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Impacts of Urbanization on Agricultural Sustainability and Rural Life in West Java, Indonesia

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Impacts of Urbanization on Agricultural Sustainability and Rural Life in West Java, Indonesia*

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Abstract

Current Indonesian development policies, including the regional development strategy for the Northern Coastal Region (NCR) of West Java, favor urban development. This research addresses the effects of urbanization on the sustainability of traditional agriculture—irrigated rice production in a region considered the "rice bowl" of Indonesia. In addition, analysis is conducted on the effects of urbanization on the quality of life of the rural population engaged in agriculture, the regional urbanization process and its causal factors, its relationship with regional development and its impacts on agricultural development. The goal is to identify policy interventions needed to sustain a viable regional agricultural sector. The study employed three sets of data: primary data collected at the village level for the period 1982-1992, secondary data derived from the censuses of 1980 and 1990, and secondary data provided by the Project of Land Conversion in Java.

Urbanization in the region is caused mostly by economic stress in rural agricultural areas rather than increased economic opportunities in the urban areas. Using population density as the differentiating criterion, the rate of regional urbanization was found higher in the "non-rural" areas, indicating a cumulative causation process or self-reinforcing urbanization. Principal urbanization impacts include increases in agricultural land parcelization, landless farming households, absentee agricultural landownership and conversion of agricultural land to non-agricultural uses. Urbanization has also transformed self-employed farmers into agricultural laborers and farms to non-farm, small-scale enterprises.

Existing regional development strategies have increased rural-urban disparities, expressed as a comparative lack of economic progress and the availability of and access to public facilities in rural areas. Urbanization has had a cumulative negative effect on the viability of the regional food production system, specifically its important role as the major contributor to the national policy of food (rice) self-sufficiency. Moreover, the welfare of the rural population engaged in the agricultural sector is decreasing.

To sustain regional agriculture, to overcome the negative impacts of urbanization on the welfare of rural populations and to decrease rural-urban disparities in the near term, the government must change development policies and investment strategies targeting primarily non-agricultural sectors and urban areas. This may be accomplished by a diversion of regional investments to promote the establishment of generative, secondary cities in the region — so-called "growth centers" — complemented with the development of a subregional infrastructure, effective regional planning and improvement of rural service functions. In the longer term, the government must also provide greater local autonomy, at least, by fostering the development of local land use plans and effective legal controls. This can be supplemented by incorporating policy measures providing incentives for rural populations engaged in agriculture, such as creating transferable land development rights, preserving prime agricultural lands, open space conservation easements, agricultural tax abatements, targeted subsidies in agricultural inputs and marketing, and public investments in the rural physical and service infrastructure.

Introduction

Indonesia's population of 204 million (World Handbook, 1995) is growing at about 1.6 percent per year, with most of the increase occurring in urban areas. Expectations are that almost 40 million residents will be added to Indonesia's cities in the final two decades of this century (Hamer, Steer and Williams, 1986). The most recent census indicates that 62 percent (more then 126 million) of Indonesia's population is concentrated on the island of Java[2] (Moochtar, 1992; Soegijoko, 1992; Soemarwoto, 1992; Firman, 1992; Hill, 1992a; Hill, 1992b; Soemarwoto *et al.*, 1991; Hardjono, 1983), which accounts for only 7 percent of Indonesia's territory (Poot, Kuyvenhoven and Jansen, 1990; Hill, 1992a). Java, with an urban population of 23 million people in 1980, had about 70 percent of Indonesia's total urban population. The World Bank estimates that the urban population in Java alone will rise to 41 million by the year 2000[3], with Jakarta—the capital city of Indonesia— having 26.46 percent, followed by West Java Province with 25.17 percent. Outside Jakarta, most of the urban population (34.24 percent) is concentrated in West Java (Hamer *et al.*, 1986), specifically the Northern Coastal Region (Hill, 1992b; Soegijoko, 1992; Firman, 1992). Here, economic growth of the industrial, trade and service sectors acts as the driving force of urbanization. Firman (1992) concludes that urban population growth in Java is evident not only in the big cities but also in their peripheries and in the areas close to the regional arterial roads connecting the larger cities. In other words, urbanization occurs in the corridors joining large cities, such as the area between Jakarta and Cirebon, usually referred to as *Jalur Pantai Utara Jawa Barat* or Northern Coastal Region (NCR) of West Java.

Firman's finding confirms McGee's assertion that rapid urban growth in Asia is accompanied by the emergence of peri-urban regions and urbanized corridors joining big cities[4] (McGee, 1991). McGee (1987 and 1990, cited in Firman, 1992, p. 96) identifies six characteristics of such urbanized corridors in Asia: (i) a very high population density; (ii) generally but not exclusively wet-rice regions with very small landholdings; (iii) enveloping big cities in the regions; (iv) growth of diverse, non-agricultural activities; (v) considerable interaction between rural and urban activities; and (vi) an intense land use mix.

The study of the urbanization process in such a *corridor region* is a relatively new phenomenon in the literature of urbanization, which usually focuses on the dynamics of urban centers with an analytical context fitting developed nations rather than developing nations[5] (Bhadra and Brandao, 1993; Datta, 1990). Although several studies have analyzed this type of region, it is treated as a small urban center with functions similar to those of large urban centers[6] (Hardoy and Satterthwaite, 1986; Kabwegyere, 1979; Southall, 1979; Rondinelli and Ruddle, 1976; Hamer et al., 1986; Armstrong, Warwick and McGee, 1985; Bhooshan and Misra, 1980; Honjo, 1981; McAndrew, 1990). Moreover, studies on the impacts of urbanization on agricultural development in peri-urban and corridor-regions are rarely conducted in developing nations (Bhadra and Brandao, 1993, and Firman, 1992). Consequently, the nature of urbanization and its impacts on the rural service infrastructure and on agricultural development in such urbanized corridors are not fully understood.

Because regional growth complicates and modifies problems of regional and agricultural development, studies are needed to analyze structural changes in urbanized corridors to enhance development strategies and their implementation in the form of comprehensive regional plans. These include studies to analyze: (i) impacts of changes on regional development at the aggregate level (e.g., regional income, agricultural sector performance and regional input-output accounts); (ii) impacts of urbanization on agricultural development measured in basic socioeconomic indicators, including income, employment and quality-of-life measures; (iii) changes in land use patterns and land prices in the area immediately surrounding main cities and in rural areas; (iv) the

2 Indonesia is a country composed of more than 13,700 islands, including the five biggest islands of Kalimantan, Irian Jaya, Sumatra, Sulawesi and Java.

3 This estimate assumes that interprovincial and rural-urban migration patterns are unchanged from 1975-1980 rates. This assumption will underestimate the real urban population growth because the dynamics of rural-urban migration as a result of infrastructure development in the past 15 years and the dynamics of economic development in the areas around big cities (Firman, 1992, p. 101).

4 McGee, in his article, *Urbanisasi or Kotadesasi?: Evolving Patterns of Urbanization in Asia*, 1989, called the development of urbanized regions such as the NCR a process of *kotadesasi*. "*Kotadesasi* is a coined word [in Indonesian or Bahasa Indonesia] that joins *kota* (town) and *desa* (village) to make up a word which carries the concept of urban and rural activity occurring in the same geographic territory" (McGee, 1989, pp. 93-94).

5 Bhadra and Brandao (1993, p. 2) assert: "The literature analyzing urban development is large. Over the last four decades, researchers have dealt with numerous related issues, such as explanations for the existence and growth of cities, the relationship between city growth and industrial growth, allocation and efficient use of urban sector-specific resources, availability and proper management of those resources and policies concerning balanced urban development.... Surprisingly, the literature has given much less attention to the implications of urban development planning and the process of land allocation between rural and urban uses, or, equivalently, between agriculture and non-agriculture. Moreover, most of the studies focus on the developed countries and in particular, on the United States." Costa et al. (1989, p. 3) state: "While Asian urbanization is similar in many respects to Western urbanization, it is quite different as well."

6 In their article, Why Small and Intermediate Urban Centers, Hardoy and Satterthwaite (1986, p. 6), for example, state: "...that it is small or intermediate urban centers which are the urban centers with which most rural people and rural enterprises interact. Yet the role that such centers can play in supporting social and economic development within rural areas...is rarely given sufficient attention."

extent of agricultural land use conversion and its impacts on the welfare of the households and on agricultural sustainability; (v) changes in linkages with metropolitan centers; (vi) changes in socioeconomic conditions in the region and their impacts on migration—patterns of migration within the region and migration to the metropolitan centers; (vii) changes in rural and urban employment; (viii) changes in the settlement patterns; (ix) changes in environmental quality; (x) socioeconomic disparities between rural and urban areas within the urbanized corridors; and (xi) changes in rural-urban linkages in the area and in urbanized area-metropolitan center linkages.

This study analyzes some aspects of the changes of the corridor region, especially impacts of regional urbanization on agricultural development. The primary focus is on the corridor region joining large cities subject to urbanization and with regional characteristics as those described by McGee, as represented by the Northern Coastal Region (NCR) of West Java, connecting Jakarta and Cirebon. The NCR consists of four kabupatens[7]: Bekasi, Karawang, Subang and Indramayu. This is both the most urbanized region in Java (Firman, 1992) and the center of agricultural development, especially for wet-rice production[8]. As such, it is traditionally considered the rice bowl of Indonesia (Soemarwoto, 1992).

Research Context

About 21 percent of Indonesia's GDP is contributed by outputs from agriculture, forestry and fisheries, which involve slightly more then 50 percent of the national labor force (World Handbook, 1995). Of the total land surface, 8 percent is arable land, of which about 40 percent is devoted to food production, with rice as the basic staple crop. The NCR contains the most productive agriculture, the best irrigation systems (Soemarwoto et al., 1991) and the most advanced agricultural development institutions in Indonesia (Nasoetion, 1994). Its development as an agricultural production center dates back to the Dutch colonial period, when the development of the irrigation systems started. Following the independence of Indonesia in 1945, the region was further developed through the rehabilitation and expansion of the irrigation systems. In the mid-1960s, the green revolution[9] in Indonesia—pioneered by Bogor Agricultural University—originated here. The policies and programs implemented by the Government of Indonesia (GOI) included improvements in the irrigation infrastructure, continued investment in the agricultural research capacity, the intensification of agricultural inputs, the introduction of high-yielding varieties, continued provision of highly subsidized inputs such as fertilizers and pesticides, and the development of the agricultural extension service. All these efforts have made the region one of the centers of agricultural development contributing to Indonesia's self-sufficiency in rice in 1985 (Erwidodo, 1990).

Besides agricultural production subsidies, the GOI also introduced several policies that directly or indirectly affect agricultural development as well as urbanization in this region.

At the macro level, GOI policy is to preserve self-sufficiency in food production, especially rice. Consequently, the government maintains policies of price controls on agricultural commodities, especially rice; subsidies in the development and rehabilitation of irrigated paddylands; provision of agricultural inputs; and a buffer system to anticipate price fluctuation in agricultural commodities (Nasoetion, 1994).

Most importantly, the GOI restricts conversion of agricultural land (especially irrigated paddyland) into non-agricultural uses. This reflects the realization that urbanization in this region has created development pressure on agricultural land. Also, through regional development planning, which was introduced by the local government of West Java in 1974 (Government of West Java, 1990), the GOI restricts agricultural land conversion (Presidential Decree No. 55, 1993, adopted into the Governor of West Java Decision No. 593.05/SK.1785-Pem.Um/1993). This decree clearly states that land use and land allocation for development should follow regional development planning (II.4.1) guidelines, which are designed to prevent the regional conversion of agricultural land into non-agricultural uses.

The development of the NCR cannot be separated from the development of Jakarta and West Java as a whole. According to Hill (1992b), industrial development — which was viewed as a necessary condition for economic and regional development in Indonesia during the past three decades — favored the region because of its infrastructure and proximity to the seat of government. This notion implies that development and investments favor metropolitan areas, which become centers of political power and commercial activity (Honjo, 1981a; Coates, Johnston and Knox, 1977; El-Shakhs, 1976). Furthermore, Mehretu (1989) and Mehretu, Wittick

7 *Kabupaten* is an administrative unit under province consisting of several *kecamatan*. In turn, one kecamatan consists of several *desa*, the smallest administrative unit equivalent to a village in the U.S. system.

8 "At least half of West Java's population occupies the Northern Coastal Region, which represents less than one-third of the total land area of the province"(Hehanussa and Hehuwat, 1979). The NCR is an alluvial lowland. It consists largely of alluvial river deposits and lahars [volcanic flow deposits] (Ongkosongo, 1979). Average annual rainfall is about 1880 mm (Ongkosongo, 1979), with average temperatures between 27.1o and 29.7o C (Ilahude, 1979).

9 The *green revolution* is a term used for rapid increases in rice yields in Indonesia brought about by improved varieties, irrigation and agricultural institutions with the expanded use of fertilizers and other chemical inputs (Andersen and Hazell, 1985).

and Pigozzi (1983) state that regional economic and social development in most LDCs have been characterized by centripetal forces of concentration and agglomeration of public as well as private investments favoring relatively more developed regions.

> In Indonesia, city residents have received priority access to centrally funded, and heavily subsidized, public services, while the much larger and poorer population of the countryside has failed to keep pace. Metropolitan centers, in turn, have benefited most of all (Hamer *et al.*, 1986, p. 9).

More recently, the GOI encouraged and subsidized medium- and large-scale industries in this region (Hill, 1992b). Hill's study shows that Java dominates Indonesia's non-oil manufacturing economy, generating almost three quarters of value-added products by medium and large firms. West Java alone contributes over one-third of this total, and its industrial output exceeds that of the outer islands. Notably, most of the medium- and large-scale manufacturing industries in this region are developed along the NCR, where the prime agricultural land is located. Moreover, the combined Jakarta-West Java value-added output accounts for more than 45 percent of the national total. This reflects the very high degree of spatial concentration of industrial development.

Industrial development, with its backward and forward linkages, has attracted more people to the NCR. In other words, concentrated industrial development has induced urbanization in this region because of the transfer of resources from agriculture to non-agriculture and from rural to more urbanized areas. This transfer includes skilled and unskilled labor, capital and land resources (Bhadra and Brandao, 1993), and service provision (Unwin, 1989).

The increased transfer of resources over time is determined mainly by the supply of and demand for resources in the growing regional economy. Bhadra and Brandao (1993, p. 3) describe such a transfer process as follows:

> From the demand side, the incentive for resource transfer arises, in part, from larger income shares spent on industrial products and services relative to that on agricultural goods.... The supply side effects come from faster technical progress in industry than in agriculture...and from significant scale economies in urban production process.

More importantly, the resource transfers "are not only symptoms of the 'development process' but are themselves active features in the transformation of rural and urban places" (Gould, 1982, p., cited in Unwin, 1989, p. 13).

The modernization theory of urbanization, furthermore, explains that urbanization occurs when the region faces structural economic transformation (Choe, 1981, p. 101), characterized by the increased relative share of the industrial and service sectors and the decreased relative share of the agricultural sector in the regional economy (Timmer, 1990). Moreover, "...the rate of urbanization or equivalently the rate of labor redistribution to the urban-industrial sector is largely dictated by industrialization..." (Choe, 1981, pp. 100-101). The implicit assumption behind this line of thinking is that urbanization is a natural and inevitable consequence of industrialization and modernization (Sharbatoghlie, 1991, p. 11).

Whatever the reason behind urbanization occurring in the NCR, the process puts pressure on the agricultural resource base, especially on prime agricultural land (Schmid, 1968) destined to support and maintain national food self-sufficiency (Firman, 1992; Soegijoko, 1992; Soemarwoto, 1992; Soemarwoto et al., 1991).

Parallel to the described industrial development in the NCR, the West Java regional development plan designed in 1974 has accelerated urban-biased development, concentrating investments in the primary cities. In addition, urban development has accelerated because West Java adopted functional integration rather than territorial integration[10] as its regional planning strategy with "growth centers"[11] as the principal element of regional development policy.

At a broader level of regional development (Jakarta-West Java), economic and social development were to have focused on the big cities, Jakarta and Cirebon, with the latter to balance the development of Jakarta. At the kabupaten level, development efforts and investments were to have focused on the primary city or capital city of the kabupaten. This regional development strategy has put agricultural development in the NCR at risk, even though it was designated as the center of agricultural development with major government investments in the agricultural sector (Nasoetion, 1994). Therefore, the development of Jakarta and Cirebon, as well as the development of primary cities in each kabupaten, will put some pressure on the agricultural resource base. According to Friedman and Wolff (1992), this type of policy in regional development will wash out higher quality resources in the rural agricultural hinterlands. Accordingly, smaller cities or centers of development will be used as outposts by the urban

[10] "The territorial force derives from common bonds of social order forged by history within a given place. Functional ties are based on mutual self-interests. Given inequalities at the start, a functional order is always hierarchical, accumulating power at the top. Territorial relationships, on the other hand, though they will also be characterized by inequalities of power, are tempered by the mutual rights and obligations which the members of a territorial group claim from each other" (Friedman and Weaver, 1979, p. 7).

[11] Growth center is defined as "induced urbanization through a combination of direct public investments and capital subsidies to private enterprise" (Friedman and Weaver, 1979, p. 6).

ruling class and urban interest to achieve three related purposes: to extract a sizable surplus from the rural economy, chiefly in the form of primary products through a process of unequal exchange; to expand the market for goods and services produced in urban centers; and to ensure stability of the political system that maintains urban domination over the rest of the region.

Macro and regional development policies implemented in the NCR seem to conflict with the GOI's intention to maintain the NCR as the "rice bowl" of Indonesia. Even as the GOI has launched several policies to protect the agricultural resource base and to maintain agricultural production in the NCR, current macro and regional policies put agriculture under pressure from urbanization. This is, in part, induced by regional industrial development as well as urban-biased development. Moreover, the NCR itself has also faced massive urbanization in the past two decades (Firman, 1992; Soemarwoto, 1992).

Urbanization in the NCR, both as a corridor region connecting Jakarta-Cirebon and as a region designated as the rice bowl of Indonesia, represents a public policy challenge in Indonesian agricultural and regional development. Assuming that Indonesia will be able to maintain and improve food security in the long run by expanding agricultural production to the outer islands or by international trade, it may be expected that the role of the NCR as the rice bowl of Indonesia will be diminished. Under this assumption, sacrificing agriculture to accelerate regional economic growth through industrialization might be feasible. Totally abandoning agricultural development in this region, however, will not be socially and economically acceptable for three fundamental reasons:

a. **Economic (opportunity and social) cost:** The government has already made large capital investments in agricultural development in this region resulting in large opportunity costs if agriculture in this region is to be sacrificed (Soemarwoto *et al.*, 1991). Most of the agricultural land in this area is irrigated paddyland, not dryland farming systems, and it typically takes more than 10 years to establish productive paddyland. Establishment costs are in addition to the direct expenditures associated with the development of irrigation networks and related socioeconomic costs (Winoto, 1985). Even more important may be the large social cost associated with uncontrolled urbanization. Although the agricultural sector's relative share of the regional economy has been declining over time, more than 60 percent of the labor force in this region still derives its income from agriculture (Soemarwoto, 1992). The development of the urban-industrial sector has not been able to absorb the labor surplus from the agricultural sector (Timmer, 1990). Consequently, the land-labor ratio and labor productivity per unit of land in agricultural areas will decline (Naylor, 1992) and income per capita will also decline[12] (Eicher and Staatz, 1990).

   Furthermore, Erwidodo (1990) shows that this conversion process has also resulted in fragmentation or disaggregation of agricultural land per household. The percentage of households on farms of less than 0.5 ha was 45.7 percent in 1973 and 63.3 percent in 1980. The number of landless farmers has consistently increased at a higher rate than the number of landowners. The landless made up 3.2 percent of the total farm households in 1973 and 14.9 percent in 1980.

b. **Labor supply constraints:** Classic studies by Jorgenson (1961), Ranis and Fei (1961), Enke (1962a; 1962b) and Ranis (1963; 1964) established the theoretical relationship between agricultural development and industrialization, and asserted that agricultural stagnation, especially food shortage, could choke off growth in the non-agricultural sectors by affecting labor supply.

c. **Agricultural sustainability:** Pingali, Moya and Velasco's (1990) study about the post-green revolution in the Philippines, Thailand and Indonesia used West Java, a "rice bowl" province, as a sample. It concludes that: there is a trend towards stagnation and/or a decline in irrigated rice yields, and the rate of degradation of the paddy environment is greater than the rate of growth in yield potential. They also asserted that "...while national average yield [of rice] continues to rise, [the] average yield in the province has been stagnant..." (Pingali *et al.*, 1990, p. 11). This can affect net farm household income since the study shows that the increased use of modern agricultural inputs does not result in an increase in productivity. The decrease in household net income will discourage farmers from staying in agriculture. In addition, the increased rate of degradation of paddy rice production will reduce the long-term agricultural productive capacity of the region. These imply that the agricultural viability of the region is at risk.

Therefore, whether or not other regions in Indonesia can increase their share in maintaining the national food security, sustaining a viable agricultural sector in this region is a national public policy imperative — short- and long-term — especially considering development objectives pertaining to improving the welfare of rural populations.

This study starts with the assertion that urbanization in the NCR and Jakarta-West Java regional planning have negatively affected agricultural development in the NCR and assesses causal relationships between urbanization

[12] Assuming that the increase in productivity from technological innovation is less than the increase in agricultural labor supply.

and agricultural development. Specifically, it describes the spatial effects of existing regional development policies on the distribution of benefits of regional development, especially between rural and urban areas of the region; analyzes the nature and process of urbanization and determinant factors affecting urbanization; and describes effects of urbanization on agricultural development, specifically the structure of land tenure, land conversion and its impact on household income, and the structure of rural employment.

