

## THE INFLUENCE OF SPATIAL URBANIZATION TO REGIONAL CONDITION IN PERIURBAN AREAS OF YOGYAKARTA

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### ABSTRACT

*It is interesting to study periurban areas because of its transitional characteristic. Periurban areas undergo dynamic changes as a result of spatial urbanization. This study is aimed at: (1) examining the development pattern of spatial urbanization in Yogyakarta and finding out the influential determinant factors; (2) examining the dynamics of land use changes in periurban areas and finding out the resultant impacts; (3) examining the pattern and development of services (infrastructures) and finding out the determinant factors supporting the development of services (infrastructures) in periurban areas; (4) examining the role of the development of periurban services (infrastructures) as magnetic forces for periurban development; and (5) making policies concerning periurban development and management in order to achieve optimal development and to balance the functions of urban and rural areas. The methods used in this research are secondary data analyses and aerial photo interpretation. This study applies secondary data analysis by comparing the data to find out the extent of the changes. Descriptive statistics, scaling, and discriminant analysis are used as the analytical techniques to find out the determinant factors of urban growth in periurban areas. Spatially, urbanization in Yogyakarta periurban areas tends to move toward the western part (Ngestiharjo village), northern part (Catur Tunggal village) and eastern part (Banguntapan village). Besides centrifugal forces, the development of built land and urban characteristics in the western, northern and eastern parts are also influenced by the main roads (corridors) from Yogyakarta to Kaliurang, from Yogyakarta to Wates, and from Yogyakarta to Solo. The existence of the corridors prompts the functions of trade and services which, in turn, trigger the development of the surrounding housing complex. On the contrary, in the southern and south-east part of Yogyakarta the activities of service have not yet well-developed and neither have the new housing complex. The development of number and density population are variables determining urban development in Yogyakarta periurban areas. The dynamics of land use changes in Yogyakarta periurban areas are characterized by the decrease in agricultural land (6.46 % per year) and the increase in built land. The decrease in agricultural land reduces the sustainability of agricultural environment. Agricultural production can no longer satisfy periurban people's needs for food. The different strength in interaction results in the difference in the facilities of service (infrastructure) between periurban areas. The periurban dynamics in Yogyakarta are also characterized by the increase in function and sustainability of services. The development of service (infrastructure) in Yogyakarta periurban areas have a lot of impacts especially those related to the increase in urban characteristics. In some parts of periurban areas, there is a relation between the increase in service provision and the development of urban characteristics.*

*Keywords : Influence, Spatial Urbanization, Regional Condition, Periurban Areas*

### INTRODUCTION

Periurban areas are interesting to study in terms of their transitional characteristics. These areas are dynamic and un-

dergo continue development as a result of spatial urbanization. Yogyakarta periurban areas also experience such kind of development triggered by the development of housing complex and infrastructures as a

consequence of urban center centrifugal movement and government policy. The development of housing complex and infrastructures in periurban areas will potentially change the areas into urban (built up areas). In many cases, some areas grow even faster than the prediction. It can be seen from the mega or mini projects conducted by developers in the form of residential resorts, mini estates, agro-estates, and integrated resorts in periurban areas (Lee, 1979). Without the readiness of regional socio-economic basis, this phenomenon has reclassified suburban areas into urban areas, and hence, it does not encourage the functional change of the areas. Also, the spatial physical changes (interchange dynamic) caused by land exploitation and infrastructural development in periurban areas have caused spatial fragmentation.

In fact, periurban areas have no uniform spatial characteristics. Periurban areas appear in diverse physical characteristics (Yunus, 2001). The diversity is influenced by the centrifugal and centripetal movement as well as the magnetic forces (Colby, 1959). The various magnetic forces in periurban areas bring about the different spatial appearance. The development of functional agglomeration and the additional facilities in periurban areas prompt the functional changes of the surrounding land. These phenomena generate the existence of spatial transformation in periurban areas. The development of new functions because of spatial transformation will have an impact on the socio-economic condition of periurban residents (Garland, et. al., 2007). Reorientation of land use and economic activities will be the consequence of the change in land value.

This research is aimed at:

1. Studying the developmental pattern of spatial urbanization in Yogyakarta and finding out the influential determinants.
2. Studying dynamic changes of land use in periurban areas and finding out the impacts
3. Studying the developmental pattern of infrastructure and finding out the determinant factors that support the infrastructural development in periurban areas.
4. Examining the role of infrastructural development as a magnetic force for the periurban development.
5. Making policies concerning periurban development and management in order to achieve optimal development and to balance the functions of urban and rural areas.

With the above objectives, the research results hopefully will be able to provide direction for policy makers (local government) or city planners to formulate realistic spatial policies in managing periurban areas as a part of urban developmental management. In addition, the research results will be able to be employed as guidance in the development of housing complex and infrastructures in periurban areas in order to achieve optimal development and to balance the functions of urban and rural areas.

## **RESEARCH METHOD**

### **Diagram of Framework Flow**

The methods used in this research are secondary data analyses and aerial photo interpretation. The approach employed in this research is the theme of pattern, pro-

cess, and impact. To understand the pattern, physical morphological approach is used in terms of deductive reasoning. The discussion of developmental process and impact employ empirical approach (1996 and 2006). The variables used in this research covering landuse, production, number dan density of population, livelihood, number and types of services. That variables source from Village Potentialities Data. The analytical techniques used namely descriptive statistics, scaling, and discriminant analysis are used to find out the determinant factors of urban growth in periurban areas.

