

Land Demand and Land Potential of Central Java in 2030: a Forecast to Promote a More Balanced Development Policy

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1 ABSTRACT

This paper assesses the land demand and the land potential of Central Java-Indonesia for development based on trend in 1994 and 2006 to forecast the situation of 2030. Calculation of the land demand is derived from population projection and land use coefficient formula. Land potential is represented by probability values of transferability from non built-up to built-up area based on several variables namely slope, land use type, distance to previous built-up, and distance to main road. Spatial analyses using Geographic Information Systems (GIS) method are applied to analyse those variables. Based on result of the calculation, if it is assumed that what had been happened from 1994 to 2006 will take place in a similar pattern for 2030, the spatial formation of Central Java will be highly unbalanced. Most of all, land conversion will take place in protected paddy field. These findings provide evidence that the past as well as the current land use development policies are not towards a satisfactory outcome. Growth oriented development policy under centralized government in previous era in addition to the failure to integrate and to harmonize agricultural and industrial activities are recognized as the main factors of the unsatisfactory condition. Therefore, revised development policy framework is required to redirect the trend in order to create a more balanced spatial formation.

2 INTRODUCTION

Rapid urbanization that has been taking place in many developing countries including Indonesia has led to the fact that land allocation has become as a critical issue to optimize the outcome of development. Concerning land allocation terminology, land demand and land supply calculation are considered as two important aspect that needs to be further examined. While land supply is defined as a relatively fix value, land demand for development is likely to vary depends on needs of built-up areas to accommodate number of growth population as well as to fulfill people activities. It is also critical to maintain arable land for food supply as well as to protect land allocation for environmental purposes.

However, the existence of worst disparity and primate city phenomenon in many developing countries provide evidence that current development policy to plan as well as to control or to evaluate land allocation either for urban activities, food security, environmental balance, and other purposes in these countries are still far from satisfying results. In the case of Indonesia, it can be shown from the fact that rapid urban growth is still concentrated in Java Island while actually Java also contributes a significant area of arable land mostly for paddy field to produce rice, staple food in the country (Tambunan, 2003). Concerning the phenomenon, as has been explained by Gilbert and Gugler (2001) and Hugo (1996), there is something principle should be reconsidered in the policy level. Current development policies are likely to maintain disparity or unbalanced development path instead of delineate the disparity or achieving a more balanced development pattern. Therefore, this paper aims to assess the land demand and the land potential of Central Java-Indonesia based on trend in 1994 and 2006 to criticize current phenomena and to forecast the situation of 2030 mostly to further propose revised policy framework to create a more balanced spatial formation in the study area.

This paper is organized into four parts. The first part is an introduction to explain the rationale of this study. The second part briefly explains the land demand and the land potential analyses. The third part discusses the policy aspect focusing on the dilemma between growth and equity oriented policy and relation between agriculture and industry in the context of balanced development. This paper is concluded with some remarks in regard to the importance of clear policy framework through policymaking criteria.

3 LAND DEMAND AND LAND POTENTIAL ANALYSES

3.1 Land Demand: Number of Population Growth and Land Use Coefficient Calculation

Two parts were completed to calculate land demand for 2030 in Central Java province as the study area. The first is number of population growth per district that was determined based on population projection. The

second is land coefficient per district. Land coefficient is estimated number in km² that indicate area needed to accommodate or to be converted for one additional inhabitant in the district .

To estimate number of population growth, there are two scenarios applied for population projection:

- Status quo scenario. The assumption in this scenario is the urban population growth rate take place in similar path with what has been happening before. Therefore, growth rate (r) that has been identified based on 1990 and 2000 population census released by Indonesian central bureau of statistics (CBS) were used to calculate number of population in district level within the province. Concerning the trend that had been taken place since 1990 until 2006, then geometric formula (Pt = Po (1+r)t) were used as this approach was considered as the most suitable formula compared to linear and exponential approach.
- Low projection. Central Java can be categorized as experiencing second stage of transition period where mortality is decline and fertility is still slightly high, therefore, low projection is considered as the most appropriate scenario as the counter part of status quo scenario. According to population transition theory, in the second stage of transition, population is still likely to growth but in the lower population growth rate. Furthermore, CBS (CBS, 2011) also has released provincial fact sheets mentioning that Central Java population growth rate has been declining in the lowest rate compared to other provinces in the country. In this calculation, national projection for provincial level was used as the reference. Following that, result of status quo scenario was used as benchmark to distribute number of population in district level.