Research Objectives

The general goal of this study was to provide a better understanding of the urbanization process and its determinants, its relationships with regional development and, most importantly, its impacts on agricultural development in the NCR, an urbanizing corridor region between Jakarta and Cirebon. Understanding this general objective provides a useful means to identify policy interventions to sustain a viable agricultural sector subject to urbanization. The study objectives are to:

1. Analyze urbanization in the NCR and identify factors associated with urbanization, such as changes in land tenure, changes in agricultural economy, demographic changes, educational development, development in public facilities, industrial development and proximity to primary cities.
2. Describe the impacts of urbanization on agricultural development, especially land tenure — the structure of landownership, the degree of absentee landownership in the agricultural sector, agricultural prime land conversion and its following impact on agricultural households' income; the impacts of urbanization on the rural and regional structure of employment; and the impacts of urbanization on rural industrialization.
3. Describe the spatial impacts of urbanization on the distribution of the agricultural resource base, the distribution in the development of public facilities, and the disparities in economic development in rural and urban areas within the region.
4. Describe the relationships among urbanization, regional planning and agricultural development.
5. Examine the policy implications of the findings for sustaining agricultural and development planning in the NCR

Urbanization and Agricultural Development: Key Concepts

Two important concepts employed in this study are *urbanization* and *agricultural development*. They reflect the literature and theories of urbanization and agricultural development, and the uses of these theories to measure the impacts of urbanization on agricultural development.

Urbanization is a term with different meanings to different scientific disciplines and specialists (Firman, 1992). For regional economists, urbanization might mean the process accompanying the structural transformation of the regional economy (Reismann, 1964; McGee, 1971; Choe, 1981; Bhadra and Brandao, 1993). For land resource developers, urbanization might mean conversion of agricultural lands to non-agricultural uses and an increase in real estate values (Schmid, 1968). For a sociologist-demographer, the urbanization process means the process of migration from rural to urban areas with its sociological and spatial consequences (Hauser et al., 1985). For psychologists, urbanization might mean the changing of personal orientation from a *rural-traditional* to *urban-modern* way of life (Helmer and Eddington, 1973).

The importance of the growth of non-agricultural activities in defining urbanization was also emphasized by Sjoberg (1960) when he defined urbanization as the increase in population density and an increase in heterogeneity of a wide range of non-agricultural occupations. The literature of urban geography provides some fundamental aspects of urbanization that facilitate the development of indicators of urbanization. Breese (1966, p. 3) defined urbanization as a "process of becoming urban, moving to cities, changing from agriculture to other pursuits common to cities, and corresponding changing of behavior patterns." By definition, urbanization involves a change in economic orientation from agricultural to non-agricultural activities and a migration from rural to urban areas. Schmid (1968) gave as a specific indicator of urbanization the increase in land values in the rural-urban fringe.

Friedman (1966) gives two broad definitions of urbanization that are applicable to urbanization in lesser developed countries (LDCs). First, "urbanization commonly refers to the concentration of formerly dispersed populations that are primarily engaged in farming in a small number of settlements whose principal economic activities are in the services, trades, and manufactures." The second meaning "refers to urban modes of production, living, and thinking originating in these centers and spreading from these to outlying towns and rural populations" (Friedman and Wulff, 1982, p.1). These definitions are modified by Williams, Brunn and Darden (1983, p.5) when they define urbanization as "a process involving two phases or aspects: (i) the movement of people from rural to urban places where they engage primarily in non-rural functions or occupations; and (ii) the change in life-style from rural to urban with its associated values, attitudes, and behaviors. The important variables in the former are population density and economic functions; the important variables of the latter depend on social, psychological, and behavioral factors. The two aspects are mutually supportive."

Urbanization in Indonesia is usually defined according to Central Bureau of Statistics' (BPS, 1988) criteria[13]. As presented by Firman (1992, p. 97), an urban area is commonly defined as an area that has: (i) a population density of 5,000 persons per square kilometer or above; (ii) 25 percent or fewer agricultural households; and (iii) eight or more types of urban facilities. Murphey (1966) suggested that the study of urbanization would be most useful if the researcher used the criteria of urbanization adopted by the nation where the study was conducted. His suggestion was based on his experience in Indonesia and China, where reliable data for the study of urbanization—such as conducted in MDCs—were not available.

This study follows the Friedman (1966) and Williams *et al.* (1983) definition of urbanization so that a single indicator of urbanization can be developed. In a more recent study of urbanization, this line of thinking in defining urbanization is employed by Sharbatoglie (1991, p. 51) when he defines urbanization as "the process which results in an increasing number of people living in non-agricultural settlements."

Thus, urbanization, in this study, is defined as a concentration of formerly dispersed populations accompanied by the changing occupational orientation to non-rural or non-agricultural functions. Such urbanization can be measured by using at least three indicators — population density, land rent and economic functions. This study, however, will use the rate of change in population density to describe the urbanization process. The use of this single indicator as a measure of regional urbanization in the study area is based on the simple fact that data on population density are available at the desa (or village) level and monitored by national census every 10 years. In addition, it is also based on the theoretical statement proposed by Adna Weber (cited in Berry, 1981, p. 27), "...urbanization is a process of population concentration. It proceeds in two ways: the multiplication of the points of concentration and the increasing in size of individual concentrations.... Just as long as cities grow in size or multiply in number, urbanization is taking place.... Urbanization is a process of becoming. It implies a movement from a state of less concentration to a state of more concentration."

The selection of change in population density as the indicator of regional urbanization in this study follows a classification of rural and urban areas based on population density. This classification may seem a rather simplistic measure because it does not reflect the dynamics of economic activities in both rural and urban areas. However, this measure can be used as a surrogate of urban phenomena by interpreting less populated areas as real rural areas and more populated areas as areas with urban characteristics. Moreover, this measure is commonly used to classify rural and urban areas (Firman, 1992; Sharbatoglie, 1991; Hamer *et al.*, 1986; Sutton, 1989; El-Bushra, 1989; Obudho and Waller, 1976; Nath, 1989). The main difficulty in using population density as the indicator to differentiate rural and urban areas is in determining the cutting point of population density representing the transition between rural and urban areas. Various studies have used different density levels to differentiate rural and urban areas.

The definition of *agricultural development* (AD) adopted in this study goes beyond Hayami and Ruttan's (1985) concept that emphasizes the total production and productivity of agriculture. It adopts the concept of *sustainable agricultural development* (SAD) with its main focus on the results of agricultural development — namely, to maintain and improve the welfare and well-being of the people who earn their livelihood in agriculture. It is assumed that agricultural development should be "directed to the well-being of people rather than on agricultural growth itself" (Cramer and Jensen, 1988, p. 334). In formulating an operational definition of AD, this last study used an eclectic approach that allows the classic theory of development, the theory of sustainable development, the classic theory of agricultural development and sustainable agricultural development to be linked.

The starting point in formulating an operational definition of agricultural development is to trace the meaning of "development" itself. Although development is a very broad concept, the literature of development has provided some important components of development that can be applied in this study.

With the assumption that social and political problems can be overcome if the national income increases more than the population growth, most development theorists have equated development with economic development and economic development with economic growth (Eicher and Staatz, 1990). Consequently, development efforts have been directed mainly to increase national income (Mabogunje, 1981; Santos, 1977; and Dadzie, 1980). But the experience of the past decades has shown that social problems and political upheavals have emerged in countries at all stages of development, both in countries with rapidly rising per capita incomes and those with stagnant economies (Seers, 1970). Therefore, the theory of development becomes critically questioned by most development theorists (Gillis *et al.*, 1987; Little, 1982). According to some of these development theorists, "...development is a normative concept which is almost a synonym for improvement..." (Okun and Richardson, 1961; Seers, 1970; Colman and Nixson, 1978; Honjo; 1980; Bhooshan and Misra, 1980; Bryant and White, 1982).

[13] In Indonesia, the differentiation between urban and rural areas is made at the village or desa level, so there are urban villages (*desa kota*) and rural villages (*desa desa*).

Two important concepts are embedded in the theory of development. The first is a concept of *value* that should be followed in the development efforts; the second is the concept of *improvement*. In the value concept, Seers (1970) proposes the necessary conditions for a universally acceptable norm as the realization of the human personality. The necessary conditions are enough food (physical necessity) and income to cover other basic needs such as clothing and shelter, and, more importantly, social justice, reflected, in part, in income distribution. Accordingly, the concept of "improvement" represented in development is overcoming poverty, unemployment and inequality, as well as fulfilling human potential through freedom, education and political independence. This theory measures development by using broader indicators than just the increase of national income. Moreover, some indicators of development (e.g., basic needs, equity, poverty reduction) are incorporated in the theory of sustainable development, although sustainable development is more than the theory of development proposed by Seers (1970).

Sustainable development emphasizes moral responsibility, which is rooted in the philosophy that the current generations have a moral obligation toward future generations (Mellert, 1985) because: (i) future generations will be essentially the same as the present generation; (ii) one is born into a given generation by historical accident; (iii) our survival as a species is more important than our individual survival; and (iv) even after we die, the effect of our lives continues. Our obligation is based on the truth that we are more than unique and separate individuals, living only the immediacy of the now. We are, rather, parts of a much larger whole, one that transcends space and time.

The generic definition of SD is "paths of human progress to meet the needs of the present generation without compromising the ability of future generations to meet their own needs" (UNCED, 1987). This definition has fundamental objectives — meeting current needs while considering future generations' needs — from which we can derive a range of operational objectives that cut across most previous intellectual and political boundaries (Lele, 1991).

The concept of *sustainable development* originated in the context of renewable resources and has subsequently been adopted as a broader paradigm by the environmental movement. Agriculture, consequently, as one of the foundations of human society and as a major activity at the human-environment interface, receives the most attention in the operationalization of sustainable development (Lele, 1991). The concept of sustainable agriculture is still evolving from the dialogue concerning the issue of agriculture and the environment (Ikerd, 1990). Douglas (1984) identifies three schools of thought in sustainable agricultural development (SAD).

The first concerns SAD as food sufficiency — expand the supply of food with some combination of more resources and greater productive capacity. For this school of thought, the problem of sustaining the resource base or of honoring the culture of agriculture seems less important than the challenge of keeping up with population growth. Ruttan (1990) supports this school of thought. He believes that sustainability is not enough, that "if the concept of sustainability is to serve as a guide to practice, it must include the use of technology and practices that both sustain and enhance productivity" (Ruttan, 1990, p. 402).

The second sees SAD primarily as an ecological question. It concerns the ecological balance. For this school of thought, the agricultural system that needlessly depletes, pollutes or disrupts the ecological balance of natural systems is unsustainable and should be replaced by one that honors the longer term biophysical constraints of nature. Instead of taking population as given, this approach tends to espouse policies that limit population to those levels that a finite physical environment can sustain.

The third is an alternative agriculture or radical agriculture. Its attention focuses primarily on the effects of various agricultural systems on the social organization and culture of rural life. According to DESFIL (no date), this school of thought resembles the ecologists in their desire to husband the permanent carrying capacity of renewable resources, but it differs in its emphasis on sustainable human communities. Not only must human beings establish stewardship of the earth — they must also establish this sense in their relations with each other, particularly as it affects justice and participation.

According to Lockeretz (1986), this last school of thought has broader goals than the other two schools of thought. Accordingly, it can be taken to refer to agricultural systems that share certain broad goals: (i) to consider the structure of the agricultural sector that favors small to moderate-sized farms, especially independent family farms worked by resident owner-operators; (ii) to reduce the ties to the industrial economy by increasing the self-sufficiency of farms; (iii) to strengthen local and regional agriculture to achieve regional food self-sufficiency; (iv) to preserve farmland and avoid further disaggregation of farmland; (v) to better protect the agricultural resource values; and (vi) to achieve long-term sustainability through conservation of the finite agricultural resource base.

Across these three schools of thought, Schultink (1992a, p. 206) defines SAD as "the development and management of natural resources to ensure or enhance the long-term productive capacity of the resource base and improve the long-term wealth and well-being derived from alternative resource use systems, with acceptable

environmental impacts." Therefore, in SAD, policy and objectives should be designed to accomplish one major goal, "the achievement of a sustained flow of benefits which enhance the quality-of-life of human populations without reducing the long-term productive capacity of our resource base" (Schultink, 1992a, p. 204).

For its policy purposes, the GOI has defined SAD as "...development in which social benefits exceed social costs, considering a long time frame and special consideration for the poor and vulnerable. It implies, for present and future generations, continuous improvement in real per capita income and quality of life, continuous narrowing of income distribution, elimination of physical suffering due to poverty...." (Tarrant *et al.*, 1987).

In defining agricultural development, Stevens and Jabara (1988, pp. 5-6) suggest that the following directions are included in the framework of agricultural development. They propose that agricultural development should be directed to: (i) increase real per capita income of the agricultural population; (ii) increase food security; (iii) reduce the number of people in poverty; (iv) achieve the least possible amount of disruption in cultural values, rural life and employment; (v) achieve a desired level of equity; (vi) establish economic incentives that encourage increased productivity, creativity and enterprise; and (vii) increase individual opportunities, economically and politically.

Based on the previously discussed concepts of agricultural development, this study uses the operational definition of agricultural development in LDC settings as an effort directed to *maintain and improve the agricultural support infrastructure, to promote a cost-effective structure of agricultural landownership, to reduce the dependence on absentee landownership with the objective to maintain and improve food security of rural populations, to enhance the welfare or quality of life of the rural population employed in agriculture, and to reduce rural-urban disparities without reducing the long-term productive capacity of the agricultural resource base.*

The assumption embedded in this definition — that improvement of the rural population's food security, quality of life and rural-urban equity can be fostered by maintaining and improving the agricultural resource base, and strengthening the land tenure, such as by reducing the dependency on absentee landowners — is that this can be accomplished by an improvement of regional development strategies. This assumption may be supported by several researchers and development practitioners. Smith (1982, p. 19) states that, "...ownership of wealth, in the form of money, land or other assets, provides direct access to some of the good things in life by virtue of providing purchasing power or social status." Therefore, the agricultural household's food security, welfare and quality of life can be attributed to the secured ownership of agricultural lands as the basis of the agricultural production system (Sen, 1990; Eicher and Staatz, 1990; Stevens and Jabara, 1988; Chuta and Liedholm, 1990).

In this aspect, this study is limited to analyzing the changes in the structure of landownership, the changes in the degree of absentee landownership, the changes in agricultural prime land (or agricultural infrastructure, based on the World Bank's definition [World Bank, 1994]) and its subsequent impact on agricultural household income, changes in the structure of rural employment and rural-urban disparities.

Data Collection and Research Method

This study used three sets of data. The first set was primary data collected through village surveys. These data represented a regional sample with the desa (village) as the unit of analysis. Secondary data were provided by the Agricultural Land Conversion Project, based on an agricultural household survey of irrigated land conversion in the past 10 years. The third was 1980-90 census data.

The primary data, collected in 1982 and 1992, updated information from census data, collected every 10 years. Using the village as a unit of analysis made it possible to differentiate desa kota (urban villages) and desa desa (rural villages).

The information covered 1982-1992. The data include:

1. General information on the villages such as village area (hectare [ha]), total paddyland[14] (ha), agricultural dryland (ha), land used for housing (ha), and other lands (ha).
2. Village population — total households and total population as well as total numbers of men and women.
3. Population distribution based on sources of income[15] such as farmer (landowner), sharecropper, agricultural laborer, small-scale enterprise[16], government official, private sector (entrepreneur)[17], manufacturing labor and informal sector[18].
4. Migration, including total in-migration and total out-migration by sex.
5. Village distance to the cities and market (kilometer [km]) including the distance from the village to Jakarta (km), to Cirebon (km), to the capital city of the

[14] "Paddyland" and "irrigated paddyland" are used interchangeably in this study.

[15] Based on the largest share to the total individual income and defined as more than 50 percent of the total income.

[16] Small-scale enterprise is defined as an activity related to subsistence that needs labor from outside the household.

[17] Entrepreneurs (private sector) are defined as people who have their own businesses and use outside labor.

[18] Informal sector is defined as an activity that is not captured in the definition of small-scale enterprise, such as angkot driver (angkot is a small bus) or ojek (a transportation system using motorcycles).

kabupaten (km), to the capital city of the kecamatan (km) and to the local market used mostly by the village population (km).

6. Infrastructure and social-economic conditions such as total paved road (km), total hardened road (km), number and types of public transportation modes, number and types of economic institutions in the village such as banks or cooperatives, number and types of health care facilities, number and types of educational facilities, number and types of social and religious facilities such as youth centers or mosques, number of households with electricity, number of households with televisions and number of households with telephones.
7. Village industries, including number of small scale-, medium- and large-scale industries[19].
8. Paddyland conversion (ha); the price of paddyland (Rp., [Rupiah]) and the number of land transactions in the village.
9. Average agricultural wage rate (Rp.) in the village, based on plowing and harvest periods.
10. Landownership of dryland and paddyland, absentee landownership of dryland and paddyland, and number of absentee landlords.
11. Some qualitative data, such as village perception about the urbanization process in the region or problems with compensation for land conversion.

The sampling procedure employed follows Barber's (1988) process, consisting of five steps:

1. **Definition of population**, i.e., a collection of all individual elements from which the samples will be collected. The unit of analysis of this study is the desa or village, and the population considered in this study represents all villages in the NCR.
2. **Construction of a sampling frame** or a population frame, i.e., an ordered list of population elements. The sampling frame or the population frame was developed using a list of villages and a village-level map of each kabupaten. In this study, the target population was the same as the sampled population[20].
3. **Selection of a sampling design**, i.e., a procedure used to select elements from the sampling frame for the sample. There are four sampling designs commonly employed in the data collection: simple random sampling, stratified sampling, systematic sampling and cluster sampling (Barber, 1988; Williams, 1986; Berry and Baker, 1968). According to Barber (1988, p. 216), in terms of efficiency, "Stratified samples are [the] best and cluster samples are [the] worst. Random samples usually lie somewhere between these two extremes. That is, for a given level of precision, stratified samples require the fewest respondents and cluster samples require the most respondents...."

   To optimize sampling efficiency (highest confidence level at a given sampling size), the study used a stratified, random sample in each kabupaten in the NCR as the sampling design. Each kabupaten in the NCR was stratified into four strata based on the village population density, which reflected the degree of urbanization. The first stratum was villages with up to 750 people per square kilometer; the second stratum was villages with population densities between 751 and 1500 people per square kilometer; the third stratum was villages with population densities between 1501 and 2250 people per square kilometer; and the fourth stratum was villages with population densities of more than 2250 people per square kilometer. In each of these strata, the village samples were randomly chosen.

   Total samples for this study were 44 villages or desas. According to the central limit theorem, sample sizes of > 30 can be expected to represent sample characteristics on which basis inferences about the population can be made with confidence.
4. **Specification of the information** to be collected.
5. **Collection of the data**. In this study, data collection or data gathering was divided between two groups. The first group covered the kabupatens Bekasi and Karawang and was coordinated by the Center of Agro-Economic Research (PAE). Within this group and for each kabupaten, data were collected by three enumerators from the office of PAE accompanied by one kabupaten coordinator. The second group, which covered kabupatens Subang and Indramayu, was coordinated by the Research Institute, Bogor Agricultural University (IPB). Within this group, data collection in both kabupatens was conducted by three enumerators from IPB accompanied by one coordinator,[21] who was also responsible for gathering secondary data in all four kabupatens in the region. All enumerators were trained to ensure that they understood the questions and concepts. Prior to the training, the coordinators conducted several meetings to develop the questionnaire and coordinate the survey.

Two sets of secondary data were gathered from several sources. The

[19] Large-scale industry is defined as an industry with 100 or more employees; medium-scale industry is defined as an industry with 20 to 99 empoyees; and small-scale industry is defined as an industry with more than 5 to 19 employees.

[20] "The target population is the set of all [elements] relevant to a particular study. The sampled population consists of all the [elements] listed in the sampling frame" (Barber, 1988, p. 206).

[21] Dr. Winoto was the coordinator of this group.

first data set represented 1980 and 1990. Census data collected at the desa level contained information related to population and village economy. The census data covered all 1099 villages in the NCR. The second data set related to the impacts of agricultural land conversion on household income. These data were provided by the Project of Agricultural Land Conversion in Java, Center of Agro-Economic Research (PAE), Ministry of Agriculture, which had conducted a household survey in the NCR in 1993. The respondents of that survey were the households involved in land conversion during the past 10 years. The total number of respondents was 100 households, consisting of 52 households involved in land conversion and 48 households not involved in land conversion. For the households involved in land conversion, income —both farm income and off-farm income before and after land conversion — was recorded. The survey used a random sampling technique for each group of agricultural households.

Compilation and Organization of Data

Primary data and secondary data from the 1980 and 1990 censuses were tabulated, edited and compiled at Michigan State University (MSU); the secondary data related to household income were compiled and organized by the office of PAE, Bogor, Indonesia. The first two data sets were organized using the standard geographic matrix recommended by Berry (1964). This standard matrix is widely used in regional economic analysis. It eases the process of statistical analysis by considering both the spatial and time dimensions. Most importantly, this organization of data was compatible with the structure of data in the SPSS, the analytical software used in this study.

Data Analysis

To address the research objectives, the data were analyzed in the following sequence :

1. The study area was stratified into two main strata, rural and urban, based on population density. For the purpose of analyzing disparities in the distribution of the benefits of regional development and the concentration of resource base and economic activities, the rural and urban strata were further subdivided into smaller substrata.
2. The level of urbanization in the study area was analyzed.
3. The process of urbanization in the study area was analyzed, based on the selected variables of push and pull factors by using a multiple regression model.
4. The location quotient (LQ) and Gini coefficient (GC), indicators of spatial concentration and spatial disparities employed in this study, were calculated for variables related to regional agricultural development, regional economy and regional development in public facilities.
5. Lorenz curves were constructed to represent the results of the analysis.
6. The impacts of urbanization on agricultural development were assessed.
7. Relevant hypotheses were tested.