The characteristics of periurban area is used to determine of periurban areas. In this research, the selected periurban areas are located around Yogyakarta city (parts of Sleman dan Bantul Regency). Those areas are indicated by the mixture of urban and rural land uses. This mixture is the main characteristic of a periurban area. The sample areas are selected purposively by considering the aspect of developmental speed, developmental orientation, intensity and form of land changes, and accessibility rate.

The analyses in this research are divided into three main groups : (1) analysis of pattern, (2) analysis of process (development), and (3) analysis of impact. These three analyses are related to each other in explaining the changes in periurban areas. The view of changes include the infrastructural development, spatial transformation, and socio-economic condition of periurban residents. The analysis of pattern has three dimensions : (1) spatial dimension, (2) temporal dimension, (3) spatial policy dimension (Yunus, 2001). Next,

the research on physical spatial aspect and socio-economic condition of periurban residents is conducted to analyze the impact. Air photo interpretation and Geographic Information System are used to examine the spatial transformation. This research employs time series data to examine the development.

## **RESEARCH RESULT AND DISCUSSION**

### **Spatial Urbanization of Yogyakarta Periurban Areas**

Every year, Yogyakarta periurban areas develop significantly. It is shown from the extension of urban physical appearance as a result of spatial urbanization. The pattern of spatial urbanization in periurban areas can be identified by observing the development of built land and the extent urban development in Yogyakarta periurban areas.

The development of built land is one of the elements when observing the urban development. The development of built land will show physical development of buildings. Therefore, urban characteristics can be clearly observed physically. The development of built land in periurban areas is the impact of urban development (McGee, 1987).

Spatially, urbanization in Yogyakarta periurban areas tends to move toward the western part (Ngestiharjo village), northern part (Catur Tunggal village) and eastern part (Banguntapan village) (Table 1 and Figure 1). Besides centrifugal forces, the development of built land and urban characteristics in the western, northern and eastern parts are also influenced by the main

roads (corridors) from Yogyakarta to Kaliurang, from Yogyakarta to Wates, and from Yogyakarta to Solo. The existence of the corridors prompts the functions of trade and services which, in turn, trigger the de-

velopment of the surrounding housing complex. On the contrary, in the southern and south-east part of Yogyakarta the activities of service have not yet well-developed and neither have the new housing complex.

Table 1. The Dynamics of Built Land in Yogyakarta Periurban (1996 and 2006)

Village	Spatial Location	Wide of Areas (Ha)	Wide of Built Land 1996 (Ha)	Wide of Built Land 2006 (Ha)	% Wide of Built Land 1996 (Ha)	% Wide of Built Land 2006 (Ha)	% Increase	Classification
TAMANAN	South	375.00	87.50	111.00	23.33	29.60	6.27	Low
WIROKERTEN	Southeast	386.20	97.50	126.00	25.25	32.63	7.38	Low
POTORONO	Southeast	390.00	89.80	109.00	23.03	27.95	4.92	Low
BATURETNO	East	393.60	96.10	135.00	24.42	34.30	9.88	Medium
BANGUNTAPAN	East	833.30	423.10	551.00	50.77	66.12	15.35	High
BANGUNHARJO	South	679.10	277.80	327.00	40.91	48.15	7.24	Low
PANGGUNG HARJO	South	560.90	254.50	323.00	45.37	57.59	12.21	Medium
TIRTONIRMOLO	Southwest	513.00	244.30	313.00	47.62	61.01	13.39	Medium
NGESTIHARJO	West	510.00	293.00	421.00	57.45	82.55	25.10	High
BANYURADEN	West	400.00	198.40	227.00	49.60	56.75	7.15	Low
NOGOTIRTO	West	349.00	168.60	192.00	48.31	55.01	6.70	Low
TRIHANGGO	Northwest	562.00	156.80	226.00	27.90	40.21	12.31	Medium
SINDUADI	North	737.00	285.80	371.00	38.78	50.34	11.56	Medium
CATUR TUNGGAL	North	1104.00	751.20	968.00	68.04	87.68	19.64	High
<b>TOTAL</b>		<b>7793.10</b>	<b>3424.40</b>	<b>4400.00</b>	<b>43.94</b>	<b>56.46</b>	<b>12.52</b>	

Source: Result of Data Analysis of Village Potentialities in 1996 and 2006

Spatial urbanization in periurban areas can also be identified from the extent of urban development. This development is studied using multivariate statistics. The appropriate method is discriminant analysis. Before applying discriminant analysis, variables characterizing urban development are classified and presented in the form of a table. The table contains the composite scores of the development of each variable characterizing urban development (Table 2.). Total scale scores of the development of each variable describe the final result of overall development. The measurement of the development composite

index will show the development of urban characteristics of every village. The final development score will then be tested to find out the most determinant factor of urban development.