Figure 1 describes the final result of population projection for status quo and low projection scenario.

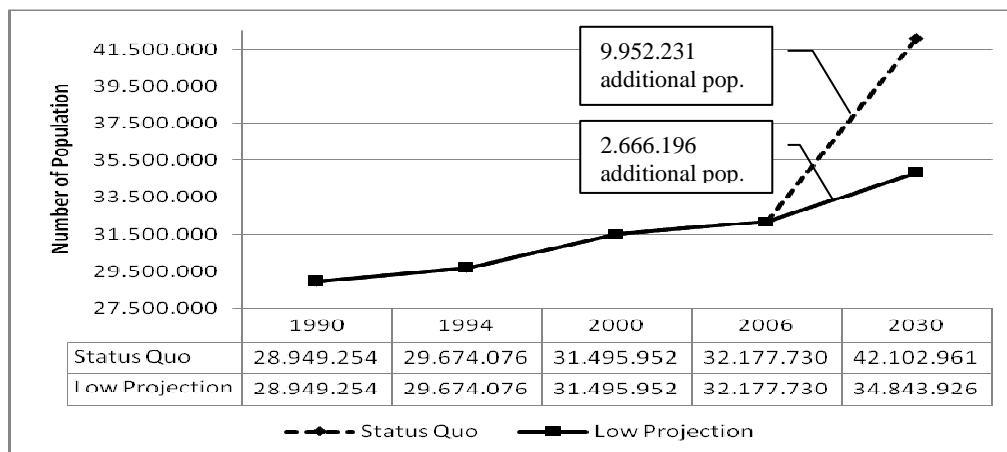


Fig. 1: Population projection for Central Java, 2030: status quo and low projection scenario

Besides estimating number of population growth in 2030, land use coefficient formula was applied to estimate the land demand. Formula for land use coefficient was used to calculate 1994 and 2006 data. They include data of built-up area and number of population in district level. The formula is:

$$\mu = \frac{(L2 - L1)}{(Pop2 - Pop1)} \tag{1}$$

Where:

- L2 = Built-up area 2006
- Pop2 = Population 2006
- L1 = Built-up area 1994
- Pop1 = Population 1994

To summarize, Table 1 shows result of land use coefficient calculation in 35 districts located in Central Java province.

Year	Change in built-up area	Change in population	Land use coefficient (Provincial average, m ² per person)
1994-2006	1836,52	2.701.907	640,569

Table 1: Land use coefficient in Central Java, 1994-2006



Following summary of land use coefficient as explained in Table 1, as the very final result of estimate number of population growth in 2030 and land use coefficient calculation per distric and provincial average, Figure 2 illustrate land demand in 35 districts located in the province in four possibilities.

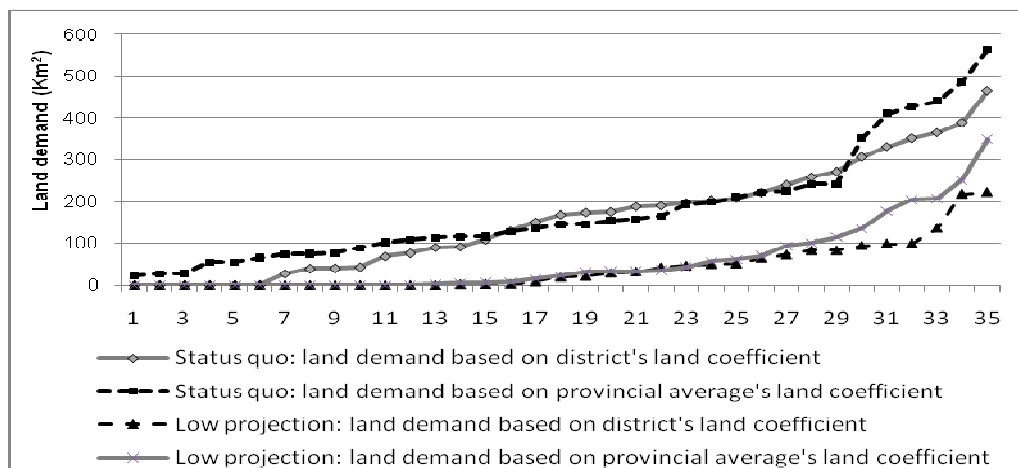


Fig. 2: Land demand in 2030, status quo and low projection scenario. Note: shrink district assumed as 0 (zero) growth population

Considering trend that is illustrated in Figure 2, in 2030, there will be two categories of regions. The first is shrink regions in which they experience decreasing number of inhabitants while the other one is developed region that experience increasing number of population. As the implication, some districts require quite high land demand while few others, categorized as shrink regions, do not require significant area to be converted in to built-up area.

