial modeling techniques in GWR considered the locational factor in the regression model. The problem of poverty data could have been influenced by the location (space) and neighborhood, so the data in each observation unit are difficult to be assumed independently. The Tool that accommodates this problem is Geographically Weighted Regression (GWR).

GWR Model is a simple regression model that has been converted into a weighted regression model [9]. Each parameter value will be calculated at any point of geographical location so each point geographic location has a different regression parameter value. This will give a variation on regression parameter values in a set geographic area. If the value of the regression parameter in each geographic region is constant, the GWR model is global models or ordinary least square regression. Means each geographical region has the same model. The general form of GWR is as follows.

$$y_i = \beta_0(u_i, v_i) + \sum_{k=1}^{k=n} \beta_k(u_i, v_i) x_{ik} + \varepsilon_i \tag{5}$$

On the GWR models assumed that the observation data close to point-i have a great influence on the estimation of the $\beta_k(u_i, v_i)$ rather than being away from point-i. In GWR an observation on the i-th is weighted by the value associated with that point. w_{ij} weights, for j = 1, 2, ... , n, at each location (u_i, v_i) is obtained as a continuous function of the distance between point-to-i and other data points.

3.2 Bandwidth

Bandwidth is a measure of the distance weighting function and the extent of influence a location to other locations.

There are currently three different approaches for exogenously estimating the kernel bandwidth in GWR, direct assignment of the bandwidth of number of nearest neighbors, cross-validation and a corrected Akaike Information Criterion. The corrected AIC that use in this paper is a compromise between goodness-of-fit of the model and model complexity, in that there is a penalty in the criterion for the effective number of parameters in the model.

3.3 Spatial Weighted Matrix

The weighting W(*i*) calculated for each *i* and *wij* indicates the closeness or weight of each data point to the location *i*. This is what distinguishes GWR with other Weighted Least Square, which is generally having a constant weight matrix. The role of the weight is very important because it represents a weighted value of an observation data with another. Type of weighting functions that be used is adaptive Gauss kernel function, where the weight value that will decrease following the *Gaussian* function when d_{ij} getting greater.

$$w_j(u_i, v_i) = \exp[-1/2(d_{ij}/b)^2]$$ (6)

4. Result and Discussion

Many assumptions underlying the global regression model, one of that is the observations should be independent of one another. The characteristic of spatial data set is there are a spatially autocorrelation, indicating every observation is associated with a specific geographic location. Its will lead parameter model estimation inefficient in global regression.

The solution for this problem is spatial statistic model, that control spatial effect in model equation. Ones popular tools to investigate spatial autocorrelation is Moran Index.

According to the equation (1) MI for Bengkulu municipal poverty data set is 0,7158. This value showed that there are positive spatial autocorrelation. The spatial pattern of these poverty data sets is clustered.

From GWR results, we can say that there are spatial varrying relationship between observed variables. The variation of relationship different among innercity, intermediatery area and phery-phery.

Otherwise the differ bandwidth choice made different value of variable association, the adaptive better than fixed model.

The empirical evidence regarding a connection between the commercial land use and accessibility on poverty reduction, prove that a relationship differs at different location of observation. Application of GWR in this paper using fixed and adaptive kernel.

First, the spatial context solves each local regression analysis is a fixed distance.

Second, Gaussian kernel is a function of a specified number of neighbors, where feature distribution is dense, the spatial context is smaller; where feature distribution is sparse, the spatial context is larger. Bandwith type is Akaike Information Criterion (AICc). We fit the following GWR model,

The result as table 1 explained model with adaptive kernel marked reduction AICc coeficient than fixed, its means better than fixed model. The level of correlation using value of R^2 and R^2 adjusted give the same prudence [10], whereas adaptive stronger than fixed, these proved that adaptive kernel model better than fixed.

Table 4: Model Fit with spatial context FIXED dan ADAPTIVE Kernel

Jenis Koefisien	Fixed Kernel	Adaptive Kernel
AICc	-147,723110	-153,508415
R2	0,441349	0,566187
R2 Adjusted	0,358492	0,452242

The more information from *adaptive kernel model* indicate that the variation of poverty can explain by the coefficient of determination (R^2) at GWR adaptive models is 0,5661, meaning that the influence of variable predictors (commercial land use and accessibility) to the diversity of the percentage of variable response (poverty) is 56.61% and 43,39% is the influence of other factors that are not explained in GWR adaptive models. The local regression model gives the lowest R^2 is 0,006797 for Rawa Makmur Permai Muara Bangkahulu sub district, mean in this village ability of model only 0,68%. The highest R^2 is 0,6656 in Teluk Sepang Kampung Melayu sub district, means model able to explain 66,56% the diversity of variable response. The differentiation of R coefficient indicates the variation of the model's ability depend on space or observation location.