The table shows that the level urban development rates in Yogyakarta periurban areas varied throughout regions. There were four villages with high development rates, namely Sinduadi (northern), Ngestiharjo (western), Banguntapan and Baturetno (eastern). This fact shows the trend of the extension of level urban development. Spatially, it is obvious that urban characteris-

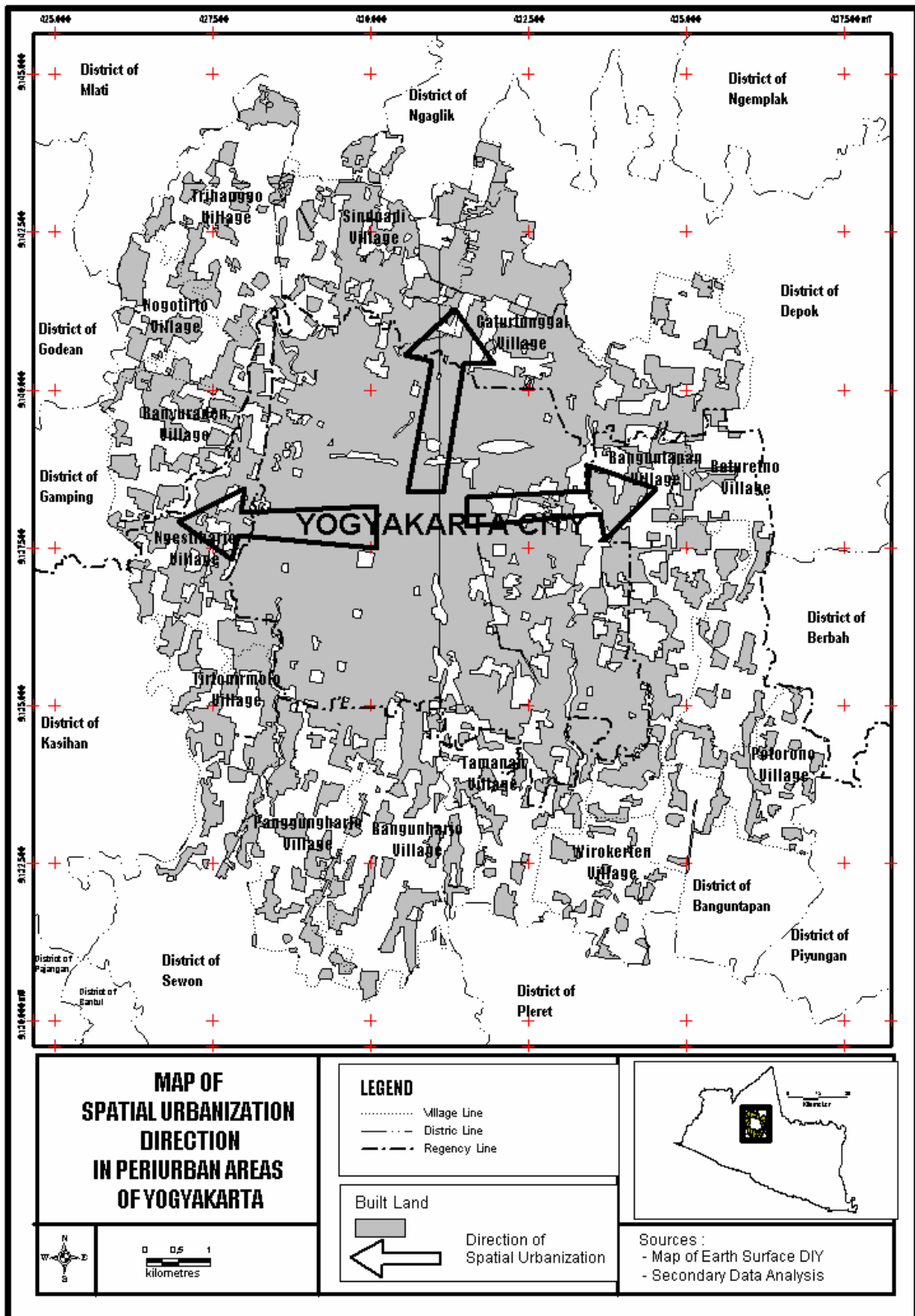


Figure 1. Spatial Urbanization Direction in Periurban Areas of Yogyakarta (1996 – 2006)

tics developed to northern, western and eastern parts of Yogyakarta periurban areas. The northward development reached not only to Catur Tunggal village but spread out to the west of Catur Tunggal, i.e. Sinduadi village.

The eastern rapid development shows the strong influence of the city. Two villages, Banguntapan and Baturetno, showed the categories of high urban development. The western part, represented by Ngestiharjo village, provided a good access from the western areas. In the southern parts of Yogyakarta, urban characteristics were not well developed as a result of the low growth of service functions.

