The Development of Agricultural-Based Small Urban Areas to Promote Rural Development

A Case of the Cattle-Related Industries in Ampel Sub-District, Central Java

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by

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CERTIFICATION

I, Emil Elestianto Dardak, declare that this thesis, submitted in fulfillment of the requirements for the award of Doctor of Philosophy, in the Graduate School of Asia Pacific Studies, Ritsumeikan Asia Pacific University, is wholly my own original work unless otherwise referenced or acknowledged. The document has not been submitted for qualifications at other academic institutions.

Emil Elestianto Dardak
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EXECUTIVE SUMMARY

This thesis focuses on the development of agricultural-based small urban areas in rural regions. The interregional development in Indonesia has been characterized by imbalances in the rural-urban linkages. The discussion on urban and regional economic theories and the empirical studies have shown the potential development of small urban areas in predominantly agricultural rural areas. The criteria for the selection of research area were defined by drawing upon the various interpretations of Agropolitan. Ampel sub-district in Boyolali District, Central Java, was chosen as the research area. Ampel has an established agro-business system in the cattle rearing sector.

The analysis on the accessibility factor shows the importance of accessibility in urban development. The calculation of spatial industrial linkage indices shows that Ampel has a balanced rural-urban linkage, which is characterized by high magnitude and market size for the rural sectors. The high concentration of rural sectors' forward linkages to the Ampel city shows the significant role of Ampel city in the cattle rearing industry. The moderated structural equation modeling for Ampel shows that the residents' willingness to travel has insignificant effect on the positive relationship between accessibility and the usage of small urban center. The model also shows that the residents' modernity has significant effect on the negative relationship between rural amenities and the usage of small urban center.

Overall, agricultural-based small urban areas can develop the rural economy by benefiting from economies of scale that is subject to high accessibility, concentration of forward linkages and the development of urban amenities that meets the needs of the local people.

CHAPTER I

INTRODUCTION

1.1. Background

The development of agricultural-based growth centers urban areas was inspired by the desire to develop the rural economy. The rural economy has a tendency of being dominated by low value-added agricultural activities with consistently decreasing land productivity and the high risk of loss arising from fluctuations in the prices of fresh farm products. This condition along with the population growth has brought villages to the point where they can no longer sustain their populations in terms of job creation. This leads to rural-urban migration, which has adverse impacts. However, there is an important distinction that must be made between different kinds of rural-urban migration.

This research argues that rural-urban migration has detrimental impacts when the migration takes place from rural area to metropolitan areas located far away from the rural areas and not if the migration takes place from rural areas to a nearby small to middle-sized urban area. We believe that the latter form of migration indeed creates healthy rural-urban linkages. In addition, it is also important to distinguish between day-time population and night-time population. Migration that contributes to the increase in day-time population in the urban areas is usually because of commuters who live outside the urban areas. However, again, a distinction needs to be made between commuting that takes place in the metropolitan areas and that which takes place in small to medium sized urban areas. The former tends to take place from suburban areas to urban areas and is a clear indication of urban sprawl. The sprawl usually has a combination of concentric and linear growth pattern.

Urban sprawl has been the major feature in the development of “primate” cities. The sprawl is due to the centralized governance in Asian countries such as Indonesia, Thailand and the Philippines (Anwar, 2000). The primate is defined as the excessive growth of the largest metropolitan areas in a country (Mills and Hamilton, 1994). Preferential treatment in terms of state budget allocation to capital cities can, however, lead to a significant disparity in urban amenities, and suppress the growth of other urban areas within the country. The population of Jakarta, the capital city of Indonesia, has grown at an average rate of 4.59 percent per annum from 1961 to 2002. The population increased from 2.9 million in 1961 to 8.4 million in 2002. With 3.95 percent of the national population residing in Jakarta, the local GDP of Jakarta has reached 15 percent of Indonesia’s GDP and this clearly indicates how Jakarta has grown to become a primate city (Kasikoen, 2005).

Although the other metropolitan areas in Indonesia may not yet qualify as primate cities, these metropolitan areas including Medan in North Sumatra, Surabaya in East Java, Bandung in West Java, Semarang in Central Java and Makassar in South Sulawesi, are also growing rapidly. Henderson and Kuncoro (1996) find that in Java Island, there is an increasing degree of population concentration in four metropolitan areas, namely Jakarta, Bandung, Surabaya and Semarang. For these cities, the population increased by 32 percent and industrial sector labor increased by 51 percent during 1961 to 2002 (Kasikoen, 2005). We cannot consider the development of other cities in Indonesia as a sign of equitable development, because these are simply replications of the similar pattern of over-concentration as that of Jakarta, but on a smaller scale. The growth of these cities has gone beyond their carrying capacity in terms of employment opportunities and infrastructure provision. In addition, these cities have not contributed to healthier rural-urban linkages. If this trend continues without any improvement of employment opportunities and infrastructure in the cities, these cities will face the threat of unsustainable development.

As mentioned above, the growth of Jakarta, and subsequently the other metropolitan areas in Indonesia, is a result of the preferential treatment to these cities. Although industrialization that took place in the 1970s and 1980s led to a fall in the contribution of agriculture to GDP, Indonesia has failed to maintain healthy rural-urban linkages. Garcia (2000) sees this policy as an urban-biased policy that creates significant disparities in development and leads to rural areas being left behind in terms of economic development. Anwar and Rustiadi (2000) see the development policy in Indonesia as pursuing the creation of growth poles with a spatial polarization of development efforts to a few cities. The initial intention was to make smaller areas act as growth centers and this was expected to lead to trickle down effects within the cities' hinterland. However, in reality, rural resources are being drained by these cities and no beneficial developmental impacts are being enjoyed by the hinterlands.