GWR gave the local regression coefficient vary involve urban village administrative data set. A positive value indicate that poverty increase when commercial land use and accessibility developed, and a negative value means, poverty reduced when commercial land use and accessibiliy increase. The varying local regression coefficient showed in table 2.

Table 5: Interval of GWR Coefficient Fixed and Adaptive Kernel Model

Parameter	Fixed Kernel		Adaptive Kernel	
	Minimum	Maximum	Minimum	Maximum
b0	0,126986	0,431930	-0,030242	0,401401
b1	-0,294190	0,256897	-0,403078	0,332133
b2	-0,019333	0,005442	-0,016869	0,011226

From adaptive kernel model, the local regression coefficient of X1 (commercial land use) minimum value is -0,403078 for Malabero and maximum is 0,332133 for Sumur Dewa, average of the coefficient is -0,05200.

This point argue when commercial landuse increase, will reduce poor people vary in every observation unit.

In some location can be reduce but in the other location will increase poverty.

The local accessibility regression coefficient is between -0,016869 – 0,011226. Its mean some region could be reduce and some increase poverty.

Location with minimum and maximum coefficient is Teluk Sepang and Anggut Bawah.

5. Mapping GWR Results

Both negative and positive GWR results, have the sufficient information to be able to discern the areas where local parameter estimates have significant local t-values.

Tabel 6: The location of GWR parameter estimate for commercial land use (X1) and accessibility (X2) on significance less than 95% (α 0,05)

Variable	Location of Observation
X1	Kel. Pasar Melintang, Pintu Batu, Penurunan, Lingkar Barat, Kebun Ros, Bumiayu, Sumur Meleleh, Malabro, Kebun Keling, Sukamerindu, Bajak, Jalan Gedang
X2	Kel. Pasar Berkas, Pondok Besi, Surabaya, Pasar Melintang, Tanjung Jaya, Anggut Dalam, Pintu Batu, Penurunan, Kebun Geran, Lingkar Barat, Lingkar Timur, Anggut Atas, Padang Nangka, Teluk Sepang, Betungan, Padang Serai, Kandang, Kandang Mas, Pematang Gubernur, Panorama, Sumber Jaya, Cempaka Permai, Tanah Patah, Kebun Beler, Lempuing, Bumiayu, Sumur Meleleh, Malabro, Kebun Keling, Sukamerindu, Bajak, Jalan Gedang, Pekan Sabtu, Sumur Dewa

Referred to table 3 the descriptive analysis of local regression coefficients can be mapped as figure 2.

Figure 2a, explained the observation unit in inner city able to *reduce* poverty from 0,256 – 0,403 percent when commercial land use increase 1 percent.

Move to intermediatery area or near sub city center the ability of X1 to support poverty alleviation more less than innercity its only 0,256-0,108 percent.

Contradiction result in near phery-phery area indicate that expanding commercial land use will increase poor people.

Its seen at number of observation unit 0, 43 and 57.

The other area do not signify.In figure 2b, accessibility has a different effect on poverty.

In innercity more access improved poor people, shift to intermediatery area the ability of this variable to improve poverty more decline and in phery-phery area accessibility give effect to reduce poverty.

Improve 1 unit of village accessibility (length of road divided into village area) can induce 0,0056-0,0112 percent poor people around innercity.