Mathematical Models

The mathematical models presented include models to determine the rate of change in population density over time and over space, a model to analyze the urbanization process, models for calculating location quotients (LQ) and Gini coefficients (GC), and models to compare means of spatial and temporal characteristics.

Rate of Change in Population Density Over Time

The rate of change is commonly defined as a change in any characteristic or substance over a period of time. If the rate of change is defined as dR, the change in the characteristic or substance is defined as dX and the time needed for the change is defined as dT, the mathematical relationship among these three variables can be presented as :

$$\delta R = \frac{\delta X}{\delta T} \quad \text{.....(1)}$$

Using this model, the rate of change in population density in the study area can be determined by dR – the rate of change in population density, dX – the difference of population density in a given time period, and dT – the time period. For example, if population density in 1982 is k people/km2 and population density in 1992 is m people/km2, the annual rate of change in population density between 1982 and 1992 is equal to (m-k) people/km2 divided by 10 years.

Rate of Change in Population Density Over Space

The rate of change in population density over space is predicted to decline as the distance between the area and the central business district increases (Blair, 1991; Dicken and Lloyd, 1990; Rees, 1970). The rate of change in the population density over space is commonly predicted by a general model of a spatial decay function (Rees, 1970, p.277; Blair, 1991, p. 373), presented as :

$Dx = D_0 e^{-bx}$ ..... (2)

Where : D_x is population density at a distance-x

D_0 is population density at the urban core

e is a constant, and

X is the distance from the village to the capital city of the kabupaten (km)

b is rate of change in population density

In Equation 2 above, there is one parameter, b, that can be predicted using existing data from the study area. Therefore, in this study, parameter estimation is conducted by transforming equation 2 into a linear model, presented as :

$\ln D_x = \ln D_0 - bX \pm E$ ..... (3)

Where : D_x is population density in each village in the kabupaten in the NCR

D_0 is population density at the capital city of the kabupaten

X is the distance from the village to the capital city of the kabupaten

b is the rate of change in population density, and

E is the standard error

Assuming that the capital city of each kabupaten in the NCR is also the center of development in the kabupaten makes it possible to determine the rate of change of population density over space in each kabupaten. Using least square estimators (Neter and Wasserman, 1974; Johnston, 1991; Barber, 1988; Runyon and Haber, 1980; Ott, 1988), the value of the rate of change in population density (b), the expected value of population density in the capital city of the kabupaten (D0) and the standard error (E) of the regression model (equation 3) in each kabupaten can be determined through equations 4, 5 and 6 below :

Estimation of *b*:

$$b = \frac{\Sigma(Xi-\overline{X})(\ln Dxi-\overline{\ln Dx})}{\Sigma(Xi-\overline{X})(Xi-\overline{X})} \quad \text{..... (4)}$$

Estimation of In D_0:

$$In\ D_0 = \overline{\ln Dx} - b\overline{X} \quad \text{..... (5)}$$

Estimation of *E*:

$$E = \sqrt{\frac{\Sigma(\ln Dxi - b - bXi)(\ln Dxi - b - bXi)}{n-2}} \quad \text{..(6)}$$

Where n = number of sample villages (1, 2, ..., i)

Urbanization Analysis

Urbanization is affected by two groups of factors: rural push factors and urban pull factors. If urbanization, measured as a rate of change in population density, is expressed as Y, in the general multiple regression model, the process of urbanization in the NCR can be expressed as :

Y = f (rural push factors, urban pull factors) ..... (7)

Suppose that rural push factors consist of all identified rural factors affecting urbanization in the NCR, expressed in the mathematical form such as S (Xi), for i = 1, 2, ..., N and urban pull factors, expressed as S (Xj), for j = 1, 2, ..., M; then, equation 7 can be expressed in the multiple regression model such as :

$$Y = A_{0.1\text{-}(n+m)} + \sum_{K=1}^{N+M} A01.\text{-}(n+m)\ Xk + E \quad \text{..... (8)}$$

Where : Y is the urbanization process, expressed in rate of change in population density (people/km2/year)

X_k represents rural and urban factors affecting the urbanization process in the NCR; all these factors are stated in the form of their rates of change, where k = 1, 2, ..., N+M

$A_{0.1\text{-}m}$ are constants (value of Y when Xk = 0)

$A_{01.\text{-}m}$ are partial regression coefficients, and

E is an error term

Then, the partial regression coefficients—the slopes of the relationship between Y and X1-k when the other variables are held constant—can be used to determine which factors or variables in the equation significantly determine the urbanization process in the NCR.

However, to show comparable rates of change, all variables must be expressed in the same measurement scale. This can be obtained by transforming the A coefficient into the β coefficient, using the standardized variable value such as :

ZXk = (Xk – X)/Sx ..... (9)

Where : Z_{Xk} is standard Z-score of the variable (Xk) value

X is mean value, and

Sx is standard deviation

Equation 8, then, can be transformed as equation 10 below :

$$Z_{Y0.1\text{-}(n+m)} = \beta_{0.1\text{-}(n+m)} + \sum_{K=1}^{N+M} \beta_{01.\text{-}(n+m)}\ Xk + E \quad \text{..... (10)}$$

Because we are dealing with Z-scores, the mean of every variable is zero so that the value of $\beta_{0.1\text{-}(n+m)}$ is zero. Consequently, equation 10 can be expressed as equation 11 below :

$$Z_{Y0.1\text{-}(n+m)} = \sum_{K=1}^{N+M} \beta_{01.\text{-}(n+m)}\ Xk + E \quad \text{.....(11)}$$

To properly employ a linear model of multivariate analysis (unbiased estimates), all model assumptions should be satisfied. These (Johnston, 1991) are: (i) linearity — partial plot of the dependent and independent variable must depict a linear relationship; (ii) the conditional distributions of the residuals are normal; (iii) the means of the conditional distribution — for every value of X, the mean of $(Yi - Y_{pred(i)})$ must be zero; (iv) homoscedascity — equal variances in the conditional distributions; (v) the value of each observation on the independent

variable is independent of all of the values (autocorrelation); (vi) lack of measurement error; and (vii) the residuals from each partial regression equation are uncorrelated (collinearity).

Location Quotient (LQ) and Gini Coefficient (GC)

The location quotient (LQ) is an index for comparing an area's share of a particular activity with the area's share of some basic or aggregate socioeconomic activity. The LQ for a given activity for area i is the ratio of the percentage of the total regional activity in area i to the percentage of the total base in area i. If Ai is equal to the level of the activity in area i and Bi is the level of the base, then LQi is presented below (Barber, 1988, p.87):

$$LQi = \frac{Ai/\Sigma Ai}{Bi/\Sigma Bi} \quad \text{..... (12)}$$

The Gini coefficient (GC) or an index of dissimilarity (Barber, 1988, p. 90) is used in this study to measure disparities in the regional distribution of development benefits. Besides GC, there are several alternative methods that can be used to measure dissimilarity, such as range, relative mean deviation, variance and standard deviation of the natural log. (Cowell, 1977).

The *range* measures the difference between the highest and the lowest regional sample characteristics. This measure ignores the spatial distribution of the characteristics between the extreme values and is sensitive to outliers. The value of range falls between zero (equally distributed) and n (fully concentrated). The *relative mean deviation* looks at the entire distribution, not only extreme values. This measure may produce the same results from different distributions on the same side of the mean. The *variance* is a better measure than the relative mean deviation because it is sensitive to differences from the mean for all observations. Its major disadvantage is that a distribution could have a larger relative variation than another and still have a lower variance if the variation around the mean characteristic level is smaller than the comparative distribution. The *coefficient of variation* is a more comprehensive measure than the previous measures and is sensitive to differences from the mean like the variance, and independent of the mean characteristic. It has, however, two weaknesses: the squaring procedure in its calculation procedure is arbitrary and it weighs differences equally. The *standard deviation of the natural logarithm* is the most useful measure of inequity, especially if one is interested in attaching greater weight to extreme differences, such as the lower income characteristic per capita. This measure is an appropriate one to analyze extreme poverty. However, it uses an arbitrary squaring procedure in its calculation and it is seldom reported so that it creates difficulties in comparative studies of social equity (Cowell, 1977).

Among them, the GC is the most common method used to measure dissimilarity of inequity (Smith, 1982) and has better characteristics than the others. It is more sensitive to the characteristic of differentials, independent of proportional changes in the characteristics and population, avoids the arbitrary squaring procedure and provides a direct measure of the characteristic differences (Cowell, 1977). Therefore, this study uses the Gini coefficient to measure disparities in the regional distribution of development benefits.

The GC is measured using the location quotients approach (Smith, 1982). The coefficient is derived as follows:

1. The variables used in the GC are selected.
2. Reference variables are selected for use in the computation of location quotients.
3. Location quotients are calculated for all subregions (see equation 12).
4. The subregions are ranked according to their location quotient value.
5. The Gini coefficient is computed according to:

$$Gx = \sum_{I=1}^{M-1} (YiXi+1 - Yi+1Xi) \quad \text{..... (13)}$$

Where G_X is the Gini coefficient of variable X

X_i is the cumulative share of variable X corresponding to subregion-i

Y_i is the cumulative share of the reference variable corresponding to subregion-i

Two types of Gini coefficient ratios can be used:

1. To determine spatial disparities between subregions. When the GC ratio is close to unity, the set of subregions are almost identical in spatial disparity. To the extent that this ratio is different from 1.0, regional differences exist.
2. To determine changes in inequality over time. The ratio of the GCs can be calculated between two points in time. If there is no significant change in the disparity between the two, the ratio will be close to 1.0. The higher the ratio, the higher the spatial disparity over time.

Sample Mean Comparison

To compare regional characteristics between 1982 and 1992, the study used the t-test method for paired samples to test the proposed hypotheses. Following Barber (1988), Netter and Wasserman (1974) and Runyon and Haber (1990), the procedure and mathematical presentation of analysis can be summarized as follows:

Suppose that the pair of values expressed as X_{82i} and X_{92i}, the matched-pairs, is $di = X_{82i} - X_{92i}$; for i = 1, 2, ..., n. The hypothesis concerning the value of sample mean difference,

$$\frac{\overline{d} - 0}{Sd/\sqrt{n}}$$

is tested using the t-test of

$$t = \frac{\bar{d} - 0}{Sd/\sqrt{n}}$$ with degree of freedom of n-1 for $$Sd = \sqrt{\frac{\Sigma(di - \bar{d})(di - \bar{d})}{n - 1}}$$

Hypothesis testing is constructed as follow :

Hypothesis :

$H_0 : \mu_1 - \mu_2 = \mu_d$

$H_A : \mu_1 - \mu_2$ is not equal to μ_d (two tailed), or

$H_A : \mu_1 - \mu_2 < md$ (lower tail), implies $H_0 : \mu_1 - \mu_2 > \mu_d$, or

$H_A : \mu_1 - \mu_2 > \mu d$ (upper tail), implies $H_0 : \mu_1 - \mu_2 < \mu_d$, or

Decision Rule :

Reject H_0 if $t < -t_{a/2}$ or if $t > t_{a/2}$ for two-tailed test with CF : $\mu_d + t_{a/2}$ S_d/n

Reject H_0 if $t < -t_a$ for lower tail test with CF (confidence interval) : $\mu d + t_a S_d/n$

Reject H_0 if $t > t_a$ for upper tail test with CF (confidence interval) : $\mu d + t_a S_d/n$

To compare the characteristics of rural and urban areas, this study used the *t-test for two independent samples* because the two population variances are not known. If the variances of the two populations are the same, sample variance 1 and sample variance 2 are combined using pooled variance,

$$S_p^2 = \frac{(n1-1)s_1^2 + (n1-1)s_2^2}{(n1-1)(n2-1)}$$, with

degree of freedom (df) of $n_1 + n_2 - 1$ and t-statistic of

$$t = \frac{\overline{X1} - \overline{X2}}{Sp\sqrt{1/n1 + 1/n2}}$$

In these equations, X_1 refers to sample 1 with number of sample n1 and X_1 refers to sample 2 with number of sample n_2, and the mean of X is calculated by

$$\overline{X} = \frac{\sum Xi}{n}$$

If the variances of the two populations are not the same, the t statistic used to test the hypothesis is

$$t = \frac{\overline{X1} - \overline{X2}}{\sqrt{S_1^2/n1 + S_2^2/n2}}$$.

The degree of freedom for this case is

$$df = \frac{(S_1^2/n1 + S_2^2/n2}{(S_1^2/n1)^2/(n1-1) + (S_2^2/n2)^2/(n2-1)}$$.

Urbanization And Its Causal Factors

The level of urbanization is described on the basis of the rural-urban classification described earlier, followed by the analysis of the rate of change in population density or the level of urbanization. In the analysis of the urbanization process, regional pull and push factors are described in detail so that specific factors affecting the urbanization process can be identified.

To analyze the urbanization process, the study treats the NCR as a single entity without disaggregating the region into administrative units of kabupatens or into several agro-ecological zones. The NCR can be treated as a single entity because all four kabupatens in the region, according to Firman (1992) and Soemarwoto *et al*. (1991), have similar agricultural development problems affected by urbanization. In addition, at the Jakarta-West Java regional level, the NCR can be categorized as one agro-ecological zone because irrigated lands for rice cultivation are ubiquitous in the region (Soemarwoto, 1992), the region consists of similar types of farm management (Erwidodo, 1990), the area is composed of alluvial lowlands (Ongkosongo, 1979), and there are no significant regional differences in rainfall and temperature (average yearly rainfall is about 1880 mm and temperature ranges from 27.1 to 29.7^0 C (Ongkosongo, 1979; Ilahude, 1979). Nevertheless, in determining the spatial rate of change in population density, this study uses the kabupaten as a basis of analysis because the capital city of each kabupaten in the NCR is the center of development in the kabupaten.

Urbanization in the NCR

Similar to Indonesia's Central Bureau of Statistics (CBS), this study defines urbanization at the village level. However, the criteria used to classify rural and urban villages are different. Here the process of rural-urban classification is described, followed by the analysis of the level of urbanization. In the latter analysis, rates of urbanization of urban villages and urban populations are presented and compared. Finally, results are presented in the form of both temporal and spatial rates of change in population densities.

Rural-Urban Classification

Urbanization in Indonesia is defined at the desa or village level by categorizing the villages into rural villages and urban villages (Hamer *et al*., 1986; Firman, 1992). The urban population is defined as the population in the villages categorized as urban. This study uses the same method but a different criterion to classify the rural and urban villages of the study area.

Several criteria can be used to define urbanization and classify rural and urban areas. The first is the level of regional economic progress, which is commonly approached by classifying the aggregate measures of the state of economic progress of the region (Williams *et al*., 1983). The second is land rent, such as applied in Schmid's (1968) and Thrall's (1987) studies in land conversion from rural to urban uses. The third is population density, also a very common measure used to classify rural and urban areas (Goldberg and Chinloy, 1984; Firman, 1992; Sharbatoghie, 1991; Hamer *et al*., 1986; Sutton, 1989; Obudho and Waller, 1976). Finally, two or more criteria may be combined (Williams *et al*., 1983; CBS, 1988).

Indonesia's Central Bureau of Statistics (1988) uses the fourth criterion. It classifies a village as an urban village if population density exceeds 5,000 people/km^2, agricultural households comprise 25 percent of the population or less, and eight or more urban facilities are present.[22] Although the Central Bureau of Statistics uses multiple criteria, critics argue strongly about defining such criteria. According to Rietveld (1988), all the criteria used to define urban villages in Indonesia are very arbitrarily determined. An agricultural household, for example, is defined as one where agriculture is the main job of the head of household, though in reality there is more than one working household member. The presence of an urban facility in the village is determined without considering its quality; and, more importantly, village characteristics do not contribute significantly to determining the degree of urbanization, such as the existence of an elementary school in the village. In Java, the elementary school, especially the public elementary school, is present in each village because government standards dictate that each village should have at least one elementary school. Firman (1992, p. 97) has criticized these CBS criteria by stating that "these criteria are difficult to apply because of inconsistency in result between them."

Differing from Central Bureau of Statistics (1988) and Firman (1992), this study uses population density as a single criterion to classify rural and urban areas in the NCR. Reasons for choosing this single indicator are: (i) the absence of comprehensive measures of economic progress available at the village level; (ii) the lack of formal records or comprehensive studies about land rent in the NCR that can be used as a basis for classification; (iii) the fact that population and total area data are well documented at the village level through national census data at 10-year intervals and, therefore, population density for each village can be derived; and (iv) incomplete records of 1980 census data beyond data on population and total area that can be accessed via the Central Bureau of Statistics, Jakarta, and in the Office of Statistics in the kabupatens and in the province. As a result of this last reason, this study cannot use Central Bureau of Statistics criteria because the complete census data of 1990 cannot be compared with the incomplete census data of 1980.

Level of Urbanization

This study uses a population density of 1,500 people/km^2 as the cutoff between rural and urban villages in the NCR. It finds that the use of CBS's criterion of 5,000 people/km2 results in a very small number of urban villages in the NCR. From a total of 1099 villages in the NCR, only 18 villages in 1980 and 37 villages in 1990 could be categorized as urban villages.

This represents only 1.64 percent of all villages in 1980 and only 3.37 percent of all villages in 1990. Table 1 and Figure 1 compare the number of villages categorized as rural and urban areas based on a village population density of 5,000 people/km2 in 1980 and 1990.

The data (Table 1, Figure 1) show that the use of a population density of 5,000 people/km$_2$ as the threshold to differentiate rural and urban areas contradicts the assertion that the NCR is the most urbanized and industrialized region in Java (Soemarwoto, 1992; Firman, 1992; Hamer *et al.*, 1986; Hill, 1992b), because the analysis shows that only a very small portion of the NCR can be categorized as urban villages. Hamer et al. (1986, p. 14), for example, calculated that 21 percent of the urban population in West Java (1980)

Table 1. Number of villages in the Northern Coastal Region (NCR) of West Java by population density interval in 1980 and 1990.

Area	Pop. density (people/km^2)	Number of villages		Percent of villages	
		1980	1990	1980	1990
R1	< 1,000	760	635	69.15	57.78
R2	1,001-2,000	246	55	22.38	5.00
R3	2,001-3,000	47	325	4.28	29.57
R4	3,001-4,000	18	19	1.64	1.73
R5	4,001-5,000	10	28	0.91	2.55
RURAL	< 5,000	1081	1062	98.36	96.63
U1	5,001-6,000	6	9	0.55	0.82
U2	6,001-7,000	5	5	0.46	0.46
U3	7,001-8,000	1	4	0.09	0.36
U4	8,001-9,000	2	6	0.18	0.55
U5	9,001-10,000	1	5	0.09	0.46
U6	> 10,000	3	8	0.27	0.72
URBAN	> 5,000	18	37	1.64	3.37
NCR		1099	1099	100.00	100.00

Sources of data: 1980 and 1990 population censuses issued by the Central Bureau of Statistics, Jakarta, and the Offices of Statistics of the kabupatens Bekasi, Karawang, Subang and Indramayu.

[22] Facilities considered as urban facilities include primary school or equivalent, secondary school or equivalent, high school or equivalent, theater, hospital, maternity center, clinic, hardened or paved road, telephone/post office, market with permanent building, shopping center, bank, factory, restaurant, public electricity and party supply renting service.

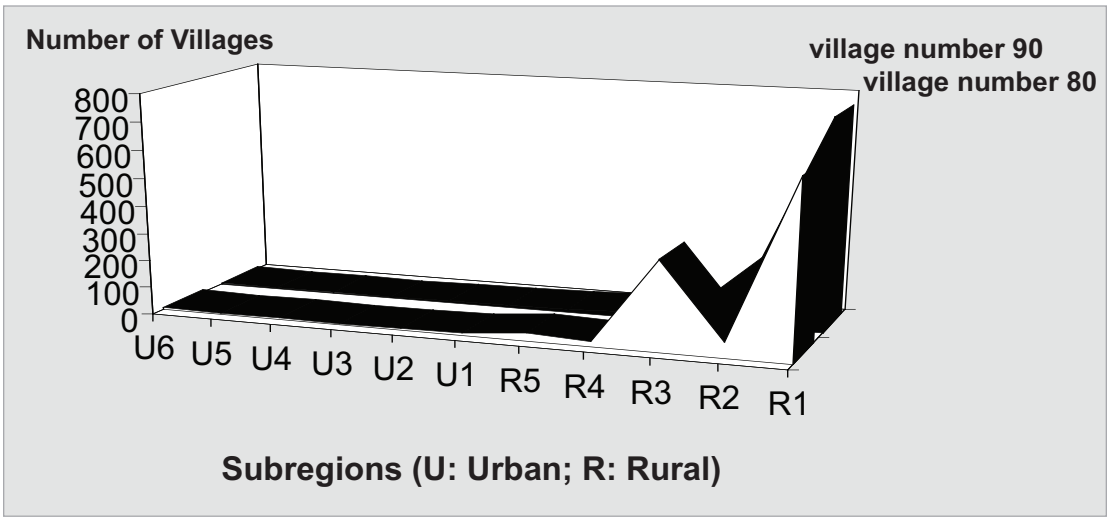

Figure 1. Distribution of the villages in the NCR based on the village population density (source: Table 1).

was concentrated in the NCR (Firman, 1992). Since the calculation of urban population in Indonesia is based on urban villages, the high urban population must reflect the high number of urban villages. The result will be much lower if the other two CBS criteria—agricultural households and urban facilities—are included in the analysis. Therefore, adopting the CBS's criteria implies that urbanization in the NCR is very low and much lower in other regions in Java, and it does not reflect the reality of urbanization in the NCR. In addition, Figure 3 shows that a village population density of 5,000 people/km^2 is not the best threshold to differentiate between rural and urban villages in the NCR because no clear distinction between rural and urban villages is present.