3.2 Land Potential: Probability of Transferability Calculation

Land potential or land supply basically is represented by probability values of transferability from non built-up to built-up area. These probability values were derived based on trend that had been happening between 1994 and 2006. Therefore, trend of land conversion had been taking place based on each variable were examined to calculate the probability values. The variables include slope, land use type, distance from built-up in 1994, and distance from main road. All these variables were analyzed using ArcGIS 9.3. Most of the calculation are raster based within each 300mx300m cell sized (grid). One grid represents one value. Table 3a, 3b, and 3c explain characteristic of land use change on each variables that had been happening between the time series. As it was indicated that all land use change are likely taking place in the radius of 1km from the main road, therefore, there is not any detail result for distance from main road but only deliniating the scope area of final analyses result into one km maximum distance from main road.

Slope	Area (Km ²)	Proportion
> 40 %	0,37	0
0 - 8 %	1587,46	87
15 - 25 %	76,71	4
25 - 40 %	13,00	1
8 - 15 %	146,09	8
Water body	1,92	0
		100

Table 2a: Potential of transferability based on slope, data 1994 and 2006

Land use 1994	Land use 2006	Area (Km ²)	Proportion
Dry Land Farming	Built-up	535,64	29
Forest	Built-up	65,16	4
Plantation	Built-up	4,67	0
Protected Paddy Field	Built-up	1206,95	66
Water Body	Built-up	23,18	1
			100

Table 2b: Potential of transferability based on land use type, data 1994 and 2006

Distance from built-up 1994 (Km)	Polygons	Proportion
0-1	1781	54
1,01-2	772	23
2,01-5	529	16
5,01-12	144	4
12,01-19,1	87	3
		100

Table 2c: Potential of transferability based on distance from built-up 1994, data 1994 and 2006

By examining proportion calculation as explained in Table 2a, 2b, and 2c, it is finally identified that between 1994 and 2006, the most potential land to be converted into built-up areas are likely to be located in flat area (slope 0-8 %), in 1994 functioned as protected paddy field and within radius one Km from built-up area in 1994.

Figure 3 explains the final result of multiplication of probability value that is represented as proportion in Table 2a, 2b, and 2c. It excludes 0 (zero) in which this value indicates null possibility to be transferred due to the current status that have been already perform as built-up or due to physical constraint (e.g. slope > 40 %).