Next, discriminant analysis is applied to find out the determinant factors of urban development. Discriminant analysis is

a multivariate technique as a part of dependence method involving dependent and independent variables. It means that the result of some variable depends on the data of independent variables. The specific features of this analysis are that the data of dependent variable must be in the form of category data and that the independent data must be in the form of non-category data. The variable used here is the urban development measured using scaling technique. The result of discriminant analysis is presented in the following table:

The above table presents the analytical test on the difference of group means of each independent variable toward dependent variable. After finding the difference of group means of each variable, the variable with real difference can be determined. This variable becomes a determinant vari-

Table 2. Classification of Urban Characteristic Development in Yogyakarta Periurban Areas (1996 and 2006)

Village	Spatial Location	Development Scale Score						Total	Classification
		Population Number	Population Density	Non-Agrarian Household	Built Land Size	Service Facility Provision	Function of Service Facilities		
Tamanan	South	25.61	25.61	14.21	6.66	79.41	57.66	209.16	Low
Wirokerten	Southeast	52.55	52.55	61.44	12.18	74.91	40.11	293.73	Medium
Potorono	Southeast	47.85	47.85	100.00	0.00	73.90	42.64	312.25	Medium
Baturetno	East	80.16	80.16	47.90	24.59	77.90	60.76	371.45	High
Banguntapan	East	48.74	48.74	78.80	51.68	100.00	89.45	417.40	High
Bangunharjo	South	0.00	0.00	22.41	11.51	85.94	100.00	219.86	Low
Panggunharjo	South	49.61	49.61	0.00	36.13	80.90	64.69	280.93	Medium
Tirtomirmolo	Southwest	18.31	18.31	63.97	41.98	60.64	0.00	203.21	Low
Ngestiharjo	West	48.56	48.56	82.52	100.00	82.71	51.96	414.31	High
Banyuraden	West	53.78	53.78	38.21	11.04	73.17	37.39	267.36	Medium
Nogotirto	West	51.20	51.20	56.34	8.83	70.79	13.18	251.54	Low
Trihanggo	Northwest	5.15	5.15	57.39	36.63	75.47	22.15	201.95	Low
Sinduadi	North	100.00	100.00	56.47	32.90	78.06	49.29	416.71	High
Catur Tunggal	North	60.68	60.68	57.49	72.93	0.00	8.78	260.57	Medium

Source: Result of Data Analysis of Village Potentialities in 1996 and 2006



Table 3. The Result of Discriminant Analysis

	Wilks' Lambda	F	Df1	Df2	Sig
Scale score of the development of population number	0.386	8.746	2	11	0.005
Scale score of the development of population density	0.386	8.746	2	11	0.005
Scale score of the development of non-agrarian households	0.869	0.830	2	11	0.462
Scale score of the growing size of built land	0.769	1.657	2	11	0.235
Scale score of the development of service facility provision	0.801	1.368	2	11	0.295
Scale score of the development of service facility function	0.845	1.007	2	11	0.397

Source: Result of Data Processing

able since according to the principle of discriminant analysis, a determinant variable determines the difference of each group or is often called a distinguishing variable.

The variable determining the difference can be seen in the probability or the significance score (sig). If the probability or sig. score < 0.05. there is a real difference between groups caused by the variable. If the probability or sig. score > 0.05. there is no real difference between groups. Having found out the distinguishing variable. the variable determining the difference of urban development in survey areas can be identified the development of population number and of the development of population density (sig. score < 0.05) are variables determining the difference of urban development in research areas.

That condition indication that growth of population number in periurban areas disseminate not flatten, while other town variable experience of more growth flatten. Periurban areas is place accommodate migrants and urban workers, growth of population number which tend to concentration at selected regional shares, as in

Sinduadi and Catur Tunggal in upstate and also Baturetno in southeast. But that way, growth of high enough population number in the periurban areas do not followed by the have expanding of service types and amount, so that result downhill of serving capacity him and service function. And so it is with factor growth of opportunity of non agriculture disseminating do not in line with spatial growth in Yogyakarta periurban. That Condition if let will be potency peep out the problem of not serving and the increasing of unemployment in some part of Yogyakarta periurban especially at upstate region and south-east.

Transformation in Yogyakarta periurban areas was also identified by land use changes. especially related to agricultural land (Yunus, 2000). According to the data. from 1996 to 2006 the agricultural land in Yogyakarta periurban areas had reduced to 4658.03 hectare. The decrease of 64.58% in agricultural land is of high significance. It means that during the period the conversion of agricultural land to non-agricultural land in Yogyakarta periurban areas reached 6.46% per year (Table 4).

The high percentage of agricultural land conversion resulted from people's growing needs of residential land. A lot of new residential buildings were built in Yogyakarta periurban areas to accommodate the growing number of population interested to live in periurban areas. These areas were interesting for living because of the comfort and the considerable price of the land. In addition, the conversion of agricultural land also resulted from the development of urban functions as the manifestation of urban development. The development of urban functions generated the growing demand for the establishment of trade centers, offices, and service facilities. This condition converted the agricultural land into non-agricultural land so that the agricultural land decreased.

Spatially, the decrease in agricultural land was primarily observed in the northern and western part. In the northern part, Catur Tunggal village suffered the highest-level land conversion, reaching 9.54 % per year. In the western part, Ngestiharjo village suffered the highest-level land conversion, reaching 8.47 % per year. In the northern part, the high-level land conversion was caused by the growing number of educational functions (universities) and trade centers that converted the agricultural land in Sinduadi village into non-agricultural land. The location of Sinduadi village on the access road between Yogyakarta and other important areas in the northern part induced the high-level land conversion. In Ngestiharjo village, land conversion was primarily instigated by the development of roads that

Table 4. The Dynamics of Agricultural Land Size in Yogyakarta Periurban Areas (1996 and 2006)