This study suggests a cutoff of 1,500 people/km^2 to differentiate between rural and urban villages. Using this level of population density better reflects the level of urbanization and the urbanization process in the NCR. The results of the analysis of the level of urbanization in the NCR are presented in Tables 2 and 3 and Figures 2 and 3.

The population density levels of rural and urban villages in the NCR in 1980 and 1990 are summarized in Table 2 and Figure 4. Rural and urban areas are subdivided further into four subregions (R1-4 and U1-4) based on the population density. Subregions R1-4 to U1-4 indicate the degree of urbanization from the most rural area (R1) to the most urbanized area (U4). The levels of rural and urban populations in 1980 and 1990 and the levels of population in each subregion of the rural and urban areas are summarized in Table 3 and Figure 3.

Compared with Figure 1, Figure 2 shows that a village population density of 1,500 people/km2 provides a clear differentiation between rural and urban villages in the NCR. This classification represents the best result among the alternatives that have been considered in this study.

Table 2 shows that there were 151 urban villages (13.74 percent) in 1980 and 223 (20.29 percent) in 1990. This means that the number of urban villages increased by 47.67 percent between 1980 and 1990. Table 3 and Figure 3, on the other hand, show that urban population in the NCR increased from 1,179,362 people (25.69 percent) in 1980 to 2,439,996 people (38.75 percent) in 1990. The average urban population increased between 1980 and 1990 by 106.89 percent, or 10.69 percent per year. This result shows that the level of urban population in the NCR at 25.69 percent in 1980 is higher than that of the level of urban population in West Java of 21 percent as calculated by Hamer et al. (1986). This result is expected because the urbanization process in West Java is more concentrated in the NCR (Firman, 1992).

There are differences between urban village growth and urban population growth in the NCR between 1980 and 1990. In this period, urban population in the NCR increased by 10.69 percent per year while the number of urban villages increased by 4.77 percent per year. This implies that urban population growth in the NCR is determined not only by the increase in urban villages, thus changing the rural villages into urban villages, but also by changing demographic factors, rural and urban development, industrialization and other factors. According to Hamer *et al*. (1986, pp. iii and 1), "this growth is the outcome of millions of individual household and business decisions."

Table 2 also shows that the number of villages with a population density of no more than 375 people/km^2 decreased significantly from 194 villages (17.65 percent) in 1980 to 91 villages (8.28 percent) in 1990, a decrease of 53.09 percent or 5.309 percent per year. This decrease also occurred in the subregion —the number of villages with a population density of 376 to 750

people/km² decreased from 368 (33.48 percent) in 1980 to 317 villages (28.84 percent) in 1990. In these subregions, the number of villages decreased by 13.86 percent between 1980 and 1990. On the other hand, in the other subregions the number increased between 0.576 and 6.5 percent per year in the period 1980-1990. These figures show that the number of villages in the NCR with a population density of more than 750 people/km² increased in the period 1980-1990. Among these regions, the urban areas show a larger increase than rural areas. Among the urban areas, the most populous subregion (U4) had the highest increase — 65 percent over 10 years. This implies that the highest urbanization rate occurred in the region with the highest population density, an indication of an agglomerative effect of urban population (Bhadra and Brandao, 1993).

Table 3, on the other hand, shows that between 1980 and 1990, the proportion of rural population decreased in all subregions of the rural area while the proportion of urban population increased, especially in the urban fringe and in the most populous subregions of the urban areas. These figures also imply that an increase in urban population occurs mostly in the areas characterized by previously higher population density.

Table 2. Number of rural and urban villages in the NCR in 1980 and 1990 (classification based on a village population density of 1,500 people/km2 as the cutoff to differentiate rural and urban villages).

Area	Pop. density (people/km²)	Number of villages		Percent of villages	
		1980	1990	1980	1990
R1	≤ 375	194	91	17.65	8.25
R2	376-750	368	317	33.48	28.84
R3	751-1,125	247	321	22.47	29.21
R4	1,126-1,500	139	147	12.65	13.38
RURAL	≤ 1,500	948	876	86.25	79.71
U1	1,501-1,875	48	69	4.37	6.28
U2	1,876-2,250	27	34	2.46	3.09
U3	2,251-2,626	16	21	1.46	1.91
U4	≥ 2,626	60	99	5.46	9.01
URBAN	> 1,500	151	223	13.75	20.29
NCR		1,099	1,099	100.00	100.00

Sources of data: 1980 and 1990 population censuses issued by the Central Bureau of Statistics, Jakarta, and the Offices of Statistics of the kabupatens Bekasi, Karawang, Subang and Indramayu.

Temporal and Spatial Rates of Change in Population Density

The rate of change in population density can be used as an indicator of the concentration of population over time and space. In this study, the temporal rate of change in the population density (TRCPD) is considered an indicator of the degree of urbanization over a period of time because urban areas and rural areas are differentiated by population density. And spatial rate of change in population density (SRCPD) indicates the spatial differences in the degree of urbanization from the capital city of the kabupaten to the countryside.

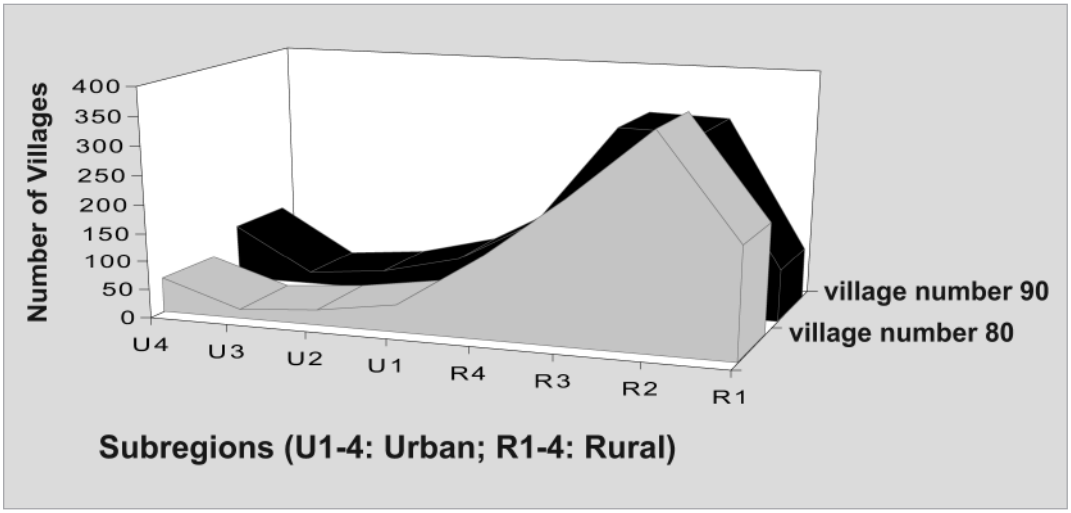

Figure 2. Distribution of rural and urban villages in the North Coastal Region of West Java in 1980 and 1990, based on a village population density of 1,500 people/ km² as the cutoff to differentiate rural and urban villages (source: Table 2).

Table 3. Changing composition of rural and urban population in the NCR in 1980 and 1990.

Area	Pop. density (people/km²)	Number of villages		Percent of villages	
		1980	1990	1980	1990
R1	≤ 375	443,004	300,792	9.65	4.78
R2	376-750	1,234,220	1,234,220	26.89	20.22
R3	751-1,125	1,058,788	1,487,116	23.07	23.62
R4	1,126-1,500	674,900	795,385	14.70	12.63
RURAL	≤ 1,500	3, 410,912	3,856,372	74.31	61.25
U1	1,501-1,875	285,916	410,672	6.23	6.52
U2	1,876-2,250	162,206	203,129	3.53	3.23
U3	2,251-2,626	144,922	175,681	3.16	2.79
U4	≥ 2,626	586,318	1,650,514	12.77	26.21
URBAN	> 1,500	1,179,362	2,439,996	25.69	38.75
NCR		4,590,274	6,296,368	100.00	100.00

Sources of data: 1980 and 1990 population censuses issued by the Central Bureau of Statistics, Jakarta, and the Offices of Statistics of the kabupatens Bekasi, Karawang, Subang and Indramayu.

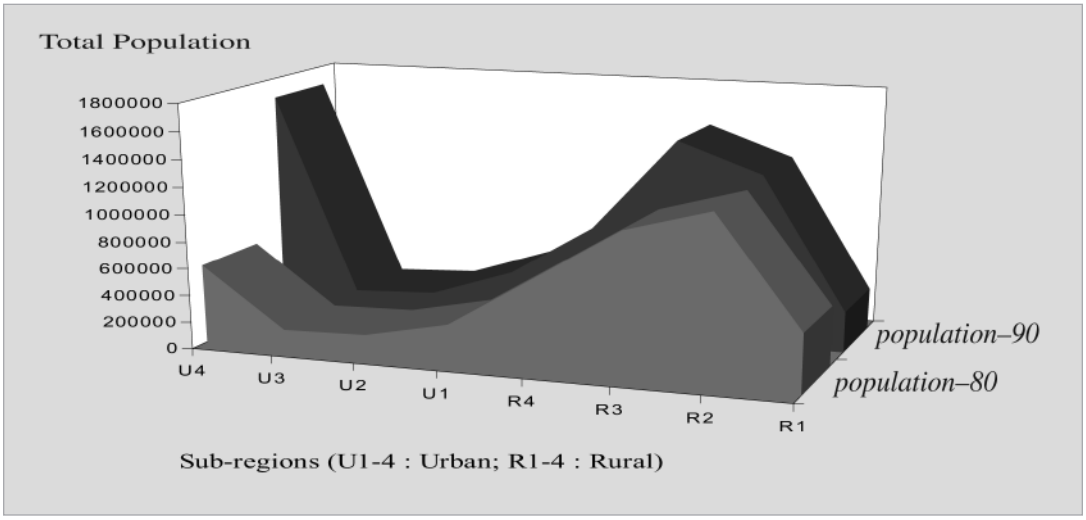

Figure 3. Total population in each subregion in the NCR for 1980 and 1990 (source: Table 3).

Temporal Rate of Change in Population Density

In this study, temporal rate of change in population density (TRCPD) is defined as the change in the NCR's population density over the period 1980-1990 and is expressed as people/km²/year. It is calculated using equation 1, above. The results of the analysis are presented in Tables 4 and 5, and Figure 4. Table 4 presents the means of rate of change in population density between 1980 and 1990 (TRCPD) in rural and urban areas as well as in each subregions in the NCR. These means are plotted in Figure 4 so that the patterns of TRCPD from the most urbanized region (U4) to the most rural region (R1) can be easily seen. Table 5 presents the result of the analysis of variance (ANOVA) of the means of the TRCPD in the NCR. It also presents the result of the analysis of mean comparison of the TRCPD in each subregion in the NCR using the least significant difference (LSD) tests of the multiple range tests.

Both Table 4 and Figure 4 show that the TRCPD in the NCR is positive between 1980 and 1990. This indicates that population density increased throughout the region. However, the increase in population density is not evenly distributed between rural and urban areas and among the subregions in rural and urban areas. The TRCPD decreases from the most urbanized area (U4) to the most rural area (R1). The mean of the TRCPD of the urban area is 115.57 people/ km²/year and that in the rural area is 12.76 people/ km² /year. Statistically, the mean of TRCPD of the urban area differs very significantly from that of the rural area, with a confidence level of 99 percent (a = 0.01). The yearly increase in population density in the urban area is 9.01 times that in rural area. Therefore, it can be interpreted that urbanization in the NCR during the period 1980-1990 increased mostly in areas with higher population densities. This substantiates the assertion by Henderson (1977) that the accumulation or movement of population in high density (core) regions occurs through a *self-reinforcing process*.

The accelerated growth in population density over time is further substantiated by comparing the means of the TRCPD among subregions in the NCR (Table 5). The analysis shows that the TRCPD is the highest in the most urbanized area (U4), at 221.22 people/km²/year, and lowest in the most rural area (R1), at 5.10

Table 4. Mean of rate of change in population density between 1980 and 1990 (TRCPD) in the North Coastal Region (NCR) of West Java.

Area	Population density (people/ km^2)	Annual rate of change in population density (people/km^2/year)
R1	≤ 375	5.1043
R2	376-750	9.8172
R3	751-1125	14.5185
R4	1,126-1,500	20.0236
RURAL	≤ 1,500	12.7631
U1	1,501-1,875	19.4939
U2	1,876-2,250	36.5776
U3	2,251-2626	61.0957
U4	≥ 2,626	221.2178
URBAN	> 1,500	115.5708
NCR		33.6240

Sources of data: 1980 and 1990 population censuses issued by the Central Bureau of Statistics, Jakarta, and the Offices of Statistics of the kabupatens Bekasi, Karawang, Subang and Indramayu.

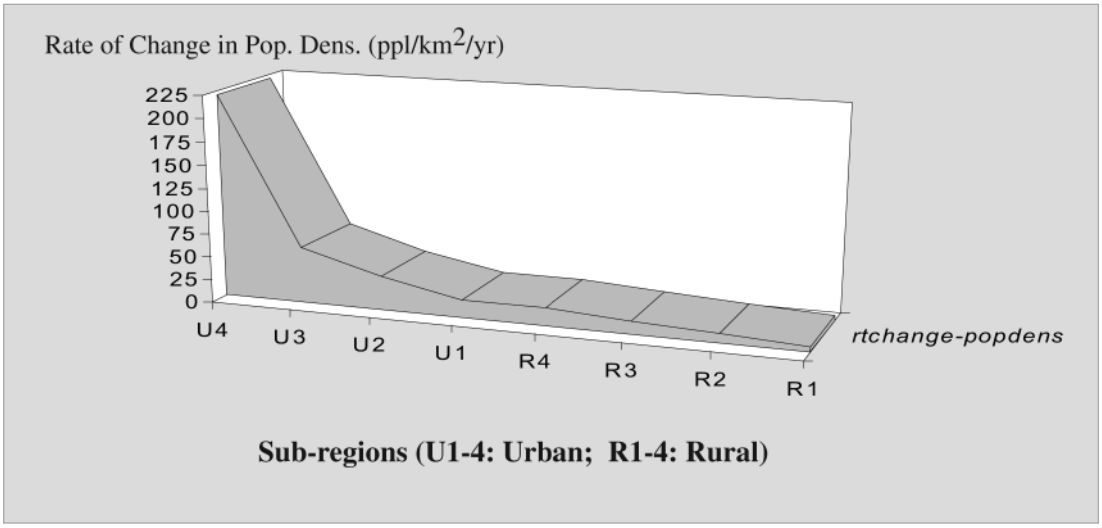

Figure 4. Mean of rate of change in population density between 1980 and 1990 in each of the NCR subregions (source: Table 4).

people/km2/year (see also Table 4).

Further analysis using one-way analysis of variance (ANOVA) and least significant difference (LSD) multiple range tests show that very significant differences exist in the means of the TRCPD among subregions in the NCR (Table 5). Comparing rural and urban areas, it seems that the TRCPDs in rural areas are relatively consistently low compared with those in urban areas. In rural areas, only R4 with a TRCPD of 20.02 people/km^2/year has a higher TRCPD than that of R1 and R2, which have TRCPDs of 5.10 and 9.82 people/km^2/year, respectively (confidence level of 90 percent or a = 0.10). On the other hand, in urban areas, U4 with a TRCPD of 221.22 people/km^2/year has a very significantly higher TRCPD than U1-3 and R1-4 (confidence level of 99 percent or a = 0.01). The subregion U3 with a TRCPD of 61.10 people/km2/year has a significantly higher TRCPD than U1 and R1-4 (a = 0.05) and also higher than U2 (a = 0.10). The subregion U2 with a TRCPD of 36.58 people/km2/year has a higher TRCPD than R1-3 (a = 0.10). Finally, subregion U1, with a TRCPD of 19.49 people/km2/year, has a higher TRCPD than R1-2 (a = 0.10).

The existence of the self-reinforcing process of population density growth implies that—assuming that spatial organization in the NCR is governed by spatial competition (Mabogunje, 1981; Mehretu, 1989)—people in the region prefer living in urban areas with high population densities than in rural areas with low population densities. This may imply that there exists a preference to locate in urban areas because of a perception of a higher *quality of life*. This assertion will be visited again in the analysis of the urbanization process in the NCR.

Spatial Rate of Change in Population Density

The spatial rate of change in population density (SRCPD) is defined as the spatial differences in the degree of population concentration over distance from the center of the region (Gould, 1972; Blair, 1991; Dicken and Lloyd, 1990). In this study, SRCPD indicates the spatial differences in the degree of urbanization from the capital city of the kabupaten to the countryside. SRCPD is calculated by using a general decay function model, a simple negative exponential function described above.

This study assumes that the model—which is successfully applied in the developed countries (Haggett, Cliff and Frey, 1977; Mehretu, 1989) to predict the decay of population density from the city

Table 5. Mean comparison of the temporal rate of change in population density (TRCPD) among subregions in the NCR using one-way ANOVA and least-significant difference (LSD) multiple range tests.

Analysis of Variance (ANOVA)					
Source	D.F.	Sum of squares	Mean squares	F-ratio	F-prob.
Among subregions	7	3911916.67	558845.24	43.33	0.00
Within region	1091	14071540.23	12897.84		
Total	1098	17993456.90			

Multiple range tests: LSD tests with a (a = 0.01; b = 0.05; c = 0.10)								
Subregions	R1	R2	R3	R4	U1	U2	U3	U
R1	-							
R2		-						
R3			-					
R4	c	c		-				
U1	c	c			-			
U2	c	c	c			-		
U3	b	b	b	b	b	c	-	
U4	a	a	a	a	a	a	a	-

Sources of data: 1980 and 1990 population censuses issued by the Central Bureau of Statistics, Jakarta, and the Offices of Statistics of the kabupatens Bekasi, Karawang, Subang and Indramayu.

center to the countryside—also applies in the NCR. Because no one city in the NCR can be referred to as the center of the whole NCR[23], this study uses the capital cities of the four kabupatens as the city center. Consequently, the analysis of the SRCPD is conducted in each kabupaten in the NCR; the regional analysis of the SRCPD in the NCR is conducted by assigning an average village distance to the kabupaten capital city.

This research addresses the value of b in each kabupaten and in the whole region. In predicting such parameters, the equation is transformed into a linear model. Using the least square method or the least square estimators (Neter and Wasserman, 1974; Johnston, 1991; Barber, 1988; Runyon and Haber, 1980; Ott, 1988), the value of b, ln D_0 and E can be determined by using equations 4, 5 and 6. The results of the analysis are presented in Table 6 and Figure 3. Table 6 presents the value of b, ln D_0 and E along with the statistical measures related to the linear model, such as the strength of linear association (r, linear correlation), measure of goodness of fit of the regression model (r^2, coefficient of determination) and significant testing of the strength of the variable relationships (Snedector's F-ratio). Figure 3 presents the result of the linear relationship between the natural log of a village's population density and its distance from the capital city of the kabupaten. The figure plots only the positive value of the natural log of the village's population density by assigning

[23] There is no big city in the NCR, although this region is located between two of the biggest cities in Indonesia, Jakarta and Cirebon. However, there are at least four smaller cities in the NCR, which also happen to be the capital cities of the four kabupatens in the NCR.

Table 6. Rate of change in population density (b) over distance (SRCPD) from the capital city of the kabupaten predicted using a linear model with least square method.

Linear model: $\ln D_x = \ln D_0 - bX \pm E$					
	NCR	Bekasi	Karawang	Subang	Indramayu
b	0.044077	0.044255	0.048547	0.043955	0.041708
ln D_0	1.867912	1.815106	1.807865	1.904647	1.888894
r	0.872140	0.846900	0.892590	0.915010	0.861320
r^2	0.760620	0.717240	0.796720	0.837240	0.741870
Adjusted r^2	0.760400	0.716040	0.796040	0.836580	0.741030
E	0.395100	0.482440	0.322270	0.286890	0.444110
F-statistic	3485.715	596.0956	1175.795	1275.720	885.1787
Sign. level[24]	0.0000	0.0000	0.0000	0.0000	0.000

Sources of data: 1980 and 1990 population censuses issued by the Central Bureau of Statistics, Jakarta, and the Offices of Statistics of the kabupatens Bekasi, Karawang, Subang and Indramayu.

numbers to the regression equations.

All statistical measures used in this analysis show that the model fits the situation in the region, including all kabupatens. The values of linear correlation ® in all regions are very high, between 0.85 and 0.92, indicating a very strong predictive relationship between a village's population density and its distance from the capital city of the kabupaten. Furthermore, F-tests show that the relationships between a village's population density and the distance from the capital city of the kabupaten in all regions is very significantly strong, with a confidence level of more than 99 percent (see footnote 3). The values of the coefficients of determination (r^2) are also very high in all regions — between 0.72 and 0.84. These indicate that distance from the capital city of the kabupaten explains 72 to 84 percent of the variance of the villages' population density.