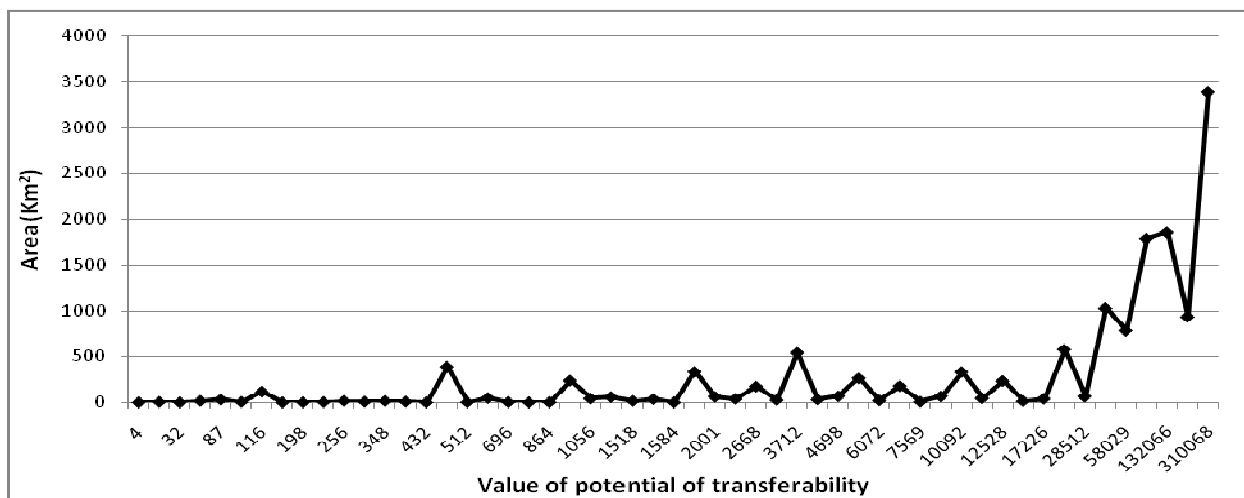


Fig. 3: Value of potential of transferability based on data 1994 and 2006

3.3 Analyses Result: Spatial Formation of Central Java in 2030

Comparing the land demand and the land supply to be transferred from non built-up to built-up, Table 3 summarizes the final result in provincial level. Following that, Figure 4 illustrates the spatial configuration.

	LAND DEMAND		LAND POTENTIAL	
	District land coefficient	Provincial average land coefficient		
Status Quo	5560,165	6357,795	Value 40.368-91.872=3604,59	Less potential
Low projection	1482,811	2051,178	Value 91.872,01-136.242=2792,52	Potential
			Value 136.242,01-310.068=3392,46	Very potential

Table 3: Total Land demand and land supply in Central Java, 2030 (Km²)

There are at least two important issues considered as significant to be furthered comprehended. In brief, these can be explained as follows:

(1) As clearly mentioned on the Table 3, in general, there are still sufficient area in the province to accommodate the people’s activity. The land demand is likely less than the land supply. However, the land supply calculation explained on the Table is resulted from trend that had been happening between 1994 and 2006. As explained in Table 2b, it implies, 66 percent of total potential land unfortunately functioned as protected paddy field zone. It means, if there is not any supporting policy to control the situation, land conversion as a critical part of urbanization process will seriously influence food security in the province as well as in the country. Map in Figure 4 in comparison with Figure 5 further illustrated that most of potential area to be converted into built-area also utilized as protected paddy field or protected arable land.



(2) It is important to clearly comprehend that district with high land demand also have significant area to be protected as paddy field while there are some other districts with quite significant available area to be converted into built-up or urban activities do not required high land demand or in other words do not categorized as fast developing area. In brief, looking inside in district level, there are still a lot of miss match between available land supply and estimated land demand.

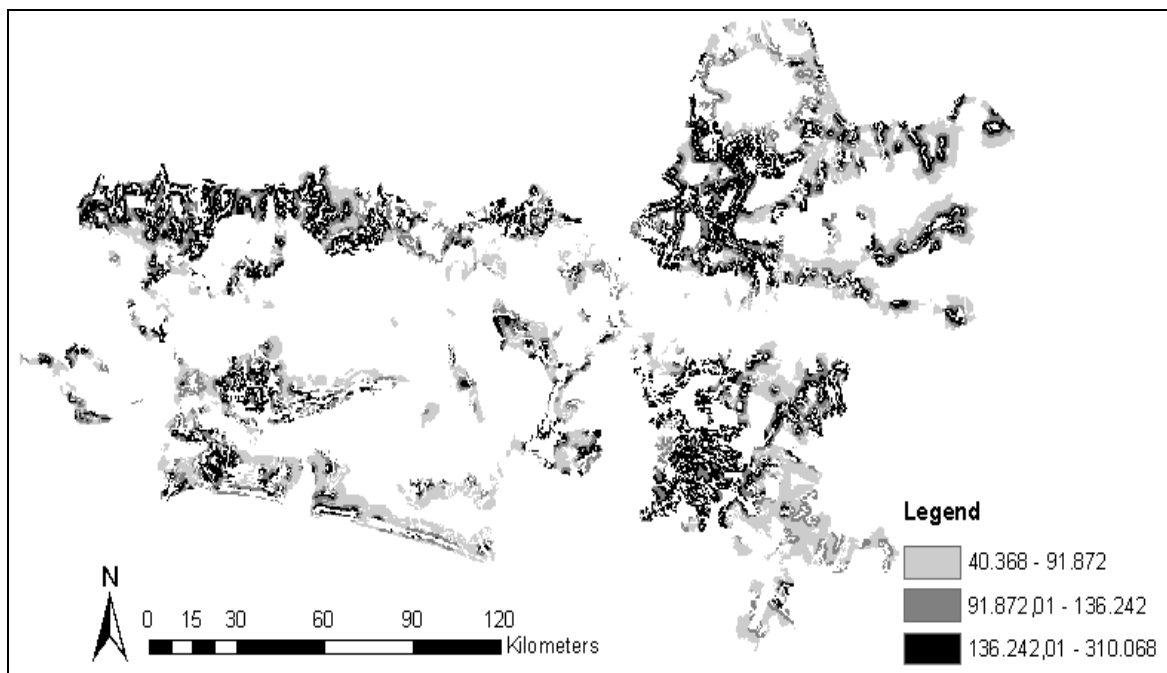


Fig. 4: Potential land to be converted into built-up area based on potential value of transferability. Note: value of land potential is resulted from multiplication of proportion explained in Table 2a, 2b, and 2c