No	Village	Periurban Location	Agricultural Land Size in 1996 (Ha)	Agricultural Land Size in 2006 (Ha)	Decrease in Agricultural Land Size (1996-2006) (Ha)	% Decrease in Agricultural Land Size (1996-2006) (Ha)	Annual Decrease in Agricultural Land Size	% Annual Decrease in Agricultural Land Size	Class
1	TAMANAN	South	380.54	231	123.24	39.30	14.95	3.93	Low
2	WIROKERTEN	Southeast	392.43	236	133.13	39.86	15.64	3.99	Low
3	POTORONO	Southeast	396.13	262	116.03	33.86	13.41	3.39	Low
4	BATURETNO	East	400.53	232	142.03	42.08	16.85	4.21	Low
5	BANGUNTAPAN	East	838.86	219	550.26	73.89	61.99	7.39	High
6	BANGUNHARJO	South	686.93	343	328.13	50.07	34.39	5.01	Medium
7	PANGGUNG HARJO	South	582.20	226	344.70	61.18	35.62	6.12	Medium
8	TIRTONIRMOLO	Southwest	541.81	199	330.81	63.27	34.28	6.33	Medium
9	NGESTIHARJO	West	576.79	88	487.79	84.74	48.88	8.47	High
10	BANYURADEN	West	424.29	171	251.69	59.70	25.33	5.97	Medium
11	NOGOTIRTO	West	425.40	155	267.30	63.56	27.04	6.36	Medium
12	TRIHANGGO	Northwest	570.72	334	239.72	41.48	23.67	4.15	Low
13	SINDUADI	North	740.67	112	373.37	84.88	62.87	8.49	High
14	CATUR TUNGGAL	North	1114.32	51	969.82	95.42	106.33	9.54	High
	Jumlah		8071.63	2859	4658.03	64.58	521.26	6.46	

Source: Result of Data Processing of Village Potentialities in 1996 and 2006



opened the access to the periurban housing complex. Relatively preservable agricultural land can be found in the southeastern part of Yogyakarta, including Tamanan, Wirokerten, Potorono, and Baturetno villages. In those 4 villages, the residential development and urban functions had not been progressively developed and brought few impacts on land conversion. Therefore, the southeastern part of Yogyakarta can be used as the center of rice production in periurban areas by implementing policies controlling agricultural land conversion. In the south part of Yogyakarta, however, despite its relatively low level, the agricultural land conversion must be well controlled given that most of technically irrigated agricultural land is found in this area.

Periurban areas are often associated with the development of agricultural sector. The land conversion in periurban areas affects agricultural sector. The changes in agricultural sector can be seen in the dynamic carrying capacity of agricultural environment (Soemarwoto, 1982). From 1996 to 2006, there was a significant decrease in the carrying capacity of agricultural environment in Yogyakarta periurban areas (Table 5.). In 1996, the carrying capacity of agricultural environment in Yogyakarta periurban areas was relatively high ( $> 1$ ). Agricultural production could satisfy the needs of Yogyakarta periurban and even urban people. In 2006, however, the carrying capacity of agricultural environment declined significantly. Agricultural production could no longer satisfy the needs of periurban people. This condition was represented by the score of carrying capacity of agricultural environment by  $< 1$  in all villages. Even in Ngestiharjo, Nogotirto, Tirtonirmolo, and Catur Tunggal villages, the carrying capacity of agricultural envi-

ronment was very low indicated by the limited scope of agricultural land; hence, agriculture was no longer considered as a reliable sector.

The decrease in the sustainability of residential environment in Yogyakarta periurban areas stemmed largely from the high conversion of agricultural land into non-agricultural land due to people's growing needs for housing. The land conversion also resulted from the building of various facilities and the development of urban functions in periurban areas. The significant decrease of 19.77 in sustainability of agricultural environment was observed in Catur Tunggal village (Table 5.). This significant decrease resulted from the high level of land conversion due to the development of urban functions and the impacts of urban sprawl. The primary cause of the decrease in agricultural land in Catur Tunggal village was the development of residential areas and facilities especially those associated with educational services. As a result, most of agricultural land was converted into non-agricultural land; and this conversion decreased the sustainability of agricultural environment. Such a significant decrease was also observed in Sinduadi village in the northern part of Yogyakarta city. This village was greatly affected by the growth of Yogyakarta having a tendency to move northward. In addition, the agricultural land conversion in Sinduadi also resulted from the increasing operational use of Yogyakarta – Semarang corridor.

The decrease in the sustainability of agricultural environment in Yogyakarta periurban areas also indicated a transformation in economic sector. Agriculture is no longer a primary sector and is replaced by other economic sectors, especially trade

Table 5. The Dynamic Carrying Capacity of Agricultural Environment in Yogyakarta Periurban Villages (1996 and 2006)

No	Village	Periurban Location	Carrying Capacity of Agricultural Environment Year 1996	Carrying Capacity of Agricultural Environment Year 2006	Decrease in Carrying Capacity of Environmental 1996-2006	Ranking
1	TAMANAN	South	4.76	0.15	4.61	5
2	WIROKERTEN	Southeast	2.51	0.14	2.37	8
3	POTORONO	Southeast	1.41	0.14	1.27	12
4	BATURETNO	East	2.51	0.12	2.39	7
5	BANGUNTAPAN	East	3.05	0.13	2.92	6
6	BANGUNHARJO	South	4.95	0.12	4.83	4
7	PANGGUNG HARJO	South	5.35	0.05	5.30	3
8	TIRTONIRMOLO	Southwest	1.77	0.03	1.74	10
9	NGESTIHARJO	West	1.24	0.01	1.23	13
10	BANYURADEN	West	1.91	0.04	1.87	9
11	NOGOTIRTO	West	1.13	0.03	1.10	14
12	TRIHANGGO	Northwest	1.78	0.11	1.67	11
13	SINDUADI	North	6.50	0.08	6.42	2
14	CATUR TUNGGAL	North	19.80	0.03	19.77	1

Source: Result of Data Processing of Village Potentialities in 1996 and 2006

and service. The development of trade and service sectors can be observed by the increasing growth of trade centers built in agricultural land.