However, the values of the expected result—*b* or the SRCPD—are very low in all regions, with values of 0.0441, 0.0443, 0.0485, 0.0440 and 0.0417 for the NCR, Bekasi, Karawang, Subang and Indramayu, respectively. This means that in Bekasi, for example, for each kilometer farther from the capital city of the kabupaten, the population density declines by 0.0443 people per square kilometer. This implies that no significant difference exists in population density over distance from the capital city of the kabupaten. Therefore, the rank size rule may not be the probable distribution of population in the NCR. In other words, as Mehretu (1983) found in his study of cities of sub-Saharan Africa, the simple negative exponential function, which has been a very successful model for the developed countries, is not

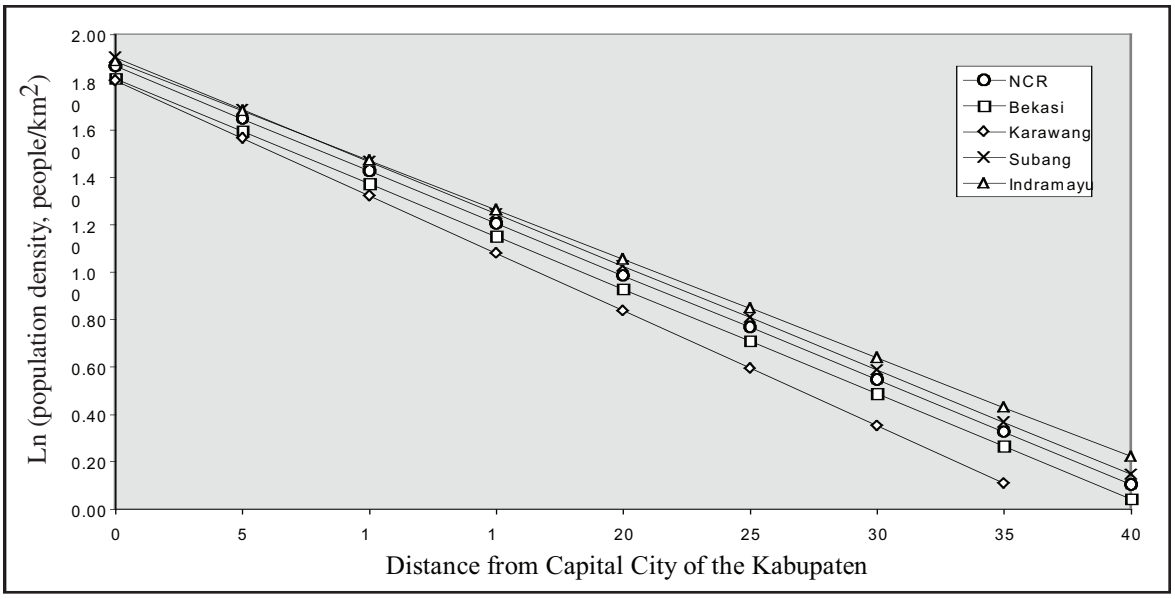

Figure 5. Distance decay function of the population density from the capital city of kabupatens Bekasi, Karawang, Subang and Indramayu, and in the NCR in 1990 (source: Table 6).

[24] F-test with significant level of a = 0.0000 means that the regression model fits the relationship with a confidence level of more than 99 percent.

representative for the NCR.

Beyond the statistical reliability of the model, the actual value of the natural log of a village's population density is plotted against the predicted value derived from the analysis (Figure 6). This plot shows whether the model provides an over- or underestimation of village population density.

The 45°-line in Figure 6 indicates a perfect model of prediction. If the model is a good predictor, the actual values of the natural log of the village's population density will be scattered close to this line. In this case, however, the actual values of the natural log of the village's population density are concentrated below the line. This indicates that the model overestimates actual values and does not represent the region's condition.

Urbanization and Agricultural Development

The relationship between urbanization and agricultural development in Indonesia is affected by both national and regional development policies — a policy to maintain the region as the nation's predominant food producer and a hierarchical regional development strategy. Urbanization and agricultural development affect each other by direct or indirect linkages, including the underlying causal factors of urbanization itself. Increased regional urbanization on Java affects agriculture by putting additional pressure on the limited island resource base, including increased food demand and the need to increase productivity with a declining resource base. At the same time, increasing agricultural activity stimulates urbanization by inducing regional industrial development through redistribution of labor among rural and urban sectors. In addition, current government policies undermine the viability of the agricultural sector and cause rural-urban disparities, forcing rural people to seek better economic opportunities in urban areas.

Urbanization is largely influenced by push factors from rural agricultural areas, though pull factors of urban areas and demographic factors play a role as well. For example, regional urbanization is associated very significantly with an increase in agricultural land conversion into non-agricultural uses that affect the viability of agriculture in rural areas. This research indicates that in the past 10 years, the proportion of urban villages in the NCR has increased from 13.74 percent to 20.29 percent. Similarly, the urban population increased from 1,179,362 people to 2,439,996 people — from 25.69 percent to 38.75 percent, an annual urbanization rate of 10.69 percent per year. It can be expected that such a high rate of urbanization will negatively affect regional agricultural development.

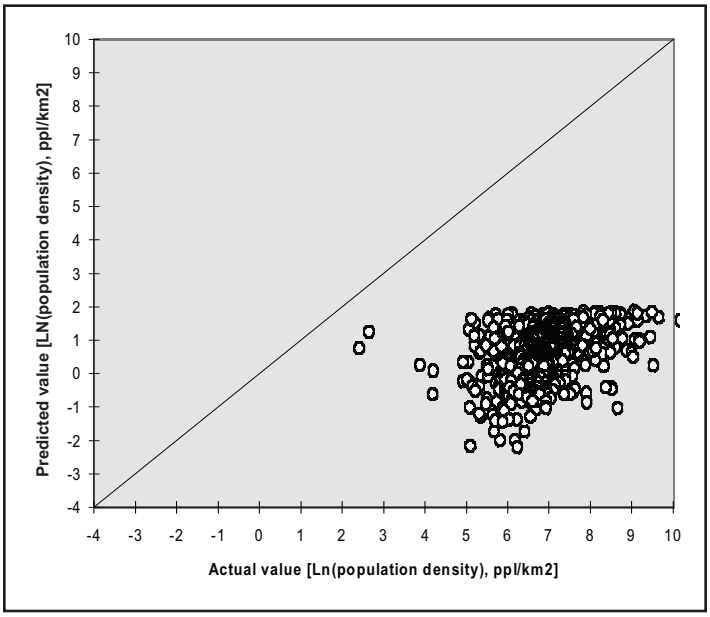

Figure 6. The relationship between the actual values of the natural log of a village's population density and its predicted values derived from the analysis.

Operational Definitions

This study defines agricultural development as any systematic effort to (1) maintain and improve the agricultural infrastructure; (2) promote farm landownership through, among other things, reduction of absentee landownership; (3) maintain and improve food security of rural populations; (4) improve the welfare of rural households, and (5) reduce rural-urban disparities, all without reducing the long-term productive capacity of the land resource base. The implicit assumption in this definition is that rural food security, overall quality of life and social equity can be enhanced by maintaining and improving the agricultural resource base, strengthening its ownership structure and reducing the dependency on absentee landownership through comprehensive regional development strategies.

This study analyzed changes in the structure of landownership, changes in the degree of absentee landownership, changes in agricultural prime land (or agricultural infrastructure), agricultural land conversion with its effects on agricultural household income, changes in the structure of rural employment and rural-urban disparities in the period 1982-1992.

Other prominent impacts of urbanization on agricultural development, such as the changing quality of the agricultural resource base

as a result of intensive land use patterns, soil and water pollution induced by urban-based agricultural management, and environmental impacts of fertilizers and pesticides – are not pursued in this study

Changes in the Distribution of Regional Landownership

The structural changes in landownership of dryland and paddyland, both in the rural area in the NCR and in the NCR as a whole, were assessed at the village level by comparing 1992 data with 1982 data. Statistical mean comparisons were conducted using t-tests for paired samples. The results are summarized in Table 7 and 8. Table 7 summarizes the comparison between the percentage of households with various land sizes (drylands and paddylands) within the NCR. Table 8 summarizes the comparison between the percentages of households with various land sizes (dryland and paddylands) in the rural areas within the region in 1982 and 1992.

a. Changes in Landownership Distribution in the NCR

The structure of agricultural landownership in the NCR between 1982 and 1992 changed very significantly (Table 7). These changes put the objectives of sustainable agricultural development at risk, especially those designed to improve the welfare of people engaged in agriculture, as a result of increased diseconomies of scale due to land parcelization. Analysis shows that the percentage of landless households increased. Specifically, the percentage of households without agricultural dryland and paddyland grew very significantly. Households without agricultural dryland increased from 47.66 to 56.64 percent in 1992, and households without paddyland increased from 43.48 percent in 1982 to 53.41 percent. Therefore, the number of households without paddyland grew faster than the number without dryland, increasing by 22.84 percent and 18.84 percent, respectively.

The increase in regional landless households is not significantly associated with the decrease in the percentage of households with < 0.5 ha dryland or < 0.5 ha paddyland. Although households with < 0.5 ha dryland and households with < 0.5 ha decreased from 32.31 to 30.86 percent and from 27.47 percent in 1982 to 27.07, respectively, this decrease is not significant. This indicates that the percentage of subsistence farmers in the region has remained largely unchanged. Regional agricultural development has, therefore, been unable to reduce the percentage of subsistence farmers.

However, the increase in regional landless households is very significantly associated with decreases in the percentage of households with ≥ 0.5 ha dryland and ≥ 0.5 ha paddyland during the period of analysis. Households with 0.5 to 1.0 ha dryland and those with 0.5 to 1.0 ha paddyland decreased very significantly, from 12.15 percent to 8.57 percent and from 16.42 percent to 12.05 percent, respectively.

Table 7. The differences in the distribution of household landownership in the NCR between 1982 and 1992.

Variable	Percent of households with land		Mean of paired differences	Significant differences
	1982	1992		
Dryland :				
0 HA	47.6639	56.6427	-8.9789	*****
< 0.5 HA	32.3098	30.8595	1.4502	
0.5 – 1 HA	12.1532	8.5748	3.5784	*****
>1 – 2 HA	5.2080	3.1732	2.0348	*****
> 2 HA	2.1645	0.7380	1.4266	*****
Paddyland :				
0 HA	43.4802	53.4057	-9.9255	*****
< 0.5 HA	27.4689	27.0698	0.3991	
0.5 – 1 HA	16.4220	12.0536	4.3684	*****
>1 – 2 HA	9.2136	5.7011	3.5125	*****
> 2 HA	3.5350	1.6350	1.9000	*****

Source: primary data (village survey)
Significance level :
* 20 percent ** 15 percent *** 10 percent **** 5 percent ***** 1 percent

These decreases are the greatest among other land divisions. For the same 10-year period, households with 1.0 to 2.0 ha of dryland or paddyland decreased very significantly, from 5.21 percent to 3.17 percent and from 9.21 percent to 5.70 percent, respectively. The decrease in the percentage of households with this hectarage of paddyland is greater than those with dryland (39.16 percent and 38.11 percent, respectively). Finally, the percentage of households with more than 2.0 ha of dryland decreased less than paddyland. Households with more than 2.0 ha of dryland decreased by 65.74 percent (from 2.16 percent in 1982 to 0.74 percent in 1992). Similarly, the households with more than 2.0 ha paddyland decreased by 53.67 percent (from 3.54 percent to 1.64 percent).

b. Changes of Landownership Distribution in Rural Areas

Changes in the agricultural landownership distribution in rural areas of the NCR during the 1982-1992 period are of the same magnitude as those in the NCR as a whole. The number of landless households increased and the households with agricultural landholdings decreased. No significant differences exist between the percentage of households with < 0.5 ha drylands and those with < 0.5 ha of paddyland in the period 1982-1992. Results of the analysis of changes in the distribution of agricultural landownership in the rural areas are summarized in Table 8.

Table 8 shows that the percentages of households without agricultural drylands and paddylands increased very significantly in the period 1982-1992, by 16.95 percent and 17.82 percent, respectively. However, households with < 0.5 ha agricultural dryland or paddyland showed no statistically significant increase. Households with 0.5 to 1.0 ha agricultural dryland decreased very significantly, from 12.11 to 8.53 percent, a relative decrease of 29.56 percent. Households with 1.0 to 2.0 ha agricultural dryland decreased significantly (32.03 percent). Also, the percentage of households with > 2.0 ha dryland decreased very significantly (58.04 percent).

Similarly, the percentage of households with 0.5 to 1.0 ha paddyland decreased very significantly (19.66 percent). The percentage of households with 1.0 to 2.0 ha paddyland decreased significantly (39.38 percent) and the percentage of households with more than 2.0 ha dryland decreased very significantly (49.56 percent).

The analysis shows a very significant increase in agricultural land parcelization during the period 1982-1992, characterized by an increasing percentage of landless households. Agricultural land parcelization puts agricultural development at risk because it threatens the welfare of the population engaged in agriculture because of diseconomies of scale in agricultural enterprises (Toner, 1979; Dunford, 1981); and Lockeretz, 1986).

Table 8. Differences in the distribution of household landownership in the rural areas of the NCR between 1982 and 1992.

Variable	Percent of households with land		Mean of paired differences	Significant differences
	1982	1992		
Dryland :				
0 HA	49.9700	58.4400	-8.4700	*****
< 0.5 HA	28.5488	27.6554	0.8933	
0.5 – 1 HA	12.1075	8.5271	3.5804	*****
>1 – 2 HA	6.3692	4.3267	2.0425	****
> 2 HA	2.5496	1.0708	1.4787	*****
Paddyland :				
0 HA	47.4821	55.9400	-8.4879	*****
< 0.5 HA	26.9838	25.4217	1.5621	
0.5 – 1 HA	13.6300	10.9513	2.6788	****
>1 – 2 HA	9.4188	5.7129	3.7058	***
> 2 HA	3.4096	1.7192	1.6904	*****

Source: primary data (village survey)
Significance level :
* 20 percent ** 15 percent *** 10 percent **** 5 percent ***** 1 percent

Moreover, the combined effects of increased absentee landownership and increased agricultural land conversion in rural areas undermines the role of the region as the rice bowl of Indonesia. This effect may be mitigated through future consolidation of agricultural lands.

Absentee Landownership in Rural Areas and the NCR

Regional urbanization is commonly accompanied by increasing prices of agricultural land. With prior knowledge of regional land use plans, land speculators can acquire agricultural land proposed for urban development. This increases the hectarage of land in rural areas owned by people from outside rural areas. In the NCR, the increased hectarage of land owned by outsiders, however, is determined not only by increased land speculation, but also by other factors such as increased investment in agricultural land as a hedge against inflation.

In sociological terms, the land owned by outsiders is usually referred to as absentee land and is controlled by absentee landowners. In the NCR, parallel terms such as "tanah gontai" and "tuan tanah" (or "spekulan" to indicate land speculators) are commonly used.

The study describes changes in the degree of absentee landownership in the rural areas and the region as a whole during the period 1982-1992, including changes in the hectarage of absentee lands and the number of absentee landlords. It does not, however, differentiate between the causes of absentee lands, i.e., land speculation or other socioeconomic reasons.

a. Absentee Landownership in the NCR

Changes in absentee landownership in the NCR between 1982 and 1992 are summarized in Table 9, which presents absentee ownership of dryland, paddyland and total land.

The total absentee lands and the number of absentee landlords in the region increased very significantly. Average absentee lands in the region, assessed at the village level, increased by 193.20 percent, or 19.32 percent annually. The average number of absentee landlords increased by 12.30, an increase from 28.43 in 1982 to 40.73 in 1992. Therefore, the average number of absentee landlords increased by 4.33 percent annually. The total hectarage of absentee lands increased faster than the number of absentee landlords, indicating a concentration in absentee landownership.

Comparing the total hectarage of absentee lands of dryland and paddyland shows that increased absentee hectarage can be attributed to an increase in absentee dryland. Average absentee dryland in the region increased very significantly, from 12.45 ha in 1982 to 87.89 ha in 1992. This means that the total absentee dryland in the NCR increased by 60.59 percent annually! Average absentee paddyland, meanwhile, increased very significantly, by 14.40 ha. This means that the total absentee paddyland in the NCR increased by 42.29 percent during the period 1982-1992, or 4.23 percent annually.

The pattern of increase in absentee dryland is accompanied by a higher number of absentee landlords acquiring dryland than acquiring paddyland. The average number of absentee landlords with dryland

Table 9. Regional differences in the hectarage of absentee lands and the total number of absentee landowners or absentee landlords between 1982 and 1992.

Lands owned by and the number of absentee landlords in the village	Total in the village		Mean of paired differences	Significant differences
	1982	1992		
	ha	ha	ha	
Total absentee land:				
1. Dryland	12.4530	87.8927	-75.4398	*****
2. Paddyland	34.0455	48.4470	-14.4016	*****
3. Dryland and paddyland	46.4985	136.3397	-89.8412	*****
	no.	no.	no.	
Total absentee landlords with:				
1. Dryland	3.3409	11.0000	-7.6591	*****
2. Paddyland	25.0909	29.7273	-4.6364	***
3. Dryland and paddyland	28.4318	40.7273	-12.2955	*****

Source: primary data (village survey)

Significance level :

* 20 percent ** 15 percent *** 10 percent **** 5 percent ***** 1 percent

increased by 22.93 percent annually. Meanwhile, the average number of absentee landlords with paddyland increased only 1.85 percent annually.

While it is more profitable to invest in paddyland than in dryland, the high increase in absentee dryland in the NCR might be attributed to increased regional land speculation because rural land allocated for urban uses is rarely irrigated land. This is especially important given the fact that existing GOI policies prohibit conversion of paddyland to non-agricultural uses.

b. Absentee Landownership in the Rural Areas

Changes in absentee landownership in the rural areas of the NCR during the period are more staggering than those in the region as a whole. Absentee landownership in rural areas for the period 1982-1992 is summarized in Table 10. It shows that the degree of absentee landownership in the rural areas is much greater than that in the whole NCR.

Tables 10 and 11 show that in 1982 the average hectarage of absentee lands and the number of absentee landlords at the regional level were 46.50 ha and 28.43, respectively. These are smaller than in the rural areas, where they were 67.88 ha and 40.38, respectively. In 1992, the figures for the NCR are 136.34 ha and 40.73; in the rural areas they are 198.86 ha and 54.42, respectively.

Changes in landownership in rural areas, however, are similar to those in the region. Table 10 shows that total absentee lands and the number of absentee landlords in rural areas increased very significantly between 1982 and 1992 (confidence level of 99 percent).

Average absentee village land increased by 130.98 ha. This means that total absentee lands in the rural areas increased by 19.30 percent annually. The average number of absentee landlords in rural areas, meanwhile, increased by 14.04, or 3.48 percent annually. As at the regional level, the increase in absentee land is larger than the increase in the number of absentee landlords, indicating a concentration of absentee landownership.

Comparing the total hectarage of absentee lands (dryland and paddyland), Table 10 shows that the total increase in absentee land in rural areas can be attributed more to the increase in absentee dryland, which increased by 63.81 percent annually. Absentee paddyland, meanwhile, increased by 2.98 percent annually.

Increases in absentee dryland are accompanied by a higher number of absentee landlords acquiring dryland rather than paddyland. However, the average number of absentee landlords with paddyland increased insignificantly, indicating that absentee paddyland in rural areas is also becoming more concentrated in absentee ownership.

Agricultural Land Conversion in Rural Areas and the NCR

According to Schmid (1968) and Firman (1992), regional urbanization is accompanied by increased demand for land to support residential and industrial development. Since vacant urban land is scarce and typically more expensive, agricultural land is commonly converted to non-agricultural use. Therefore, it can be expected that agricultural land in the NCR is subject to conversion.

Table 10. The differences in the absentee landownership and the number of absentee landowners (absentee landlords) in the rural areas of the NCR between 1982 and 1992.

Lands owned by and the number of absentee landlords in the village	Total in the village		Mean of paired differences	Significant differences
	1982	1992		
	ha	ha	ha	
Total absentee land:				
1. Dryland	18.2138	134.4054	-116.1920	*****
2. Paddyland	49.6667	64.4563	-14.7896	*****
3. Dryland and paddyland	67.8805	198.8617	-130.9812	*****
	no.	no.	no.	
Total absentee landlords with:				
1. Dryland	2.2083	12.3750	-10.1667	*****
2. Paddyland	38.1667	42.0417	-3.8750	***
3. Dryland and paddyland	40.3750	54.4167	-14.0417	*****

Source: primary data (village survey)

Significance level :

* 20 percent ** 15 percent *** 10 percent **** 5 percent ***** 1 percent

This study assesses the changes in total agricultural lands in the rural areas and in the region as a whole between 1982 and 1992 to determine whether irrigated land is mostly converted to non-agricultural uses. This question addresses the policy objective to preserve the region's importance as the "rice bowl" of Indonesia.

a. Agricultural Land Conversion in the NCR

Results of the analysis of changes in the total agricultural land between 1982 and 1992 in the NCR are summarized in Table 11. It shows irrigated land and agricultural dryland conversions, both in total hectarage and weighted hectarage by number of the village population. Results indicate that average irrigated land and the average agricultural dryland decreased significantly. It also indicates that agricultural land conversion affects mostly irrigated land, the pillar of agricultural productivity of the region. Average irrigated land hectarage decreased by 2.56 percent annually. This decrease is also very significant when the total hectarage of irrigated land is weighted by the number of village population.

b. Agricultural Land Conversion in Rural Areas

Changes in total agricultural land between 1982 and 1992 in rural areas of the region are summarized in (Table 12).

Irrigated land and agricultural dryland conversions are summarized in total hectarage and weighted by the village population. In rural areas, the village's average irrigated land decreased very significantly, while the average agricultural dryland decreased insignificantly. This indicates that agricultural land conversion affects mostly irrigated land. This represents an average decrease of 2.50 percent annually. This decrease is also very significant when the total hectarage of irrigated land is weighted by the number of village residents. The average agricultural dryland conversion is, on the other hand, insignificant. Weighted by number of village residents, however, this decrease is significant.

It is clear that land conversion analysis in rural areas and in the region as a whole shows that irrigated land has been sacrificed in the process of urbanization. This process undermines the future sustainability of regional agriculture, especially in maintaining its significant contribution to the national policy of food self-sufficiency.

Impacts of Agricultural Land Conversion on Household Income

At the regional level, the increase in irrigated land conversion is risking the NCR's capacity to maintain its key role as food supplier. At the household level, this does not necessarily mean that those directly affected by irrigated land conversion will suffer diminished welfare. Therefore, this study assessed the impacts of irrigated land conversion on the welfare of the households involved in irrigated land conversion. Using data from the Project of Land Conversion in Java, Center for Agro-Economic Research (PAE), this study compared the welfare of farming households before and after irrigated land conversion. The data represent on-farm, off-farm and total

Table 11. Differences in the total land (ha) and total land for each 1,000 in village population (ha/1,000 village population) for both irrigated land and agricultural dryland in the NCR between 1982 and 1992.