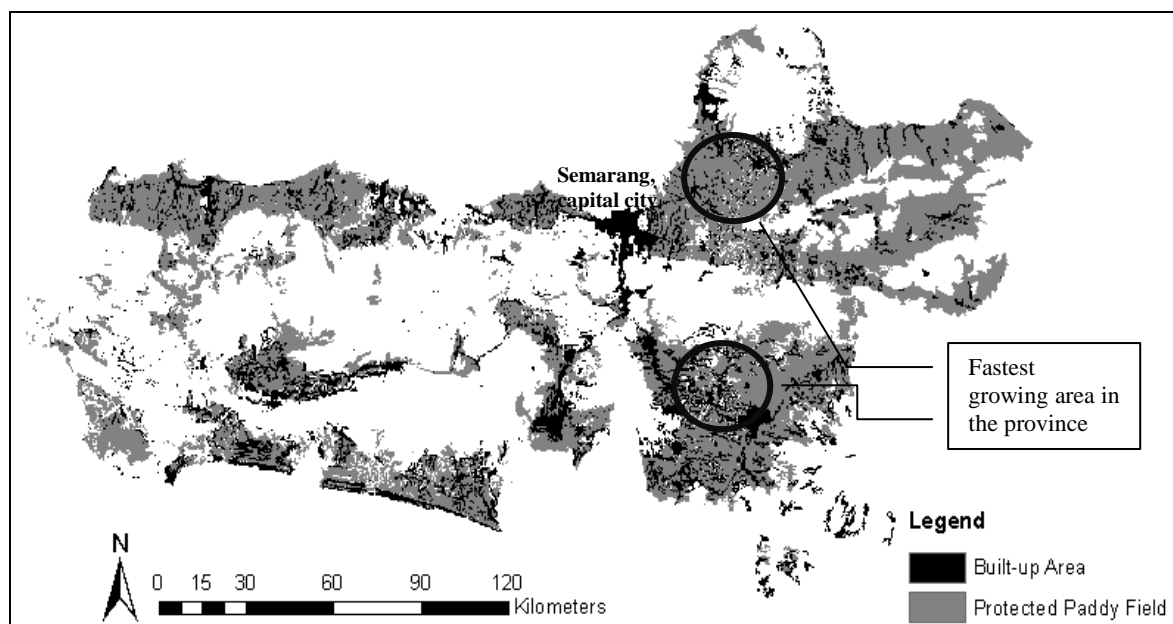


Fig.5: Built-up area and protected paddy field, 2006

4 COURSE TO BALANCED DEVELOPMENT: A POLICY REVIEW

The findings of the land demand and the land supply analyses in previous part provide evidence that the past as well as current development policies are not towards a satisfactory outcome for the future. The trend indicating that 66 percent of converted land is located in protected paddy field in addition to the fact that is a relatively unbalanced demand for land among district lead to various issues require to be adressed in policy level. Following part explain briefly policy aspect that is essential to be further reconsidered. The first is in relation to the challenge of sincronizing and integrating growth and equity policies. The second is in regard

to harmonization of agriculture and industry to maintain food security in the same time with enforcing local based industrialization.

4.1 Dilemma of two headed snake: growth vs. equity

Spatial formation is highly related to two major contested notions in development theory; growth vs. equity. Figured out as dilemma of two-headed snake, it is considered as unattainable to maintain a balance performance of these both key policy options. Pro urban or growth oriented development policy is acknowledged as a conventional policy option. This development policy is considered as very effective in accelerating economic growth of a region. The accelerated economic growth is expected to spread over the surrounding regions. Particular for context of developing countries, the policy are likely to give so much space for development of foreign based big manufacturing industries as these industries has been proofed to play a dominant role as the engine of economic growth that are concentrated in big urban centers.