The dynamics of land use changes in Yogyakarta periurban areas had an influence on the change in people's living structure (Montgomery, 2008). The number of non-agrarian household increased reaching 10531 households from 1996 to 2006 (Table 6). The increasing number of non-agrarian household resulted from the limited opportunity in agricultural sector and wider opportunity in non-agricultural sector. The decrease in work opportunity

in agricultural sector was in line with the annual decrease of 6.46 % in agricultural land size. The limited agricultural land made it impossible for households in periurban villages to rely only on agricultural sector. They had to earn additional income from non-agricultural sectors, such as trade and service. Some of periurban households even "pulled" themselves away from agricultural sector by selling their agricultural lands and worked totally in non-agricultural sectors. This changing trend of living structure developed from the wider opportunity in non-agricultural sectors (trade and service) as a consequence of the development of urban functions.

Table 6. Dynamics of the Number of Non-Agrarian Households in Yogyakarta Periurban Villages (1996 and 2006)

No	Village	Periurban Location	Number of Households in 1996	Number of Households in 2006	Number of Non-Agrarian Households in 1996	Number of Non-Agrarian Households in 2006	Increase in Number of Non-Agrarian Households from 1996 to 2006	Annual Increase in Number of Non-Agrarian Households
1	TAMANAN	South	1930	2381	1238	1119	-119	-12
2	WIROKERTIEN	Southeast	1775	2609	923	1278	355	36
3	POTORONO	Southeast	1695	2348	567	986	419	42
4	BATURETNO	East	2067	2737	1138	1314	176	18
5	BANGUNTAPAN	East	3849	7708	3033	6243	3210	321
6	BANGUNHARJO	South	4175	5457	3160	3329	169	17
7	PANGGUNG HARJO	South	4596	5809	3925	3718	-207	-21
8	TIRTONIRMOLO	Southwest	3155	5122	2437	3642	1405	140
9	NGESTIHARJO	West	4242	6556	3041	4917	1876	188
10	BANYURADEN	West	2633	5865	1842	3519	1677	168
11	NOGOTIRTO	West	2635	3152	1832	2049	217	22
12	TRIHANGGO	Northwest	2678	2692	1425	1319	-106	-11
13	SINDUADI	North	6170	9876	5213	7901	2688	269
14	CATUR TUNGGAL	North	10831	9998	10526	9298	-1228	-123
	Periurban Areas		52431	72318	40300	50831	10531	1053

Source: Result of Data Processing of Village Potentialities in 1996 and 2006

The increasing number of non-agrarian household is observed in Sinduadi village. reaching 2688 non-agrarian households from 1996 to 2006. This phenomenon stemmed primarily from the high population growth of 2.34% per year and agricultural land conversion. The growing population number made it impossible to absorb all people to work in agricultural sector. Many of them are employed in non-agricultural sector. This condition also applies in other villages but Tamanan, Catur Tunggal, Trihanggo, and Panggungharjo villages. In these three villages, the number of non-agrarian households decreased. The decreasing number of non-agrarian households is not caused by wider opportunity in agricultural sector but rather caused by the increasing number of popu-

lation moving out of the villages to find better living.

The development of services (infrastructure) is analyzed by observing the development from 1996 to 2006 focusing on the development of provision and function of service facilities. The development of provision of service facilities will show agglomeration of urban socioeconomic activities (Sati and Mansoori, 2007). The development of function of service facilities will show the extent to which each kind of facilities can serve the population of each area.

The change in service facility provision rate is described by the change in centrality index in 1996 and 2006. Centrality index is a description of the number of ser-

vice facilities provided in each area. From the table below, it is seen that the change in centrality index varies throughout villages. The positive centrality index indicates the increase in number and/or kind of service facilities while the negative centrality index indicates the decrease in number and/or kind of service facilities.

The highest centrality index of 3.06 is found in Banguntapan village (Table 7). This figure indicates that for 10 years since 1996 the number and kind of service facilities had increased by 3.06 % of total service facilities for all villages. The smallest centrality index of -8.04 is found in Catur Tunggal village. This figure indicates that since 1996 in Catur Tunggal village the number and kind of service facilities had

decreased by 8.04% of total service facilities for all villages. The changing number and kind of service facilities indicates the dynamic development of Yogyakarta periurban areas.