Types of agricultural land converted into non-agricultural uses	Total in the village		Mean of paired differences	Significant differences
	1982	1992		
	ha	ha		
Irrigated land:				
1. Dryland	285.6945	212.5166	73.1778	*****
2. Total hectarage for each 1,000 village population	58.2595	34.1545	24.1050	*****
	ha	ha		
Agricultural dryland:				
1. Total hectarage	67.3977	49.1259	18.2718	**
2. Total hectarage for each 1,000 village population	14.7352	8.0759	6.6593	***

Source: primary data (village survey)
Significance level :
* 20 percent ** 15 percent *** 10 percent **** 5 percent ***** 1 percent

income of 52 households involved in irrigated land conversion in the NCR over the past 10 years. Household welfare is measured by total household income per year and converted into the 1992 present values using an average inflation rate of 9 percent. With this standardized value of income, the level of income before and after land conversion can be compared using the t-tests method for paired samples. Results of the analysis are summarized in Table 13. It includes average household income on-farm and off-farm, and total income before and after land conversion.

Table 13 shows that total household income (adjusted for inflation) after land conversion is very significantly higher than that before land conversion. Income increased from Rp. 3,037,196.58 to Rp. 4,178,545.29, an increase of 37.58 percent. This indicates that the economic welfare of the households increased almost 4 percent per year after conversion of irrigated land.

Comparing total income with on-farm and off-farm income, it shows that both on-farm and off-farm household incomes are significantly higher after land conversion. The fact that on-farm income is higher after land conversion is surprising unless households involved acquire additional agricultural land after land conversion. Further analysis conducted in this study verifies this

Table 12. Differences in the total land (ha) and total land for each 1,000 in village population (ha/1,000 village population) for both irrigated land and agricultural dryland in the rural areas of the NCR between 1982 and 1992.

Types of agricultural land converted into non-agricultural uses	Total in the village		Mean of paired differences	Significant differences
	1982	1992		
	ha	ha		
Irrigated land:				
1. Dryland	382.3441	286.5920	95.7521	*****
2. Total hectarage for each 1,000 village population	80.9563	47.1675	33.7888	*****
	ha	ha		
Agricultural dryland:				
1. Total hectarage	78.3896	55.9579	22.4317	
2. Total hectarage for each 1,000 village population	19.7113	9.9446	9.7667	**

Source: primary data (village survey)
Significance level :
* 20 percent ** 15 percent *** 10 percent **** 5 percent ***** 1 percent

Table 13. Differences in on-farm, off-farm and total incomes (Rupiah, Rp.) of farming households before and after irrigated land conversion during the period 1982-1992, adjusted for inflation .

Sources of income	Mean of household income (Rp./year)		Mean of paired differences	Significant differences
	Before land conversion	After land conversion		
On-farm	1,576,587.62	2,102,767.88	-526,180.26	****
Off-farm	1,460,608.96	2,075,777.40	-615,168.44	*****
Total	3,037,196.58	4,178,545.29	-1,141,348.71	*****

Source: Household survey conducted by the Project of Agricultural Land Conversion in Java, the Center for Agro-Economic Research (PAE), 1993.
Significance level :
* 20 percent ** 15 percent *** 10 percent **** 5 percent ***** 1 percent

suspicion. In fact, average household irrigated land significantly increased from 1.0665 ha per household before land conversion to 1.2628 ha per household after land conversion, an increase of 0.1962 ha per household. This indicates that households used the returns from land conversion to invest in other irrigated lands.

An additional question pursued in this study is whether the household's decision to convert land is economically rational. If so, it may be expected that regional land conversion is primarily dictated by market prices and that government policy does not significantly affect household decisions regarding land conversion.

The decision is economically rational if on-farm incomes of households not involved in land conversion are *in*significantly different from the *after* land conversion on-farm incomes of those involved in land conversion. For the purpose of this analysis, on-farm income *after* land conversion of those households involved in land conversion is compared with on-farm income of households not involved in land conversion using the t-test for two independent samples. The result of the analysis is presented in Table 14.

Table 14 shows that no significant difference exists in mean on-farm household income before and after land conversion. This indicates that farm households in the NCR will convert their land if it is economically profitable; otherwise, they will not. This implies also that it is difficult to restrict agricultural land conversion unless the government promotes indirect policy measures to enhance farm household incomes and the profitability of agricultural enterprises.

Structural Changes in Regional and Rural Village Employment

Modernization theory asserts that urbanization is accompanied by regional structural employment changes. That is, regional urbanization is associated with a decrease in the percentage of the population employed in the agricultural sector compared with industrial and service sectors.

To test this assertion, structural changes of regional and rural employment in the NCR are assessed at the village level during the period 1982-1992. The primary focus of analysis is to determine if the percentage of people employed in the agricultural sector decreased and whether an identical trend was present in rural areas. As previously, a paired t-test is used and results are summarized below (Table 15).

Various regional and rural structural changes in employment during the period 1982-1992 are identified. Because the analysis is conducted at the village level, the types of employment described in this study are somewhat different from those usually used to analyze regional structural employment in the regional economic literature. Village employment, in this study, is classified on the basis of the largest share (more than 50 percent) of employment contributing to total individual income. Eight types of employment are identified :

1. Agricultural labor — percentage of the village population providing labor input to farm enterprises.
2. Farmers — percentage of the village population engaged in owner-operated agricultural enterprises.
3. Sakap/sharecroppers — percentage of the village population engaged in agriculture through either land leases or sharecropping.
4. Manufacturing labor — percentage of the village population employed in the manufacturing sector.
5. Small-scale enterprises — percentage of the village population engaged in subsistence, small-scale trade without labor inputs from outside the household.
6. Government officials — percentage of the village population employed in the public sector.
7. Private enterprises — percentage of the village population employed in the local business sector using outside labor input.
8. Other — percentage of the village population engaged in other employment.

At the regional level, Table 15 shows that village employment in 1982 consisted of 22.49 percent

Table 14. Differences between after land conversion on-farm income of the households involved in land conversion and on-farm income of those not involved in land conversion, 1992.

	Mean of household income (Rp./year)		Mean of differences	Significant differences
	After land conversion	No land conversion		
On-farm	2,102.767.88	1,564,273.75	538,494.13	

Source: Household survey conducted by the Project of Agricultural Land Conversion in Java, the Center for Agro-Economic Research (PAE), 1993.
Significance level :
* 20 percent ** 15 percent *** 10 percent **** 5 percent ***** 1 percent

Table 15. Differences in the regional and rural area's employment structure between 1982 and 1992.

Types of employment	Percent of population		Mean of paired differences	Significant differences
	1982	1992		
In the NCR :				
Agricultural labor	22.4864	22.2720	0.2143	
Farmer (operator)	24.0291	12.2289	11.8002	*****
Sharecroppers (sakap)	20.1564	14.7836	5.3727	*****
Manufacturing labor	11.9532	22.4200	-10.4668	*****
Small-scale enterprise	7.5334	11.0880	-3.5545	*****
Government official	4.4484	6.1586	-1.7102	*****
Private enterprise	4.0159	5.7039	-1.6880	*****
Others	5.3780	5.3452	0.0327	
In the rural areas of the NCR :				
Agricultural labor	28.5929	34.8946	-6.3017	
Farmer (operator)	31.1454	17.9908	13.1546	*****
Sharecroppers (sakap)	26.1000	22.9992	3.1008	
Manufacturing labor	2.5258	6.2729	-3.7471	*****
Small-scale enterprise	7.1371	11.8246	-4.6875	****
Government official	1.7463	3.1683	-1.4221	****
Private enterprise	0.7646	1.2521	-0.4875	*****
Other	1.9883	1.5996	0.3887	

Source: primary data (village survey)
Significance level :
* 20 percent ** 15 percent *** 10 percent **** 5 percent ***** 1 percent

agricultural labor, 24.03 percent farmers, 20.16 percent sharecroppers, 11.95 percent manufacturing labor, 7.53 percent small-scale enterprises, 4.45 percent government officials, 4.02 percent private enterprises and 5.38 percent other. This employment structure is very significantly different in 1992, at which time village employment was 22.27 percent agricultural labor, 12.23 percent farmers, 14.78 percent sharecroppers, 22.42 percent manufacturing labor, 11.09 percent small-scale enterprises, 6.16 percent government officials, 5.70 percent private enterprises and 5.35 percent other.

Although there is no significant change in the percentage of agricultural labor, the percentages of farmers and sharecroppers decreased very significantly in the region during 1982-1992 — 49.11 and 26.67 percent, respectively .

Employment in manufacturing, small-scale enterprises, the government sector and the private enterprise sector, meanwhile, grew very significantly. Employment in manufacturing increased by 87.62 percent, small-scale enterprise employment by 47.28 percent and employment in the government sector by 38.43 percent. Finally, private enterprise employment grew by 41.79 percent.

These figures show that at the aggregate regional level of the NCR, decreased employment in the agricultural sector is accompanied by a relatively high increase in employment or an employment shift to the manufacturing sector. It means, indeed, that urbanization in the NCR is accompanied by a structural employment change, as asserted in modern urbanization theory.

On the other hand, the structural change in employment in the rural areas of the NCR is of a different magnitude than in the region as a whole. In rural areas, village employment in 1982 was 28.59 percent agricultural labor, 31.15 percent farmers, 26.10 percent sharecroppers, 2.53 percent manufacturing labor, 7.14 percent small-scale enterprises, 1.75 percent government sector, 0.76 percent private enterprises and 1.99 percent other. This structure is significantly different from that in 1992, when village employment was 34.89 percent agricultural labor, 17.99 percent farmers, 23.00 percent

sharecroppers, 6.27 percent manufacturing labor, 11.82 percent small scale enterprises, 3.17 percent government sector, 1.25 percent private enterprises and 1.60 percent other.

Different from the regional aggregate, it shows a significant increase in the percentage of agricultural labor in the rural areas (22.04 percent). The percentage of farmers decreased very significantly (by 42.25 percent). No statistically significant decrease is apparent in the percentage of sharecroppers during the same period.

Employment in manufacturing and private enterprises in rural areas grew very significantly. Meanwhile, employment in small-scale enterprises and the government sector grew significantly, as well. Manufacturing employment increased by 147.73 percent, small-scale enterprise employment grew by 65.55 percent and government employment increased by 81.14 percent. Finally, private enterprise employment increased from 0.76 percent in 1982 to 1.25 percent in 1992, a growth of 64.47 percent.

Five fundamental differences between rural and regional structural changes of employment exist. First, rural employment is still dominated by agricultural employment. Second, the percentage of agricultural labor in rural areas increased significantly (22.04 percent). This rural increase is much higher than that in the region (0.95 percent), a case of concentration of agricultural employment. Third, although relative employment in the manufacturing sector in rural areas increased very significantly (147.73 percent and 87.62 percent, respectively), its absolute value is much less than that of the region. Fourth, the increase in small-scale enterprises is higher in rural areas than in the region (65.55 percent and 47.28 percent, respectively). Finally, the employment ratio in private enterprises in the rural areas is much less than that in the region as a whole.

These figures imply that at the regional level a decrease in agricultural sector employment is accompanied by a significant increase in manufacturing employment and small-scale enterprises, and a decrease in the percentage of self-employed farmers is not followed by an increase in employment in the agricultural sector, an indication that manufacturing industries and small-scale enterprises have the capacity to absorb farmers displaced from the agricultural sector. Meanwhile, for rural areas the figures imply that a decrease in employment in the agricultural sector is not followed by a significant increase in the employment in the manufacturing sectors, and a decrease in the percentage of self-employed farmers is followed by an increase in employment as agricultural labor and small scale-enterprises, an indication that displaced farmers in rural areas are either being employed as agricultural laborers or entering the labor force of small-scale enterprises.

Regional Development of the Northern Coastal Region (NCR) of West Java

Regional development of the NCR cannot be separated from regional development of Jakarta-West Java as a whole, in which West Java has been designated as the hinterland of Jakarta. In this regional development framework, sectoral development, especially industrial development — which is deemed saturated in Jakarta — is to be promoted in West Java (Hamer et al., 1986). This indicates that development in the region favors areas with better infrastructure and proximity to the seat of government. Because the NCR has a better infrastructure and proximity to Jakarta, the industrial development in West Java is concentrated in this region (Hill, 1992b).

This study confirms Hill's assertion that the government policy to subsidize medium- and large-scale industries results in a higher degree of industrialization in the region. Instead of calculating the value added, this study assesses the increased number of industries during the period 1982-1992. The increased number of industries indicates a higher degree of industrialization in the NCR.

Table 16 summarizes the result of mean comparison in the number of industries between 1982 and 1992. In this analysis, the industry is categorized as: (i) large scale industry, i.e., an industry with 100 or more employees; (ii) medium-scale industry, i.e., an industry with 20 to 99 employees; and (iii) small-scale industry, i.e., an industry with 5 to 19 employees. Changes in the degrees of regional industrialization are assessed at the village level.

Table 16 shows that the villages' average number of large-scale industries increased very significantly from 0.09 in 1982 to 4.41 in 1992, an increase of 4.3182 or 4750.50 percent during the period, or 475.05 percent annually . The figure also increased very significantly after the number of large-scale industries is weighted by the village population. The villages' average number of medium-scale industries increased significantly from 0.7273 in 1982 to 2.6136 in 1992, an increase of 1.8864 or 259.36 percent during the period, or 25.94 percent annually. The level of significance of the increased number of medium-scale industries is the same after it is weighted by village population. This study also finds that the small-scale industries in the NCR increased very significantly during this period, from 6.0909 in 1982 to 11.0455 in 1992, an increase of 4.9545 or 81.34 percent during the period, or 8.13 percent annually.

Along with the regional development of Jakarta-West Java, which resulted in the increased number of industries of all scales, the NCR is also affected by the regional development of West Java.

The regional development master plan of West Java was developed in 1974 (Government of West Java,

Table 16. Differences in regional industrialization between 1982 and 1992.

Types of industry	Number of industries in the village			Mean of paired differences	Significant differences
	1982	1992	%-Change		
In the NCR :					
Large-scale industry (LSI)	0.0909	4.4091	4750.50	-4.3182	*****
Medium-scale industry (MSI)	0.7273	2.6136	259.36	-1.8864	***
Small-scale industry (SSI)	6.0909	11.0455	81.34	-4.9545	****
LSI /1,000 village population	0.0177	0.7709	4255.37	-0.7532	*****
MSI/1,000 village population	0.1343	0.4052	201.71	-0.2709	***
SSI/1,000 village population	0.9514	2.1286	123.74	-1.1773	****

Source: primary data (village survey)
Significance level :
* 20 percent ** 15 percent *** 10 percent **** 5 percent ***** 1 percent

1990) and is updated every five years along with the five-year plan for national development. According to this master plan, regional development in West Java adopts a functional integration rather than a territorial integration as its strategy of regional planning with "growth centers" as the principal instrument of its spatial policy. In this study, a growth center is defined as "induced urbanization through a combination of direct public investments and capital subsidies to private enterprise" (Friedman and Weaver, 1979, p.6). Functional integration, meanwhile, is formed on the basis of mutual self-interests among regions. Given inequalities at the start, a functional integration is always hierarchical with power accumulating at the top. On the other hand, territorial integration is derived from common bonds of social order forged by history within a given place. Although they will also be characterized by inequalities of power, territorial relationships are tempered by mutual rights and obligations that the members of a territorial group claim from each other (Friedman and Weaver, 1979; Friedman, 1988).

Such a regional development strategy is biased toward the advantage of urban development (Friedman, 1988) and characterized by large investment in the urban-industrial sector (Rondinelli, 1985). Two important problems are associated with urbanization driven by such a regional development strategy. First, agricultural development will be negatively affected by urbanization. Second, rural areas would take part in the general process of growth diffusion only to the extent that they were subject to the impact of the urban economy (Friedman and Weaver, 1979). In other words, the urbanization process is not associated with social urbanization and increasing opportunities for development in rural areas (Mehretu, 1989). Therefore, it can be expected that there are rural-urban disparities in the distribution of the development benefits as a result of a cumulative causation process (Myrdal, 1957) or self-reinforcing process.

Rural-Urban Disparities

Rural-urban disparities, in this study, are defined as an uneven distribution of goods, resources, incomes and services between rural and urban areas of the NCR (Matthews, 1983). This study does not assume that rural-urban disparities in the region are created by lack of resources in the rural areas and the inability to keep up with the development of urban areas, as proposed by several studies of regional disparities (Phillips, 1978). Instead, it assumes that the existence of rural-urban disparities is created by regional development policies, especially for the regional components that can be affected by the process of regional development and its underlying policies. The assumption is based on the fact that regional policies applied in the NCR favor urban development.

This study accepts the fact that distributed regional components resulting from development contribute to the welfare of the region's inhabitants without entering into the debate whether those components are subjective or objective measures of rural-urban disparities. In the literature of regional disparities, assertions about the components distributed are still not conclusive. Some use distribution of income per capita, wealth, or a combination of income and wealth as a measure of regional disparities (Smith, 1982). Others use and develop indicators of well-being, quality of life or standards of living as a measure of regional disparities (Knox, 1974; Kuz, 1978; Schultink, 1992). According to Matthews (1983), the meanings of those equity or quality-of-life measures remain vague and seem to overlap with few clear prescriptions

of what is involved in any assessment of them. Therefore, this study uses only the available census data of 1990 as measures of rural-urban disparities. This information includes some aspects of economic progress, including improvements of marketing facilities, educational facilities and health care facilities that may result from regional development and affect the well-being of the region's inhabitants.

The distribution of those measures is assessed using the Gini coefficients (GCs) and the Lorenz curves. The Gini coefficient is a system measure that can describe the magnitude of the distribution with only one coefficient, ranging between 0 and 1. A value close to 0 indicates equal distribution and a value close to 1 indicates unequal distribution. The distribution can also be seen in the Lorenz curve, in which the degree of inequality is depicted by how far the Lorenz curve departs from the diagonal or equal-share line (Smith, 1982). The proportion of the total area below the diagonal that is above the Lorenz curve is also a measure of the GC. The GC and the Lorenz curve are system measures; the spatial concentrations of specific components are measured using location quotients (LQs). The LQs can be used to compare the concentration of the components in each subregion of the NCR — less than 1 indicates that the subregion's share in the components in question is less than the region's share; more than 1 indicates that the subregion's share is higher than that of the whole region.

The data used to analyze rural-urban disparities are 1990 census data. The analysis addresses the results of the development process as reflected in the spatial distribution of public benefits. Because of limited data availability, the study did not consider distribution of development benefits among social strata.

Regional Economic Progress

Several studies in the NCR indicate that significant progress has occurred in the economy of the region. This progress is indicated by the increased relative share of industries and services, with their increased value-added contributions to the regional economy (Hill, 1992b; Soemarwoto, 1992). In addition, this study also indicates that in the past 10 years significant increases occurred in the number of industries of all scales, the percentage of the population engaged in the manufacturing sector, the numbers of economic institutions (such as banks), and improvements in public transportation and its infrastructure, educational facilities and health care facilities. All of the increases indicate a growing regional economy.

Because regional development policies have favored urban development, it is expected that the benefits of a growing regional economy are concentrated in urban areas and a small portion of the region's inhabitants. In this study, the benefits of a growing regional economy are indicated by the increased number of households with telephones, electricity or television—indicators of increased household economic well-being. These indicators can be used to assess the spatial distribution of benefits of regional economic development. The results of the analysis are summarized in Table 22 and Figure 8.

Table 17 summarizes: (i) the location quotients (LQs) of the households with telephones, households with electricity provided by PLN (Perusahaan Listrik Negara, a monopolistic agency providing electricity to the nation) and households with television for each subregions of the NCR; (ii) the Gini coefficients (GCs) of those indicators in rural areas, urban areas and the NCR; (iii) the distribution (percentage) of the indicators and population in each subregions of the NCR; and (iv) the cumulative percentages of the indicators and population that indicate concentration or distribution in the region.

Figure 9 presents Lorenz curves showing the inequality in the distribution of the NCR households with telephones, electricity or television in relation to the NCR population.

The Gini coefficient of the households with telephones in the NCR is 0.77, indicating that households with telephones are unequally distributed in the region. This high value of the GC is also represented by the distance between the Lorenz curve and the equal-share line.

The location quotient values show that the households with telephones are concentrated in the most urbanized subregions, U3 and U4, with values of 1.95 and 8.21, respectively. Most of the households with telephones are located in the most urbanized area (U4). U4 has only 10.39 percent of the NCR population but 85.27 percent of the telephones in the region.

Households with telephones seem very unevenly distributed. The urban areas have 22.23 percent of the NCR population and 91.98 percent of the telephones in the region. On the other hand, the 77.77 percent of the NCR population that lives in the rural areas has only 8.02 percent of the telephones.

Within both rural and urban areas, the households with telephones are also unequally distributed. This is indicated by high values of Gini coefficients of the households with telephones in both rural and urban areas — 0.41 and 0.46, respectively. Those indicate that only the elite population in rural areas enjoys this convenience.

The distribution of households with electricity is similar to the distribution of households with telephones and is more concentrated in urban areas, though the concentration is less than that of households with telephones. The Gini coefficient of the households with electricity in the region is 0.30 (compared with households with telephones, 0.77). Nevertheless, this GC value also indicates that the households with electricity are unequally distributed in the region.

Table 17. Location quotients (LQ), Gini coefficients (GC), percentage distribution of number of telephones (phone), houses with electricity (elect), television (TV) and population (pop.) by village; and data for Lorenz curves in the NCR, 1990.