In contrast, as the second option, more equity is believed could be achieved if there are more efforts to increase local potential mainly in human resource development, innovation and technology to upgrade local industries. In spatial term, this could be categorized as pro rural development policy since this option is likely to give more space for rural to be developed or in different word to prioritize equity over growth.

Significant difference of the land demand among districts in the study area that has been explained in previous part provides evidence of current and potential unbalanced development path in the future. Growth oriented development policies that has been applied in the region has resulted on rapid development. Unfortunately, the development pattern that is characterized by high rate of land conversion is concentrated only in particular districts. In addition, centralized government applied in previous era is also likely to ignore local potential. It is indicated from the fact that big manufacturing industries based on foreign direct investment were more facilitated by such incentives national policies compared to local based industries. Gilbert and Gugler (1991) believes that the role of foreign based industries which has led to the New International Division of Labour (NIDL) contribute significantly to the unbalanced pattern of development in such developing countries. Many multinational industries do their manufacturing works in particular urban growth centres which have relatively good investment climate and low rate of labourers' wages. As the manufacturing activities require high demand of low educated and cheap labourers, they attract so many migrants not only from the surrounding regions but also from almost all lagging regions across the country.

Concerning the phenomena, rapid growth cannot always be acknowledged as a good sign of development. In the majority of Asian regions including in Central Java in Indonesia, rapid growth generally takes place simultaneously with greater disparity. Figure 6 illustrates the creation of this greater disparity. In spatial term, it happens mostly due to the existence of particular type of foreign based manufacturing industries that are located in the inner zone or extended metropolitan regions. These types of industries have attracted so many laborers and raw materials from the outer zone. Undesirably, the way inner zone attracts so many potential resources of the backward region is not followed by positive spread effect proportionally. In the end, it has been creating particular unbalanced spatial formation in the region. Furthermore, it is likely that backward regions (outer zone) are not supported with adequate infrastructures so they cannot develop their local potential optimally. In addition to that, there are also many urban bias policies that have created more limitation for this region to perform a better performance of development path.

In spatial perspective, apprehension on disparity phenomenon also important to be acknowledged in relation to discussion on polycentrists vs. monocentrist urban form. Polycentricity remains elusive (Davoudi, 2003), however, it could be simply understood as 'plurality of centers' (Parr, 2004). There are at least two initial indications to find out whether particular regions could be called as having polycentricity urban forms or not. First refers to self contained conception. In polycentricity urban forms, each centre is independent in the sense that they can fulfill their basic public facilities by their own and not necessarily rely on other (larger) urban centers. Related to that, second critical feature is that polycentrist regions are likely to consist of urban centers that do not significantly differ in terms of size and economic importance. In these regards, it is obvious that polycentricity represents balanced (less disparity) pattern in spatial configuration. These urban forms only could be created in the condition where there is evenly distributed economic activity in the regions. Besides, it will create more livable places and increasing quality of life since smaller urban centre is expectedly more sensitive with environment limitation. In the end, it will also harmonious with any principles in sustainable development. On the contrary, monocentrist urban form indicates unbalanced



development due to superiority of economic activities in only particular center. It may lead to a lower quality of live because of sizeable city sized means overpopulation. It creates discomfort due to pollution, congestion, slums any many others urban problems.