The dynamics of Yogyakarta periurban development is one of the impacts of urban development. The dynamics also indicate the interaction between urban and periurban areas. The dynamic interaction brings about different regional abilities to absorb urban influences and creates a gap of development among Yogyakarta periurban areas. The different strength in interaction among periurban areas also generates different rate of development of service facilities (Douglass, 1988). The strength in interaction capable of develop-

Table 7. Classification of the Change of Centrality Index of Service Facilities in 1996 and 2006 in Yogyakarta Periurban Areas

Village	Centrality Index of Service Facilities		Change	Scaling	Classification
	1996	2006			
TAMANAN	1.80	2.58	0.78	79.41	Medium
WIROKERTEN	2.68	2.96	0.28	74.91	Medium
POTORONO	2.94	3.10	0.17	73.90	Medium
BATURETNO	3.82	4.43	0.61	77.90	Medium
BANGUNTAPAN	9.58	12.65	3.06	100.00	High
BANGUNHARJO	8.15	9.65	1.50	85.94	High
PANGGUNG HARJO	9.51	10.45	0.94	80.90	Medium
TIRTONIRMOLO	4.77	3.47	-1.31	60.64	Low
NGESTIHARJO	7.75	8.89	1.14	82.71	Medium
BANYURADEN	3.67	3.76	0.08	73.17	Medium
NOGOTIRTO	3.05	2.87	-0.18	70.79	Medium
TRIHANGGO	2.02	2.36	0.34	75.47	Medium
SINDUADI	11.67	12.30	0.63	78.06	Medium
CATUR TUNGGAL	28.60	20.56	-8.04	0.00	Low

Source: Result of Data Processing of Village Potentialities in 1996 and 2006

ing service facilities (infrastructure) was possessed by areas along the corridors of Yogyakarta – Solo, Yogyakarta – Semarang, Yogyakarta – Wates, indicated by the emergence of various kinds of service facilities.

In addition to the increase in number and kind of service facilities, a significant development could also be observed in the functions of service facilities. The development of function described the serving capacity of the service facilities provided to satisfy people's needs in the related areas. The analytical result of the function of service facilities is presented in the following table.

The ratio of service function indicates the abilities of each service facilities in serving the people in a certain area. The higher ratio figure means the higher serving capacity of the service facilities. Totally, the change rate of the function ratio in the research areas is 0.85 (Table 8). It means from 1996 to 2006 the change in serving capacity of each service facility had reached 0.85 %. This figure also means that the serving capacity of each kind of service facility in research area increased by 0.85 % of the number of population in the basic year. In other words, each kind of service facility can serve the growing num-

Table 8. Classification of Change in the Ratio of Service Facility Function in 1996 and 2006 in Yogyakarta Periurban Areas

Village	Number of Population		Ratio between Number of Facilities and Number of Population		Change in Function Ratio	Scaling	Classification
	1996	2006	1996	2006			
TAMANAN	7588	8399	0.65	1.69	1.04	57.66	Medium
WIROKERTEN	8431	9746	0.87	1.67	0.81	40.11	Medium
POTORONO	8208	9418	0.97	1.82	0.84	42.64	Medium
BATURETNO	9041	10906	1.15	2.24	1.09	60.76	High
BANGUNTAPAN	23405	26893	1.12	2.59	1.48	89.45	High
BANGUNHARJO	17272	18312	1.29	2.91	1.62	100.00	High
PANGGUNG HARJO	21186	24377	1.22	2.36	1.14	64.69	High
TIRTONIRMOLO	17045	18640	0.76	1.02	0.26	0.00	Low
NGESTIHARJO	22279	25592	0.95	1.91	0.97	51.96	Medium
BANYURADEN	10227	11845	0.98	1.75	0.77	37.39	Medium
NOGOTIRTO	12240	14119	0.68	1.12	0.44	13.18	Low
TRIHANGGO	11824	12647	0.47	1.03	0.56	22.15	Low
SINDUADI	24451	30379	1.30	2.23	0.93	49.29	Medium
CATUR TUNGGAL	49503	57958	1.57	1.95	0.38	8.78	Low
<b>TOTAL</b>	<b>242700</b>	<b>279240</b>	<b>1.12</b>	<b>1.97</b>	<b>0.85</b>		

Source: Result of Data Processing of Village Potentialities in 1996 and 2003

ber of population; and the number of served people is 0.85 % of total population in the basic year.

The change in the ratio of each village shows no big difference. The biggest difference is found in Bangunharjo village (1.62); and the smallest difference is found in Tirtonirmolo village (0.26). From the classification, four villages, namely Baturetno, Banguntapan, Bangunharjo, and Panggungharjo, underwent a high level of change. This indicates that the highest change in serving capacity is found in the northern, western, and eastern areas. The high level of change is possibly influenced by two primary factors, the increase in number and kind of service facilities and the decrease in the number of population. The

bigger possibility, however, is the increase in number and kind of service facilities.