Near intermediatery area and phery-phery accessibility development can reduce poverty from 0,0056-0,0168 percent.
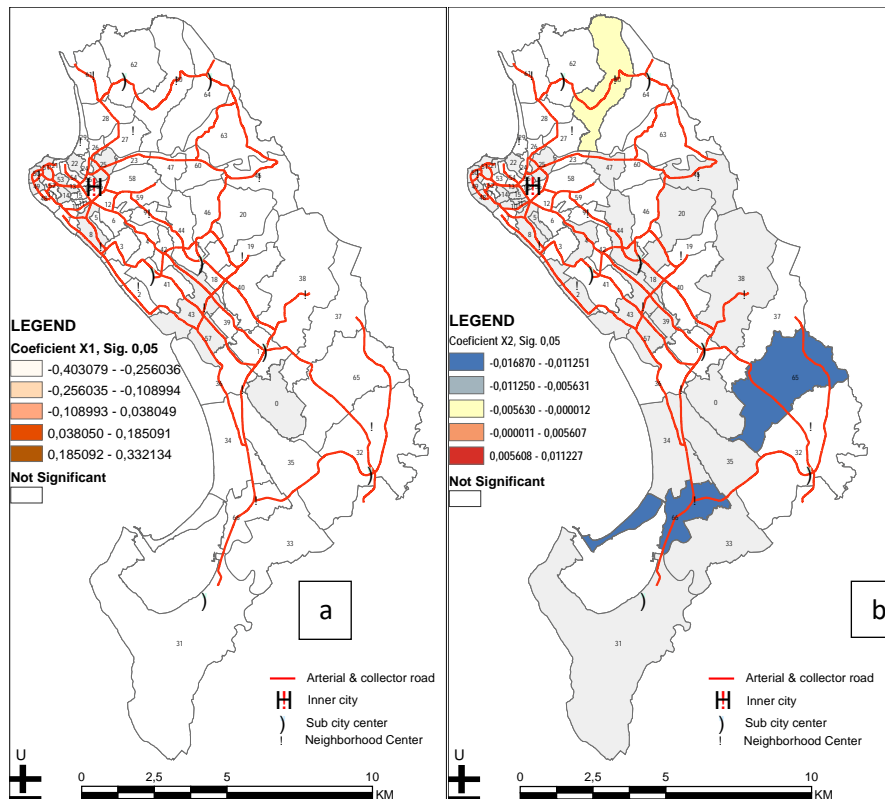
Figure 2: The GWR results map with significance less than 95% (α 0,05): *a* parameter estimate map of commercial landuse; *b* parameter estimate map of accessibility.

6. Conclusion

The result of this study suggest that urban landuse able to reduce poverty by directing its use in zoning regulation, urban landuse plan or spatial development plan. Commercial land use and accessibility influences urban poverty contrary. In inner city commercial landuse **reduce** poverty more than phery-phery and intermediatary area, but accessibility going reduce to **induce** base on phery-phery to inner city. There are spatial variation relationship between dependent and independent variable, for every observation on geographycal location (east, north).

It is recommended that urgently to expand this research by exploring more distric, landuse thematic and municipal in Indonesia which is implementing spatial development plan and regulation massively. The basic idea in this study can be used as a stimulus research to explain : (1) varying spatial relationship between urban land use and accessibility on urban poverty, (2) Allocating urban land use and locating accessibility could not lead on urban activities only but have to aware its impact on urban poverty positive or negative.

The approach of spatial development policy and regulations need to include the spatial effect on poverty as one of the planning substance. Means promote this idea as a goal of regional or urban spatial plan. Being this as a field of spatial planning not only substantive aspect, but achieving normative level. Poverty as a human behavior or culture can be changed with allocating land use and locating accessibility around them.

References

[1]   https://www.bps.go.id/subject/23/kemiskinan-dan-ketimpangan.html [Mei. 6, 2015]

[2]   https://www.pu.go.id/guntingan/6/penataan-ruang/index [Apr. 17, 2015]

[3]   Mooya M and Cloete CE. "Land Tenure and urban poverty alleviation: Theory, Evidence and New Direction", in FIG Working Week, 2008, pp.1-16.

[4]   Kuncoro M. Ekonomi Pembangunan, Teori, Masalah dan Kebijakan. Yogyakarta: Unit penerbitan dan percetakan Akademi Manajemen Perusahaan YKPN, 1997, pp. 67-68.

[5]   C.R. Laderchi, Ruhi Saith & Frances Stewart. Does it Matter that we do not Agree on the Definition of Poverty? A Comparison of Four Approaches. Oxford Development Studies, Vol. 31, pp. 243-274. Sep. 2003.

[6]   Tim Nasional Percepatan Penanggulangan Kemiskinan. Basis Data Terpadu (BDT) untuk Program Perlindungan Sosial. Jakarta: TNP2K. 2012.

[7]   Syafitri UD, Bagus S and Salamatuttanzil. "Pengujian Autokorelasi terhadap Sisaan Model Spatial Logistik". Seminar Nasional Matematika dan Pendidikan Matematika Universitas Negeri Yogyakarta, 2008, pp. 264-268.

[8]   Vasiliev, IR. "Visualization of Spatial Dependence: An Elementary View of Spatial Autocorrelation". Di in Practical Hand Book of Spatial Statistics,. Arlinghaus SL, Griffith DA, Arlinghaus DC, Drake WD and Nystuen JD, Ed. Florida: CRC Press, 1995, pp. 17-30.

[9]   Fotheringham A.S, Brunsdon C and Charlton M. Geographically Weighted Regression: the analysis of spatially varying relationships, Chichester: Wiley, 2002.

[10]   Bambang J. Ekonometrika: Pemodelan dan Pendugaan, Bogor: Penerbit IPB Press, 2009.