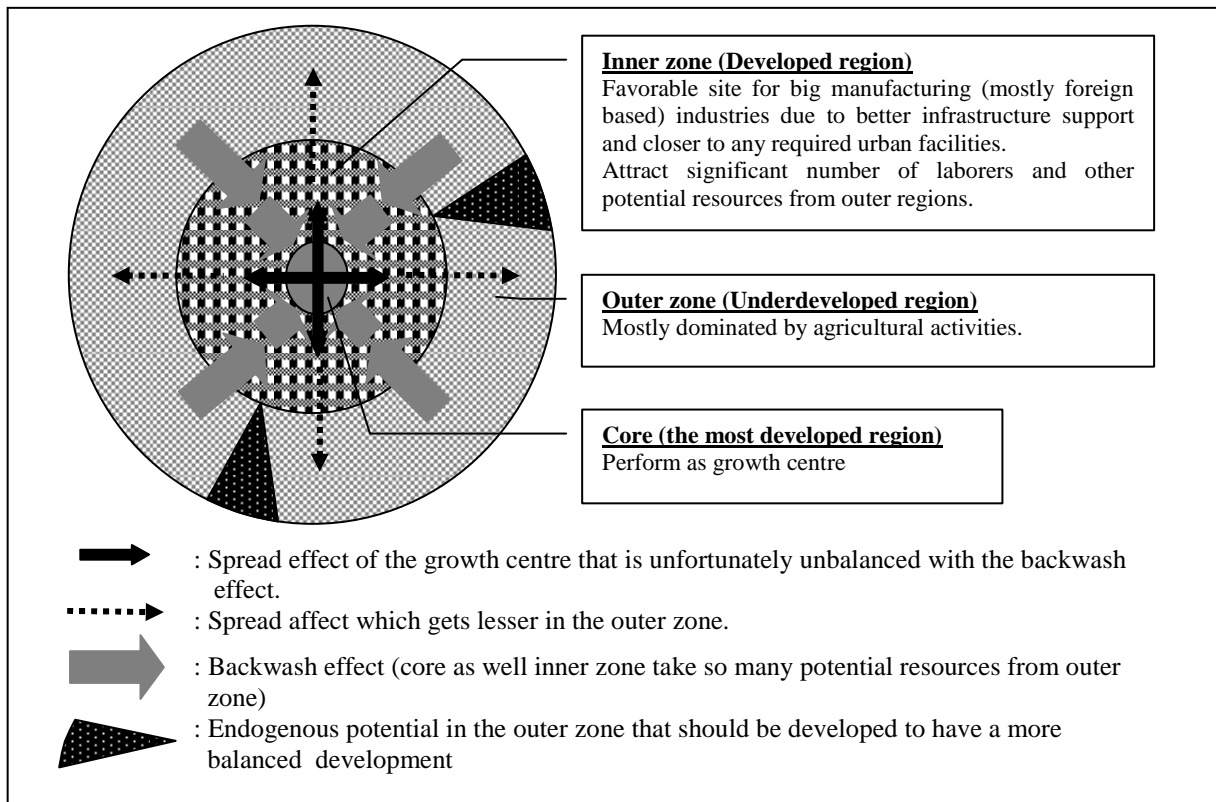


Fig. 6: Creation of Disparity: Developing Countries Experience

To follow up the findings of potential spatial configuration in the study area that has been indicated to be unbalanced due to centralized and growth oriented development policy, then, policy framework that concern on equity by utilizing local potential to create polycentrist spatial configuration should be further considered.

4.2 Food security and industrialization: harmony through decentralization

Despite the debate on growth vs. equity policy option or polycentrists vs. monocentrist spatial configuration, it is very crucial to harmonized agricultural activity to maintain food supply as well as industrialization to achieve balanced development. There is an “asymmetrical-and thus dualistic” relation between agriculture and industry (Ranis, 1988: 74). Agriculture is something characterized by more “fixed” inputs of land, not really capital intensive with significant number of pre-existing labourer. Differently, modern industry is featured by capital intensive without any compulsory requirement of particular land condition, and labourers are only absorbed as needed. Other differences are also indicated on the deployment of the activities and also on the way they play the role on labour market and technology applied. There are also different product characteristics of agriculture and industry. As a matter of fact, agriculture is a compulsory for industrialization at least for two reasons, agricultural products are very important to feed the industrial workers in urban area and as a crucial input in particular industry. On the contrary, industrial activities are not really a requirement to develop agricultures. Moreover, particularly in developing countries where labour is not really an urgent issue, various industrial products in farming that are used for labour efficiency are not really necessary. This particular relation leads to an inevitable fact that agriculture and industry is something different and cannot acknowledged as there is a mutual relation between them.

Concerning unbalanced relation between agriculture and industry, examination on highest and best used of particular land parcels are considered as very important. In property analyses, highest and best used analyses are common tools to calculate maximum benefit to utilize particular unit of area.

In the case of Java, it is very unfortunate that rapid urbanization is located in arable land. Rapid urbanization require relatively high land demand while it is also important to maintain arable land for agriculture. Indeed, food security appear as the most important in regard to agriculture in Java since land productivity of Java is

the highest in the country. According to agriculture statistic released by CBS (CBS, 2001), Java still dominating rice production in Indonesia by contributing ± 60 percent of national production in 2000. On the other hand, Indonesian rice consumption is 133 kg per capita, the highest worldwide. In comparison with other Asian countries, rice consumption per capita in Thailand is only 80 kg per capita while in Japan, it is only 40 kg per capita (Tambunan, 2003). These facts result in a dilemmatic situation for Java. Rapid urbanization through industrialization, by some means, is inevitable. This process requires land not only for industries but also for accommodating population growth and various urban activities. On the other hand, agriculture is also important mostly for food security and sustainability. Indeed, Lewis (1954 in Timmer, 1988) has argued, "economies in which agriculture is stagnant do not show industrial development". There is not any industrialization succeeds without sufficient support from agricultural sector.