The development of services (infrastructure) in Yogyakarta periurban areas influenced various conditions especially related to the development of urban characteristics. In several periurban areas, there is a relationship between the increase in service provision and the development of urban characteristics. In Sinduadi, Ngestiharjo, Banyuraden, and Banguntapan villages, the increase in service provision brings about the increasing number of non-agrarian households. This indicates that the increase in service provision especially economic services in the fourth villages can widen job opportunities especially in trade and service sectors. The similar condition can also be ob-

Table 9. Classification of the Increase in Service Provision and Urban Characteristics in Yogyakarta Periurban Areas

No.	Village	Periurban Location	Increase in Service Provision	Increase in the Number of Non-Agrarian Households	Increase in the Number of Population	Increase in the Size of Built Land
1	TAMANAN	South	Medium	Low	Low	Low
2	WIROKERTEN	Southeast	Medium	Medium	Medium	Low
3	POTORONO	Southeast	Medium	Medium	Medium	Low
4	BATURETNO	East	Medium	Medium	High	Medium
5	BANGUNTAPAN	East	High	High	Medium	High
6	BANGUNHARJO	South	High	Medium	Low	Low
7	PANGGUNGHARJO	South	Medium	Low	Medium	Medium
8	TIRTONIRMOLO	Southwest	Low	High	Low	Medium
9	NGESTIHARJO	West	Medium	High	High	High
10	BANYURADEN	West	Medium	High	Medium	Low
11	NOGOTIRTO	West	Medium	Medium	High	Low
12	TRIHANGGO	Northwest	Medium	Low	Low	Medium
13	SINDUADI	North	Medium	High	High	Medium
14	CATUR TUNGGAL	North	Low	Medium	High	High

Source: Result of Data Processing of Village Potentialities in 1996 and 2006



served in Tirtonirmolo village although the increase in service provision is not as high as that in Banguntapan villages (Table 9).

The increase in service provision can also increase the number of population. Such a condition can be found in Baturetno, Nogotirto, Ngestiharjo, and Sinduadi villages. The development of socioeconomic services in fourth villages can serve as magnetic force to attract people outside the areas to live there. The similar situation can also be found in Nogotirto and Baturetno villages. Besides demographical aspects, the increase in service provision also had an influence on physical aspect of land. Related to urban characteristics, the physical aspect of land refers to the size of built land. In fact, the development of service facilities can increase the size of built land. This condition can be observed in Banguntapan and Ngestiharjo villages.

From the above explanation, it can be concluded that the increase in service provision can develop urban characteristics in several periurban areas although it has no significant influence on several other periurban areas especially in the southern part.

## CONCLUSION AND IMPLICATIONS FOR POLICY

### Conclusion

1. Spatially, urbanization in Yogyakarta periurban areas tends to move toward the western part (Ngestiharjo village), northern part (Catur Tunggal village), and eastern part (Banguntapan village). Besides centrifugal forces, the development of built land and urban characteristics in the western, northern and eastern parts are also influenced by the main roads (corridors) from Yogyakarta

to Kaliurang, from Yogyakarta to Wates and from Yogyakarta to Solo. The existence of the corridors prompts the functions of trade and services which, in turn, trigger the development of the surrounding housing complex. On the contrary, in the southern and south-east part of Yogyakarta the activities of service have not yet well-developed and neither have the new housing complex.

2. The development of population number and of the development of population density are variables determining urban development in Yogyakarta periurban areas.
3. The dynamics of land use changes in Yogyakarta periurban areas is designated by the decreasing agricultural land and the increasing built land. The annual rate of land conversion from agricultural to non-agricultural in Yogyakarta periurban areas reached 6.46 %. It resulted from the high pressure on agricultural land especially for residential needs.
4. The reduced agricultural land decreased the carrying capacity of agricultural environment. Agricultural production could no longer satisfy periurban people's needs for food. This condition is represented by the score of carrying capacity of agriculture environment by  $< 1$  in all villages.
5. The different strength in interaction brought about the different development of service facilities among periurban areas. The strength in interaction capable of increasing the development of service facilities (infrastructure) was seen in the interaction between Yogyakarta

and Solo, Yogyakarta and Semarang, and Yogyakarta and Wates. Those three interactions generated various service facilities along the corridors.

6. The dynamics in Yogyakarta periurban areas are also designated by the increase in functions or serving capacity of services. The serving capacity of service facilities in research areas on average increased by 0.85 % of total population in the basic year.
7. The development of services (infrastructure) in Yogyakarta periurban areas influenced various conditions especially related to the development of urban characteristics. In several periurban areas, there is a relationship between the increase in service provision and the development of urban characteristics.

#### **Implications for Policy**

1. It is necessary to plan specific space for periurban areas especially in determining the borders of agricultural land and areas for urban development.
2. The urban planning must be shifted from 'urban oriented' to 'rural-urban oriented'. The 'rural-urban oriented' urban planning will incorporate the interests to develop urban functions and to preserve agricultural land. The sprawl of urban appearance will take the form of 'dispersed plan' instead of the round compact form.

3. Agricultural land in Yogyakarta periurban areas should be developed to the southeastern and southern parts.
4. The location of the construction of facilities and infrastructures should consider the subsequent impacts such as the growing number of buildings for housing and business. This is to anticipate the uncontrolled sprawl of built land that will, in turn, increase the pressure on agricultural land.
5. The development of housing complex gives no support to the development of area functions. Therefore, the residential complex must be developed to certain areas in order to optimize the development of space structure pattern.
6. Urban functions must be evenly distributed to reduce the burden of periurban areas in the northern, eastern, and western parts and to increase the development of southern periurban areas.

#### **Acknowledgements**

Greatest gratitude we say to Directorate General of Higher Education Republic of Indonesia that had funded the research of Hibah Pekerti within 2 years for 2006 -2007 periods through UGM Research Institution that has facilitated the implementation of this research. Special thank is due to Prof. Dr. Frauke Kraas. Dr. Hamhaber. and Knie for their guides and the constructive review.

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