Region	Location quotients (LQ)			Percentage distribution				Cumulative percentages *)					
	Phone	Elect	TV	Phone	Elect	TV	Pop	Phone	Pop	Elect	Pop	TV	Pop
R1	0.50	0.17	0.26	3.86	1.33	1.97	7.68	85.27	10.39	33.41	10.39	58.22	10.39
R2	0.00	0.41	0.32	0.04	11.16	8.67	27.06	89.31	12.46	39.01	12.46	62.84	12.46
R3	0.08	0.74	0.38	2.37	21.27	11.02	28.76	93.17	20.14	43.26	15.04	66.28	15.04
R4	0.12	0.98	0.55	1.75	13.92	7.80	14.27	95.19	27.33	52.32	22.23	70.54	22.23
U1	0.28	1.26	0.59	2.02	9.06	4.26	7.19	95.84	29.91	66.24	26.50	78.34	26.50
U2	0.25	1.65	1.33	0.65	4.25	3.44	2.58	97.59	44.18	87.51	65.26	89.36	65.26
U3	1.95	2.71	2.23	4.04	5.60	4.62	2.07	99.96	72.94	98.67	92.32	98.03	92.32
U4	8.21	3.22	5.60	85.27	33.41	58.22	10.39	100	100	100	100	100	100

	Gini coefficient (GC)		
NCR	0.77	0.30	0.51
Rural	0.41	0.18	0.09
Urban	0.46	0.18	0.04

Source of data: population census of 1990.

*) Cumulative percentages are calculated based on the rank of their location quotient values and are used to construct Lorenz curves.

This unequal distribution of households with electricity can also be seen in the Lorenz curve of Figure 8.

The values of the LQs show that the households with electricity are more concentrated in urban areas — with values between 1.26 in U1 and 3.22 in U4 — than in rural areas — with values between 0.17 in R1 and 0.98 in R4. Region U4, with 10.39 percent of the regional population, has 33.41 percent of this utility provided by the government. Comparing rural and urban conditions shows that urban areas — with 22.23 percent of the NCR population — have 52.32 percent of the electricity, while rural areas — with 77.77 percent of the population — have only 47.68 percent of this convenience. Within rural and urban areas, on the other hand, households with electricity seem equally distributed with the same GC value.

With the advanced telecommunication technology of satellites and with the capability to cover all Indonesian islands, it is expected that television would be found relatively equally distributed in Indonesia. This study finds that that is certainly not the case —there is disparity in the regional distribution of households with television in the NCR, the most developed region in Indonesia.

The Gini coefficient of the households with television in the NCR is 0.51, indicating unequal distribution. This unequal distribution can also be seen in the Lorenz curve of the households with television in Figure 7.

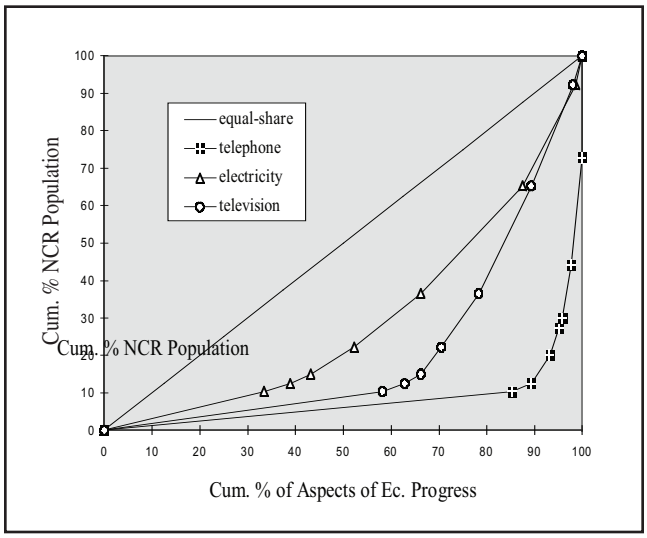

Figure 7. Lorenz curves for the distribution of the households with telephones, electricity and television in relation to population, by subregions of the NCR (source: Table 22).

The LQ values also show that households with TV are more concentrated in the most urbanized subregions, U2-4, with values of 1.33, 2.23 and 5.60, respectively. This indicates that most of the households with television are located in the most urbanized area (U4). U4, with only 10.39 percent of the NCR population, has 58.22 percent of the households with television.

The distribution of the households with television between rural and urban areas also seems very unequal. Urban areas, with only 22.23 percent of the NCR population, have 70.54 percent of the total televisions in the region.

The unequal distribution of the three indicators shows that the benefits of the growing regional economy of the NCR are enjoyed mostly by the urban population and by a small portion of the rural population.

Marketing Facilities

The study assessed the distribution of regional marketing facilities in the NCR, specifically, the distribution of marketing facilities for agricultural inputs, marketing facilities for agricultural products and local markets with permanent buildings.

The NCR is the predominant agricultural region in the country, so it would be expected that marketing facilities for agricultural inputs and outputs would be located in rural areas or equally distributed throughout the region. This study uses the number of kiosks selling agricultural inputs (KAI) as the indicator of the availability of marketing facilities for agricultural inputs, and the number of kiosks selling agricultural products (KAP) as the indicator of the availability of marketing facilities for agricultural products. All local markets are developed and operated by the government. The presence of a market with permanent buildings is used as an indicator of the degree of government commitment to develop the local economies.

The results of the analysis are summarized in Table 18 and Figure 9. Table 18 summarizes: (i) the LQs of the markets with permanent buildings (market), kiosks selling agricultural inputs (KAI) and kiosks selling agricultural outputs (KAP) for each subregion of the NCR; (ii) the GCs of those indicators in rural areas, urban areas and the NCR; (iii) percentage distribution of the indicators and population in each subregion of the NCR; and (iv) cumulative percentages of the indicators and population in the NCR.

Figure 9 presents Lorenz curves showing the inequality in the distribution of markets with permanent buildings (market), kiosks selling agricultural inputs (KAI) and kiosks selling agricultural products (KAP) in relation to the NCR population.

As expected, the results of the analysis show that kiosks selling agricultural inputs (KAI) and those selling agricultural products are evenly distributed in the region and in the rural areas. The Gini coefficients of the distribution of KAI in the region and in rural areas are 0.04 and 0.03, respectively. The Gini coefficients of KAP in the region and in rural areas are 0.15 and 0.08, respectively. These indicate that both kiosks selling agricultural inputs (KAI) and kiosks selling agricultural products (KAP) are equally distributed in the region.

Table 18. Location quotients (LQ), Gini coefficients (GC), percentage distribution of village marketing facilities, including number of markets with permanent buildings (Market), kiosks selling agricultural inputs (KAI), kiosks selling agricultural products (KAP) and population (Pop.); and data for Lorenz curves in the northern coastal region (NCR) of West Java, 1990.

Region	Location quotients (LQ)			Percentage distribution				Cumulative percentages *)					
	Market	KAI	KAP	Market	KAI	KAP	Pop	Market	Pop	KAI	Pop	KAP	Pop
R1	0.42	0.86	0.71	3.20	6.64	5.46	7.68	28.80	10.39	2.93	2.58	6.46	2.58
R2	0.86	0.98	0.75	23.20	26.58	20.20	27.06	34.40	12.97	5.28	4.65	28.28	12.97
R3	0.56	1.07	1.00	16.00	30.75	28.89	28.76	37.60	15.04	20.85	18.92	57.17	41.73
R4	0.67	1.09	0.72	9.60	15.57	10.30	14.27	48.00	22.23	51.60	47.68	62.83	48.92
U1	1.45	1.02	0.79	10.40	7.36	5.66	7.19	71.20	49.29	58.96	54.87	83.03	75.98
U2	2.17	1.14	2.50	5.60	2.93	6.46	2.58	80.80	63.56	85.54	81.93	93.33	90.25
U3	1.55	1.14	0.58	3.20	2.35	1.21	2.07	96.80	92.32	92.18	89.61	98.79	97.93
U4	2.77	0.75	2.10	28.80	7.82	21.82	10.39	100	100	100	100	100	100

	Gini coefficient (GC)		
NCR	0.26	0.04	0.15
Rural	0.10	0.03	0.08
Urban	0.13	0.09	0.22

Source of data: population census of 1990.

*) Cumulative percentages are calculated based on the rank of their location quotient values and are used to construct Lorenz curves.

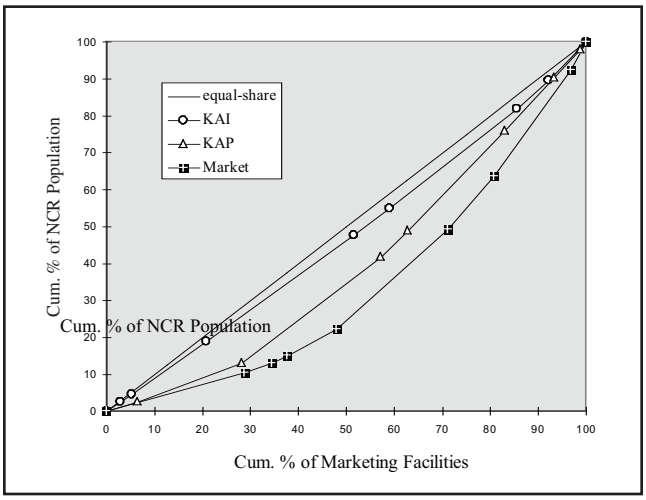

Figure 8. Lorenz curves for the distribution of markets with permanent building (Market), kiosks selling agricultural inputs (KAI), and kiosks selling agricultural products (KAP) in relation to population, by subregions of the NCR (source: Table 23).

Especially for input kiosks, the Lorenz curve shows that the line is close to the equal-share line (Figure 9), indicating that spatial distribution is nearly equal. This is also supported by the values of LQs, which are essentially identical for all subregions of the NCR.

However, the Gini coefficient of the markets with permanent buildings in the region (0.26) is higher than the other two indicators. This indicates that spatial inequality exists in the distribution of government markets with buildings, as indicated by the large area between the Lorenz curve and the equal-share line of Figure 8.

The values of LQs show that markets with permanent buildings are more concentrated in urban areas — with values between 1.45 and 2.77 — compared with rural areas, with values between 0.42 and 0.67. Urban areas have 22.23 percent of the NCR population but 48 percent of marketing facilities, while rural areas with 77.77 percent of the population have only 52 percent of the facilities.

The distribution of the three indicators shows that marketing facilities developed by the government (markets with permanent buildings) tend to be concentrated in urban areas, while marketing facilities developed through private initiatives (KAI and KAP) tend to be more equally distributed in the NCR.

Educational Facilities

This section describes the distribution of pre-college educational facilities in the NCR, including elementary schools, secondary schools and high schools. The results of the analysis are presented in Table 19 and Figure 10.

Table 19 summarizes: (i) the location quotients (LQs) of elementary schools (Elsch), secondary schools (Secsch) and high schools (Hisch) for each subregion of the NCR; (ii) the Gini coefficients (GCs) of the indicators in rural areas, urban areas and the NCR; (iii) percentage distribution of the indicators and population in each subregion of the NCR; and (iv) cumulative percentages of the indicators and population in the NCR. Figure 10 presents Lorenz curves showing the inequality in the distribution of elementary schools, secondary schools and high schools in relation to the NCR population.

The Gini coefficient of elementary schools in the NCR is 0.04, indicating that elementary schools are evenly distributed in the region. Its Lorenz curve is close to the equal-share line of Figure 10.

Although all values of the LQs in the urban areas are higher than those in rural areas, the differences are very small, indicating that elementary schools are evenly distributed in all subregions of the NCR. Within rural and urban areas, the GC values are 0.01 and 0.05, respectively.

The distribution of secondary schools is more concentrated in urban areas, with a regional GC value of 0.23. This is also reflected by the Lorenz curve (Figure 10).

The location quotients show that secondary schools are the most concentrated in the most urbanized area (for U4 — 2.84, U3 — 1.56 and U1 — 1.43.

The Gini coefficient of high schools in the NCR is 0.48, indicating an uneven distribution of high schools in the region, also demonstrated by the Lorenz curves of high schools in Figure 10.

The values of LQs show that high schools are clearly most concentrated in the urban areas (U1-4), with values ranging between 1.22 in U2 and 4.83 in U4. The share of the regional population for urban areas is only 22.23 percent, but these areas have 69.95 percent of the high schools. In addition, high schools among urban subregions are not evenly distributed, as indicated by the GC value of .25.

The distribution of the three indicators of educational development in the NCR shows a clear hierarchical distribution of public educational facilities. This distribution reflects an educational development policy with basic educational facilities equally distributed in the region and a concentration of secondary educational facilities in several regional centers. Rural people who wish to pursue higher education are expected to go to the regional centers.

Table 19. Location quotients (LQ), Gini coefficients (GC), percentage distribution of village educational facilities including number of elementary schools (Elsch), secondary schools (Secsch), high schools (Hisch) and population (Pop.), and data for Lorenz curves in the Northern Coastal Region of West Java, 1990.

Region	Location quotients (LQ)			Percentage distribution				Cumulative percentages *)					
	Elsch	Secsch	Hisch	Elsch	Secsch	Hisch	Pop	Elsch	Pop	Secsch	Pop	Hisch	Pop
R1	0.98	0.39	0.18	7.50	3.04	1.35	7.68	2.71	2.07	29.49	10.39	50.22	10.39
R2	0.95	0.63	0.38	25.64	16.97	10.31	27.06	15.85	12.46	32.72	12.46	56.50	12.46
R3	0.96	0.82	0.42	27.68	23.64	12.11	28.76	19.01	15.04	43.02	19.65	66.81	19.65
R4	0.91	0.78	0.44	13.05	11.11	6.28	14.27	26.13	22.23	45.24	22.23	69.95	22.23
U1	0.99	1.43	1.43	7.12	10.30	10.31	7.19	33.63	29.91	68.88	50.99	76.23	36.50
U2	1.22	1.22	1.22	3.16	2.22	3.14	2.58	61.31	58.67	79.99	65.26	88.34	65.26
U3	1.31	1.56	3.03	2.71	3.23	6.28	2.07	86.95	85.73	96.96	92.32	98.65	92.32
U4	1.26	4.83	4.83	13.14	29.49	50.22	10.39	100	100	100	100	100	100

	Gini coefficient (GC)		
NCR	0.04	0.23	0.48
Rural	0.01	0.08	0.06
Urban	0.05	0.18	0.25

Source of data: population census of 1990.

*) Cumulative percentages are calculated based on the rank of their location quotient values and are used to construct Lorenz curves.

Health Care Facilities

This section describes the distribution of health care in the NCR, including physicians, traditional midwives and health care facilities — hospitals, polyclinics, clinics, maternity centers and community health care centers. It is important to note that traditional midwives in the region provided extended services to local communities, including the general treatment of illnesses. The results of the analysis are summarized in Table 20 and Figure 10.

Table 20 summarizes: (i) the location quotients (LQs) of the numbers of physicians, traditional midwives (mwife) and total health care providers (care) for each subregion of the NCR; (ii) the Gini coefficients (GCs) of the indicators in rural areas, urban areas and the NCR; (iii) percentage distribution of the indicators and population in each subregion of the NCR; and (iv) cumulative percentages of the indicators and population in the NCR. Figure 11 presents Lorenz curves showing inequality in the distribution of physicians, traditional midwives and health care providers in relation to the NCR population.

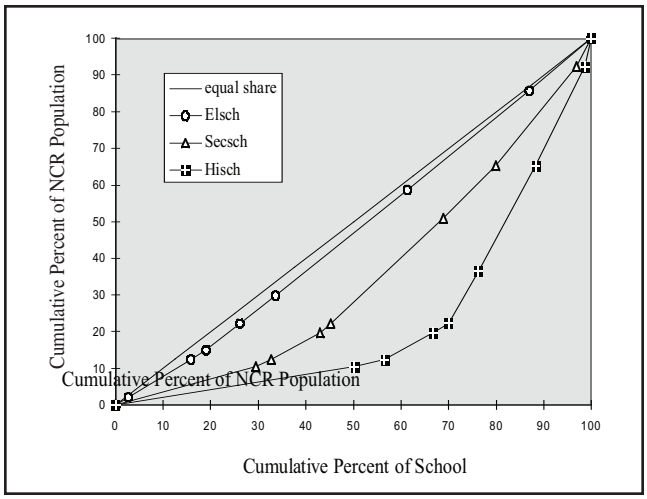

Figure 9. Lorenz curves for the distribution of elementary schools (Elsch), secondary schools (Secsch) and high schools (Hisch) in relation to population, by subregions of the NCR (source: Table 19).

The Gini coefficient of physicians in the NCR is 0.63, indicating that physicians are unevenly distributed over the region. Physicians in the region are concentrated in the most urbanized region (U4) with an LQ of 6.74, followed by U2 with 2.43. The urban areas (U1-4) have only 22.23 percent of the regional population but 80.50 percent of physicians. Within urban areas, the physicians are also unevenly distributed among the subregions (GC – 0.40).

Physicians represent modern treatments in health care and midwives represent traditional care in childbirth. LQs show that traditional midwives are evenly distributed over space, indicating that traditional treatments in health care are still popular in both rural and urban areas of the NCR. Table 20 and Figure 11 show that traditional midwives are evenly distributed

Table 20. Location quotients (LQ); Gini coefficients (GC), percentage distribution of village availability of health care facilities including numbers of physician (Phys), traditional midwives (Mwife), health care providers (Care) and population (Pop.); and data for Lorenz curves for the Northern Coastal Region of West Java, 1990.

Region	Location quotients (LQ)			Percentage distribution				Cumulative percentages *)					
	Phys	Mwife	Care	Phys	Mwife	Care	Pop	Phys	Pop	Mwife	Pop	Care	Pop
R1	0.30	1.00	0.82	2.31	7.67	6.26	7.68	70.08	10.39	3.42	2.58	20.97	10.39
R2	0.16	1.06	0.86	4.25	28.76	23.19	27.06	75.10	12.46	5.97	4.65	23.48	12.46
R3	0.22	0.94	0.84	5.02	21.63	19.50	28.76	79.15	19.65	34.73	31.71	26.54	15.04
R4	0.40	0.98	0.92	7.92	19.44	18.33	14.27	80.50	22.23	42.40	39.39	44.87	34.97
U1	0.56	0.86	0.86	4.05	6.18	6.18	7.19	88.42	42.16	52.75	49.78	68.06	62.03
U2	0.52	1.33	1.19	1.35	3.42	3.06	2.58	90.73	49.84	72.19	69.71	74.24	69.22
U3	2.43	1.23	1.21	5.02	2.55	2.51	2.07	95.75	72.94	93.82	92.81	93.74	92.32
U4	6.74	1.00	2.02	70.08	10.35	20.97	10.39	100	100	100	100	100	100

	Gini coefficient (GC)		
NCR	0.63	0.03	0.12
Rural	0.17	0.02	0.02
Urban	0.40	0.20	0.17

Source of data: population census of 1990.

*) Cumulative percentages are calculated based on the rank of their location quotient values and are used to construct Lorenz curves.

over all subregions of the NCR with a GC value of 0.03.

The Gini coefficient of total health care providers in the NCR is 0.12, indicating that the health care providers are evenly distributed over space. However, the LQ values are still higher in urban areas than in rural areas, indicating that urban areas enjoyed a larger share of health care providers.

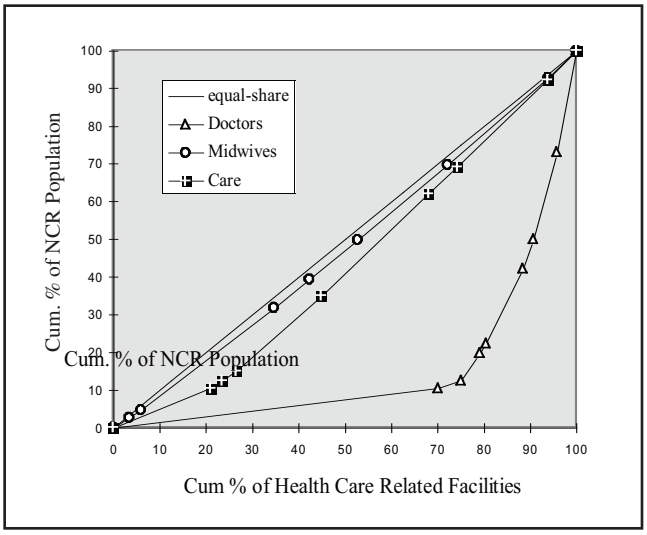

Figure 10. Lorenz curves for the distribution of the number of physicians, midwives and total health care providers (Care) in relation to population, by subregions of the NCR (source: Table 20).

Summary and Policy Implications

Urbanization in the Northern Coastal Region (NCR) of West Java, a corridor region connecting Jakarta and Cirebon and the major food (rice) production region of Indonesia, exemplifies a public policy challenge for Indonesian agricultural and regional development. The region contains the best irrigation systems and agricultural development institutions in Indonesia, has long been the center of agricultural development and is, therefore, considered a national model. At the same time, the region is experiencing massive land conversion pressure because of regional industrialization and development policies favoring urbanization.

Historical land use practices and contemporary development policies have helped to shape the agriculture in the region. At the national level, the GOI's goal has been to achieve and maintain Indonesia's rice self-sufficiency, which was accomplished in the mid-1980s. Consequently, the status of the NCR as a major food producer in Indonesia will likely be maintained. This reality is also reflected in current agricultural policies such as price supports for agricultural commodities, subsidies for the development and rehabilitation of irrigated paddylands, the provision of agricultural inputs and other supply measures to counteract significant fluctuations in agricultural commodities prices. At the same time, by presidential decree and stated regional planning objectives, the GOI aims to restrict conversion of agricultural land (especially irrigated paddyland) into non-agricultural uses. This policy reflects concerns about urbanization impacts.