In general, there are at least three influencing policies in regard to harmonization of agriculture and industry (Pearson et al, 2004). The first is macro-economic policies. It includes monetary and fiscal policies, foreign exchange rate policies, and land use policies. The second is public investment policies including infrastructures, human resource, and research development. The third is commodity price policy. In the case of paddy, rice price policy is very critical to calculate highest and best used of land either to be functioned as urban activities or maintain the area as protected paddy field. Integrated policy framework that include at least these influencing policies is considered as very important to optimized the relationship between agriculture and industry. However, how far policy intervention is 'just' enough (effective)? As a matter of fact, there are various elements should be considered to create a good integrated policy framework in addition to the importance of addressing particular weaknesses that limit such individual, people, firm, or regions to be developed optimally.

According to Pyke et al (2006), the failure of traditional development policies that have been applied in many developing countries including in the case of Java to create balanced development pattern may give at least two lesson learned. The first is that simply replicated policies in different part or the world regardless any consideration of local value will lead to the failure of achieving expected policy outcome. The second, centralization that disregard differences among regions may be effective enough to force expected economic growth but, that is clearly not sufficient to distribute the growth proportionally to the whole region. Considering these lesson learned, decentralization policy that is formally released in 1999 become one important momentum that is expected able to revise development policy framework in Indonesia.

Decentralization give more space for local government to optimizing local potential for development. On the other hand, decentralization also provide more authority for local government to boost their economic growth through industrialization. In this point of view, competition among local regions to achieve good economic performance lead to lower local government commitment to maintain agriculture for food security. Regions rivalry without strong foundation to control the implementation of national and regional spatial policies result on unfair competition. To illustrate, there is not sufficient regulation and law enforcement to ensure that agricultural based regions that are allocated as protected paddy field declared in national spatial policies not to be converted to urbanized activities. While, local government are likely to boost industrialization to accelerate economic growth of the region through industrialization.

Klaten and Boyolali, urban fringe of Jogjakarta and Surakarta, provides the best example of the dilemmatic situation for local regions in Central Java to allocate their land for development. Both districts have experienced the highest rate of converted land in the province ($\pm 23,4$ Km² per annum). According to provincial spatial development policy, area of the converted land in the districts were allocated as protected paddy field mainly due to the quality of the land as well as infrastructure support that had been invested in the area. However, the districts also experienced development pressure as Jogjakarta and Surakarta, the neighbouring area, develop very fast. Therefore, pressure to be developed as extended metropolitan regions was unavoidable. As a result, industry and urban settlement are now located in the area that were allocated as paddy field. In the situation of transition period from centralization to decentralization, there were not consistent law enforcement as well as clear incentive and disincentive policy to cope with such situation. In provincial level, there was clear regulation in land allocation. However, decentralization also provide space for local authority to create own rule for development such as rule to give permission for land conversion.

Thus, despite the importance of decentralization to explore local potential and to balanced the development pattern, incentives and disincentive regulation appear as an important aspect to create fair competition among



local region. This is critical in order to maintain agriculture in Java where rapid urbanization as well as productive agricultural activity take place simultaneously. In this regard, to balanced the development in the research area in both, economic and spatial perspective, is not solely a matter of policy framework that need to be reconsidered but also including issue in institutional improvement as the 'container' to succeed the policy implementation as well as the law enforcement.

5 CONCLUSION

Rapid urbanization should be taken place along with agricultural activity proportionally to balance the need of food supply as basic need of human being and as input for particular type of industries. In this regard, land allocation is critical in development. However, there area various aspect attribute to land allocation Current and potential unsatisfactory proportion of the land demand and the land supply proof that there is still something unfit in the developemnt process in the study area. Highly centralized government in previous era, exceedingly pro growth policy option applied supported by poor institutional capabilities, and the fact that there is not an integrated planning policy from national to local level are recognized as the main factors that are required to be further examined. Potential solutions would be begin with commitment from any related stakeholders to improve institutional capability and determining policymaking criteria to create clear policy framework.

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