In reality, however, developmental impacts in the NCR seem to contradict the GOI's goal to maintain the region as the "rice bowl" of Indonesia. Regional development of the NCR is part of the development of the larger Jakarta-West Java region, designated as the hinterland of Jakarta. More importantly, industrial and commercial sector development, which is deemed saturated in the Jakarta metropolitan area, seems to reflect public development policy targeted for West Java. The reality is that development favors areas with a better infrastructure and proximity to government institutions. Because the NCR has both a better infrastructure and proximity to Jakarta, industrial development in West Java has become more concentrated in this region.

The regional development plan of West Java adopts functional integration rather than a territorial integration as its strategy of regional planning, with "growth centers" as the principal instrument of its spatial development policy. The growth center policy is to induce urbanization through a combination of direct public investments and capital subsidies to private enterprises (or the private sector, at large). In contrast, functional integration is a strategy based on the mutual self-interests among regions. Given inequalities at the start, functional integration is characterized by the inequalities of a hierarchical power structure, while territorial relationships are tempered by mutual rights and obligations among participating jurisdictions.

A regional development strategy based on functional integration is biased toward urban development and characterized by large investment in the urban-industrial sector. Two important problems are associated with urbanization driven by such a regional development strategy:

1. Agricultural development will be negatively affected by urbanization because development of urban sectors is viewed as the major determinant of regional economic growth.
2. Rural areas take part in the general process of growth diffusion only to the extent that they are subject to the impacts of the urban economy. In other words, the urbanization process is not necessarily associated with social urbanization (e.g., a wider distribution of social services and socioeconomic benefits) and increasing opportunities for development in rural areas. Therefore, it is expected that rural-urban disparities in the distribution of the development benefits result from a cumulative causation process or self-reinforcing cycle.

The general objective of this study has been to provide a better understanding of the urbanization process and its causal factors, its relationships with regional development and most importantly, its impacts on agricultural development in the region. This objective addresses the goal to identify a rational framework for identifying and evaluating policy interventions to sustain a viable agricultural sector and promote comprehensive and sustainable development. In summary, this study addressed the following objectives :

1. An analysis of urbanization in the NCR and the identification of associated factors such as changes in land tenure, the agricultural economy, demographics and educational opportunities; the development in public facilities and industrial development; and proximity to primary cities.
2. A description of the impacts of urbanization on agricultural development, especially land tenure and the structure of landownership; the degree of absentee landownership; agricultural prime land conversion and its subsequent impact on agricultural household income; and the rural and regional employment structure.
3. A description of the spatial impacts of urbanization on the agricultural resource base, the distribution of public facilities, and the disparities in economic development among rural and urban areas within the region.
4. A description of the functional relationship among urbanization,

regional planning and agricultural development.

5. An examination of policy implications for sustainable agricultural and overall development planning in the NCR.

The following section summarizes the research findings, presents potential policy implications of these findings and identifies needs for further research.

Summary of Findings

This research yielded findings in five important areas: (i) the regional urbanization process and its underlying causal factors; (ii) the level of regional urbanization; (iii) the impacts of urbanization on regional agricultural development, especially on the structure of landownership, the degree of absentee landownership, conversion of agricultural (prime) land and its impact on the agricultural household income, and the structure of rural employment; (iv) regional industrialization; and (v) rural-urban disparities.

1. ***The process of urbanization.***

Regional urbanization during the period 1982-1992, as measured by rate of change in population density, is caused by three groups of factors: (i) *rural factors* or push factors, (ii) *urban factors* or pull factors, and (iii) *demographic factors*. Multiple regression analysis indicates that 76.84 percent of urbanization can be explained by those *three groups of causal factors*. From this total, *rural factors* contribute 45.40 percent (59.08 percent of the explained urbanization). *Urban factors* contribute 24.72 percent (32.17 percent of the explained urbanization) and *demographic factors* contribute 6.72 percent (8.75 percent of the explained urbanization).

Among *rural factors*, the increase in *agricultural land parcelization* (i.e., increased landless households and decreased households with agricultural lands) contribute 28.16 percent or 36.65 percent of the explained urbanization or *62.03 percent of the rural factors*. The contribution of the agricultural land parcelization in explaining regional urbanization is *higher than all pull factors* (24.72 percent). *Changes in the agricultural economy* (i.e., decreased real agricultural labor wage, increased rural land prices and changes in the village structure of employment) contribute 17.24 percent or 22.44 percent of the explained urbanization or *39.97 percent of rural factors. Increases in agricultural land conversion* contribute 12.38 percent or 16.11 percent of the explained urbanization or *27.27 percent of rural factors. Finally, increases in the absentee landownership* contribute 8.62 percent or 11.22 percent or *18.99 percent of rural factors.*

Among *urban factors*, increases in the *availability of public facilities explain most of the regional urbanization*, followed by increases in the availability of pre-college educational facilities. Surprisingly, besides the fact of increased *regional industrialization*, this factor *appears insignificant* in affecting regional urbanization. The total contribution of *demographic factors* explaining regional urbanization, meanwhile, is *only 6.72 percent*.

In summary, findings show that *regional urbanization is dictated mainly by the worsening structural conditions in agricultural land tenure and a deterioration of socioeconomic conditions* in rural areas compared with the more urbanized subregions.

Regarding the proximity of villages to the cities, results show that village proximity to Cirebon and to the capital cities of kabupatens does not significantly affect regional urbanization. Proximity of the villages to Jakarta, meanwhile, affects regional urbanization (confidence level of 70 percent), as does proximity of villages in urban areas (urban villages) to Jakarta (confidence level of 78 percent). Moreover, urban areas affect urbanization (confidence level of 95 percent), an indication that urbanization as a regional process is accelerated through a self-reinforcing cycle.

2. ***Level of regional urbanization***

The level of urbanization is defined at the desa or village level by categorizing villages into rural villages and urban villages. Urban population is defined as the population of urban villages.

Using a population density of 1,500 people/km^2 to differentiate between rural and urban villages, the study finds that during the period 1980-1990, the number of urban villages in the region increased from 151 villages to 223 villages or from 13.74 percent to 20.29 percent, a *subregional rural village urbanization rate of 4.77 percent per year*. Similarly, the urban population increased from 1,179,362 people to 2,439,996 people or from 25.69 percent to 38.75 percent, *a regional urbanization rate of percent or 10.69 percent per year*.

The analysis of temporal rate of change in population density (TRCPD), furthermore, shows that population density increased throughout the region. However, this rate decreases comparatively from the most urbanized area to the most rural area, illustrating a *continued concentration of population densities*. The mean of TRCPD is 115.57 people/km^2/year in urban areas and in rural areas 12.76 people/km^2/year, indicating that the *annual increase in population density in the "urban" areas is 9.01 times greater than in "rural" areas*. This may indicate a *preference to locate in more urbanized areas because of the perceived higher quality of life there*.

The analysis of spatial rate of change in population density (SRCPD), a difference in the degree of population concentration over distance from the capital cities of the kabupatens, shows that the values of SRCPD are very low in all kabupatens in the region. The SRCPD in the NCR, Bekasi, Karawang, Subang and Indramayu are 0.0441, 0.0443, 0.0485, 0.0440 and 0.0417, respectively. This means that in Bekasi, for example, for each kilometer farther from the capital city of the kabupaten, the population density declines by only 0.0443 people per

square kilometer. Therefore, *no significant difference exists in population density over distance from the capital city of the kabupaten*. Therefore, a relatively even spatial distribution of population in the kabupatens is present and the rank size rule does not represent the probable distribution of population in the NCR. In other words, the simple negative exponential function, which represents a successful explanation model for the developed countries, is not representative for the NCR.

3. Impacts of urbanization on agricultural development

The analysis shows that *a high annual regional urbanization rate is accompanied by an increase in land parcelization characterized by an increase in landless households, an increase in absentee landownership, an increase in agricultural to non-agricultural land conversion, and structural changes in village employment*, both in rural areas and in the NCR as a whole. The impacts are, however, more dominating in rural areas.

At the regional level, the analysis shows that the percentage of landless households increased during the 1982-92 period. Households without agricultural dryland increased by 18.84 percent and those without paddyland increased by 22.84 percent. The increase in regional landless households is not significantly associated with a decrease in the percentage of households with < 0.5 ha. dryland or < 0.5 ha. paddyland. This indicates that the percentage of subsistence farmers in the region has remained largely the same. *Regional agricultural development has, therefore, been unable to reduce the percentage of subsistence farmers*. However, the *increase of regional landless households is associated very significantly with the decreases in the percentage of households with > 0.5 ha. dryland or paddyland*.

In the rural areas, changes in agricultural landownership are similar to those in the NCR as a whole. *Landless households increased and the households with agricultural landholdings decreased*. The percentage of households without agricultural drylands and paddylands increased very significantly by 16.95 percent and 17.82 percent, respectively. The percentage of households with > 2.0 ha dryland and those with the same hectarage of paddyland decreased by 58.04 percent and 49.56 percent, respectively.

The analysis also shows that the urbanization is accompanied by increased absentee landownership. At the regional level, the total absentee lands and the number of absentee landowners increased very significantly — by 193.20 percent and 43.26 percent, annual increases of 19.30 percent and 4.33 percent, respectively. T*he total hectarage of absentee lands increased faster than the number of absentee landlords, indicating a concentration of absentee landownership*.

The increase in absentee land area can be attributed mostly to *an increase in absentee dryland rather than to an increase in absentee paddyland*. Absentee dryland in the region increased by 605.94 percent during the period 1982-92, or 60.59 percent annually. Absentee paddyland, meanwhile, increased 42.29 percent during the same period, or 4.23 percent annually.

This pattern of increase in absentee dryland is accompanied by a higher number of absentee landowners acquiring dryland than acquiring paddyland. The average number of absentee landowners with dryland increased by 22.93 percent annually; those with paddyland increased by only 1.85 percent annually. It is more economical to invest in paddyland than in dryland. *The high increase of absentee dryland in the NCR might be attributed to increased regional land speculation*. Buyers usually have information on rural land designated for urban use, which is rarely irrigated farmland. This is especially important, given that existing policies prohibit the conversion of paddyland to non-agricultural uses.

In rural areas, changes in absentee landownership are more staggering than those in the region as a whole. The total absentee lands and the number of absentee landowners during 1982-1992 increased by 193.20 percent and 43.26 percent, respectively.

Comparing the total hectarage of absentee lands (dryland and paddyland), the analysis shows that *absentee dryland increased by 638.06 percent, or 63.81 percent annually*. Absentee paddyland, meanwhile, increased by 29.78, or 2.98 percent annually. This pattern is also accompanied by a higher number of absentee landowners acquiring dryland rather than paddyland. *The number of absentee landowners with dryland increased by 46.02 percent annually, while those with paddyland did not increase significantly, indicating that the absentee landownership of paddyland in rural areas is becoming more concentrated*.

The analysis of agricultural land conversion and the urbanization process in the region shows that, at the regional level, irrigated land decreased by 25.62 percent during the period 1982-1992, or 2.56 percent annually, while agricultural dryland decreased by 27.11 percent, or 2.71 percent annually. In rural areas, irrigated land decreased by 2.50 percent annually, while the agricultural dryland did not decrease significantly. *This indicates that agricultural land conversion in rural areas involves mostly irrigated land, the mainstay of regional agricultural production*.

At the regional level, the increased conversion of irrigated land puts additional pressure on the NCR's capability to maintain its key role in Indonesian food production. At the household level, however, this study finds that *those involved in land conversion are better off economically*. Over the 10-year period, total household incomes increased by 37.58 percent when land was converted. This study also finds that *land conversion in the NCR is mostly dictated by market prices and that government policy does not significantly affect household decisions regarding land conversions*.

The study finds that *five fundamental differences exist between rural and*

regional structural changes of employment. First, in the period of 1982-1992, *rural employment appears still dominated by agricultural employment*. Second, t*he percentage of agricultural laborers in rural areas increased significantly* — by 22.04 percent. This increase is much higher than that of the region (0.95 percent). Third, although employment in the manufacturing sector in rural areas increased relatively very significantly (147.73 percent) and the increase is higher than that of the region (87.62 percent), *the absolute change in manufacturing employment in rural areas is much less than that of the region*. Fourth, *the increase of small-scale enterprises is higher in rural areas than in the region*, 65.55 percent and 47.28 percent, respectively. Finally, *the employment ratio in private enterprises in the rural areas is much less than that in the region as a whole*.

These figures imply that, at the regional level: (i) a decrease in employment in agriculture is followed by a significant increase in the employment in manufacturing and small-scale enterprises; and (ii) a decrease in the percentage of self-employed farmers is not followed by an increase in employment in the agricultural sector, an indication that manufacturing industries and small-scale enterprises have the capacity to absorb farmers displaced from the agricultural sector. Meanwhile, for rural areas the figures imply that: (i) a decrease in employment in the agricultural sector is not followed by a significant increase in employment in the manufacturing sectors; and (ii) a decrease in the percentage of self-employed farmers is followed by an increase in employment as agricultural laborers and small-scale enterprises, an indication that displaced farmers in rural areas are either being employed as agricultural laborers or entering the labor force of small-scale enterprises.

4. *Regional industrialization*

The degree of regional industrialization is measured by changes in the numbers of large-scale industries, medium-scale industries and small-scale industries. Large-scale industry is defined as an industry with 100 or more employees. Medium-scale industry is defined as an industry with 20 to 99 employees. Small-scale industry is defined as an industry with 5 to 19 employees. *This study finds that during the period 1982-92, the degree of industrialization increased very significantly*. The number of large-scale industries increased by 4750.50 percent, or 475.05 percent annually. The number of medium-scale industries increased by 259.36 percent during the period, or 25.94 percent annually. The number of small-scale industries increased by 81.34 percent during the period, or 8.13 percent annually. *These figures show that the development of medium- and large-scale industries is a rather recent phenomenon associated with recent regional economic growth*.

5. *Rural-urban disparities*

The study finds that rural-urban disparities exist in the distribution of the benefits of regional economic progress as measured in 1990. This is expressed by the high values of the Gini coefficients (GC) of households with telephones, electricity or television — 0.77, 0.30 and 0.51, respectively. Of the three, telephones are most evenly distributed and *rural electrification remains a significant development objective. Economic progress in the region is more concentrated in the more urbanized areas since the location quotients (LQ) of the three indicators are higher than those in rural areas*.

The marketing facilities associated with the sale of agricultural inputs and products are evenly distributed in the region, with GC of 0.04 and 0.15, respectively. However, markets with permanent buildings are unevenly distributed in the region (GC of 0.26) and most are concentrated in urban areas. Elementary schools are evenly distributed in the region, with a GC of 0.04 and with relatively similar LQs between rural and urban areas. Secondary schools and high schools are unevenly distributed in the region, with GCs of 0.23 and 0.48, respectively, and concentrated mostly in urban areas, as indicated by comparatively higher LQs.

The study also finds that physicians are concentrated mostly in urban areas. With only 22.23 percent of the regional population, the urban areas have 80.50 percent of the physicians residing in the region (GC = 0.63). On the other hand, midwives and total health care providers are evenly distributed, with GCs of 0.03 and 0.12, respectively.

Policy Implications

Research findings suggest that without any policy interventions in regional economic and agricultural development, *future agricultural viability can not be sustained and the role of the region as the major food producer of Indonesia will be undermined*. Therefore, regional urbanization is directly threatening Indonesia's future self-sufficiency in rice. More importantly, the welfare of the population engaged in agricultural activities — 49.28 percent of the regional population or 75.88 percent of the total rural population (1992) — will also be negatively affected by this process.

These assertions are supported by the research findings indicating that *urban and industrial development have displaced self-employed farmers through increased agricultural land conversion and increased absentee landownership*. The logical social adjustment commonly pursued by rural populations is to disperse household agricultural land by means of land conversion and land sales. This land parcelization results in diseconomies of scale in agricultural enterprises and provides additional disincentives for rural inhabitants to remain employed in agriculture. *The combined effects of increased agricultural land conversion, increased absentee landownership and increased land parcelization will decrease regional agricultural output and agricultural productivity. In addition, increased regional industrialization has been unable to absorb the population*

displaced from the agricultural sector. Consequently, this labor force shifts to small-scale, non-agricultural enterprises or remains in agriculture as hired laborers. Because these last two forms of employment are characterized by low economic productivity and labor rates, *the urbanization process indirectly diminishes the overall welfare of the rural population*.

The research findings also suggest that the existing urbanization process will complicate problems of regional development. Because regional development is pursued through a growth center policy, urbanization is induced by a combination of direct public investments and capital subsidies to private enterprises to create urban centers that are expected to diffuse economic growth into rural areas. The research findings show that the *expected trickle-down effects into rural areas do not occur in the NCR*. In fact, the analysis of rural-urban disparities shows that the *economic progress and development of public facilities remain largely concentrated in the urban areas*. Moreover, urbanization in the region is mostly determined by push factors from agricultural rural areas rather then increased opportunities in urban areas. This implies that, *without further government intervention, future rural-urban disparities will increase and increased economic stress in agricultural rural areas will drive income flows into urban areas, creating further rural-urban disparities*.

To sustain its critical role as the main food production region in Indonesia and to improve the welfare of its rural population engaged in agricultural activities, government must initiate a broad-based rural development strategy. The strategy must include policies on:

1. ***Agricultural land consolidation.*** Agricultural land consolidation is directed mainly to *mitigate negative effects of diseconomies of scale in agricultural enterprises*, which commonly create disincentives for the rural population to remain in agriculture. It is urgently needed in the region for two fundamental reasons: (i) current regional industrial and service sectors are still unable to absorb the labor force displaced from the agricultural sector; and (ii) economies of scale in agricultural enterprises and its service support infrastructure are needed to maintain and improve regional agricultural productivity and outputs. Policies of this nature have proven very effective in northwestern Europe (e.g., the Netherlands).
2. ***Minimizing agricultural land conversion***. This policy should be pursued by the government through effective policy measures instead of by legislation that is difficult if not impossible to enforce. For instance, this study shows that land conversion decisions are dictated mainly by land prices and, in fact, do have a beneficial effect on farm household income. Economic motives and incentives are paramount, and legal restraints such as the relevant presidential decree appeared to be ineffective in reducing land conversion. Field observations show that farm households change the status of irrigated land to non-irrigated land by taking the land out of production for two years and then converting it to non-agricultural uses and so avoid legal impediments. *Policy measures that create direct economic incentives or purchase development rights on the basis of a comprehensive land use plan would likely be more effective*.
3. ***Minimizing absentee landownership***. This policy is directed to *making agricultural enterprises in rural areas economically competitive and reducing the economic incentives to sell land. In addition, a land use plan with permanent agricultural zoning designations will reduce the opportunity to realize higher land prices based on land speculation*. Farm *loan supports and tax incentives* may provide incentives to preserve farm ownership and reconvert absentee lands to small farmers.
4. ***Strengthening rural areas***. This study shows that urbanization is affected mostly by push factors associated with rural life. Therefore, to reduce urban migration indirectly, *the physical and service infrastructure of rural areas must be improved to ensure a competitive production environment* (e.g., irrigation, transportation, marketing and service) and equitable quality of life (e.g., housing, education, health care).

These policies may be pursued in the context of an integrated rural development scenario. For instance, the four potential policy initiatives above can be addressed by the following two scenarios:

1. **Scenario I** :

   The government still maintains the current regional development strategy – namely a growth center policy in which urbanization is induced by a combination of direct public investments and capital subsidies to private enterprises to create urban centers that are expected to diffuse economic growth into rural areas.

Under this scenario, rural development is pursued along with urban development (Rondinelli, 1983). Within this framework, the notion of linkages between rural and urban areas is viewed as very crucial for rural development because major markets for agricultural surpluses are in urban centers, while public services are commonly located in urban areas. Instead of focusing investments exclusively on rural areas or urban areas, investments are diversified over space in such a manner that secondary cities can be created to build linkages between rural areas and urban centers. In other words, the focus of this scenario is to create generative secondary cities that are expected to: (i) relieve pressures on the largest cities; (ii) reduce regional inequalities by diffusing the benefits of urbanization; (iii) stimulate the

rural economy by providing public services, enlarging rural markets and facilitating the absorption of agricultural surplus labor by urban centers; (iv) provide an increased regionally decentralized administrative capacity; and (v) help alleviate poverty in intermediate-sized cities (Rondinelli, 1983).

If the expected roles of the generative secondary cities can be targeted as a regional development strategy, the agricultural sector will develop as a result of expanded local markets for agricultural products.

2. **Scenario II**:

   The government still maintains current regional development strategies but gives greater autonomy to local authorities to create land use planning initiatives (Scenario I + greater local autonomy).

Under this scenario, scenario I is broadened to include increased local autonomy to determine local land use designations at subregional and local levels. To accomplish this, the regional local government must develop (sub)regional and local land use plans, incentives and controls to effectively address, directly and indirectly, the various factors affecting regional agricultural sustainability, as identified in this study. This constitutes policy measures undertaken in addition to the development of generative, secondary cities. Planning must reflect regional agricultural development goals and current and future challenges in maintaining the region's position as the critical food production region of Indonesia. A well defined system of regional incentives and effective land use controls is to be incorporated within this economic development framework. These may include the acquisition of development rights and conservation easements to avert prime farmland conversion to non-agricultural uses or agricultural tax incentives to sustain a viable agricultural sector. Similarly, the government may assist the agricultural sector in enhancing production efficiencies and in the provision of agricultural inputs (e.g., physical infrastructure, input subsidies, technology transfer) and in the marketing of agricultural products and by improving the rural service infrastructure. In addition, the creation of value-added food processing industries in rural areas may assist in enhancing the economic opportunities for those displaced from traditional agriculture, improve wage rates and reduce the effects of rural push factors stimulating urbanization. At the same time, this scenario will reduce agricultural land conversion, which undermines regional agricultural sustainability.

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