Harun (2006) explains that this growth pole strategy relies on four main sources of financing. Three of the sources connect national economic development to the global capital system. These are export of primary goods, foreign investment and international aid. The fourth source relies on the national economy's capacity to save, particularly on the agricultural sector and taxation. During the 1970s, the government of Indonesia mobilized savings and adopted an import substitution industry. The private sector at that time was very dependent on projects initiated by the government. The fact that the technology used for these industries was imported caused Indonesia to rely on abundant raw materials and cheap labor. Such advantages became unsustainable as the development in technology has led to a continuous increase in the productivity of the machines, decreasing the demand for labor. However, a lack of indigenous technological progress caused Indonesia to rely heavily on imported technology and rendered Indonesia's past competitive advantage less effective.

At the same time, increasing population pressure has led to an upward pressure on food prices. However, farmers are least likely benefit from such price increases. Their general lack of access to infrastructure has caused farmers to rely on intermediaries in marketing their produce. Most of the profit margin is actually enjoyed by these intermediaries, due to the low bargaining power of the farmers. At the same time, the government is continuously faced with the dilemma caused by the trade-off between cheap food policies and industrial development. Thus, in response to the upward pressure on food prices, the government has resorted to a cheap food policy. This policy involves import of rice and different forms of market interventions.

It is reasonable to argue that cheap food policy is also instrumental in ensuring that poverty is kept in check. However, this triggers a vicious cycle, because the government has been focusing too much on the urban poor, in its poverty eradication strategy. In the rural areas, poverty is experienced by farmers, and the cheap food policy affects their income. At the same time, the cheap food policy at the expense of rural farmers is distorting, because urban areas continue to be attractive to potential migrants as this urban-favoring policy disguises the limitations the urban areas have in providing employment opportunities. It can therefore be argued that Indonesia's urban areas have grown at the expense of rural areas. This is due to the policy of growth pole creation. Industrialization as the fuel for urban growth is largely dependent on the supply of cheap labor.

Harun (2006) argues that farmers also suffer from the fact that they cannot be isolated from the urban economy. When they transact with the urban economy, the inflationary pressure in the urban area is "exported" to the rural areas because farming equipment and supplies tend to have price increases at a faster rate than the food prices. Another important issue that is related to the cheap food policy is the fact that the urban labor force is seen as a strong political force to the government. This has encouraged government to stabilize food price to ensure urban labor political stability.

Rustiadi and Hadi (2006) identify other possible causes of the backwash effect in Indonesia's regional development. The first is the fact that access to villages often encouraged urban elites and central bureaucrats as well as large corporations to exploit the rural resources. These rural communities were unable to defend themselves due to their lower bargaining power. Second, rural residents have low human resources capital and weak institutional capacity. This handicap made it difficult to disseminate the ideas and modern concepts of rural development. Therefore, most activities take place in enclave form by bringing in human resources from outside the villages.

According to Rustiadi and Hadi (2006), even if the urban areas remain healthy despite the sickness of the rural areas, this is not a sustainable condition, because eventually the disease in the rural areas will spread to the urban areas. This seems to be the scenario that Indonesia might face. Harun (2006) opines that the rural areas in Indonesia are considerably overpopulated if density is measured by the size of farmland per household. This is particularly the case in Java, where the average ratio of land to household is less than 0.3 hectare/household and is consistently decreasing. In many cases, farmers do not own their land and become landless peasants who must give around one-third to a half of their produce to their landlords. In relation to the decreasing ratio of land per farmer, Dardak (2004) points out the danger of land degradation caused by over-intensive cropping that has drained soil nutrients. A field trip to Malang's apple farms shows an example of how over the years intensive cropping has caused the soil to lose the critical nutrients. As a result, the farms experienced decreasing yield both in terms of quantity and quality.

The unsustainable farming condition in rural areas has caused urban areas to experience migration from rural areas beyond what they can accommodate, leading to social problems. The cheap food policy has been the key to the survival of the urban areas but if this issue remains unaddressed, food scarcity will undoubtedly take place because of the imbalance between urban food demand and rural food supply. The recent controversy over import of rice has been a real example of such a danger. The food price will inevitably increase, and the government's decision to import food in stabilizing the price will be at the expense of local farmers who will face significant decrease in income, since they will have to sell a lower quantity at the same price. Farmers may decide to give up farming and move to the cities in search of the "superficial"[1] urban opportunities. One

[1] The word superficial is used to describe how the urban areas seem to provide endless opportunities for migrants, while in reality, this is not the case. This is because the urban areas' sustainability relies on cheap food supply from the rural areas and the actual growth of industrial employment is lower than the number of rural to urban migrants.

may argue that the migration will solve the issue of overpopulation in the rural areas. However, the prevailing unemployment in urban areas shows its inability to create enough employment opportunities for the migrants, which further results in a vicious cycle leading to urban social problems and overexploitation of rural farm lands in pursuit of larger and cheaper food supply to feed the urban population.

Secondary and tertiary economic activities have been concentrated in the urban areas in pursuit of rapid growth. This involves transporting rural produce over long distances for processing or even for simple packaging and sorting. During the 1970s and 1980s, when the supply of gasoline was abundant and fuel subsidies were still feasible, the impact of long haul was hidden by the low price of fuel. However, now Indonesia has become a net importer of fuel. The phasing out of subsidy has caused a problem in the logistical arrangement. As fresh farm products with low value added are transported over long distance, the cost of transport as a percentage of the final price increases.

There is an opportunity for the rural areas to process their produce so that they can cope with the increasing burden of transportation costs. Minimizing the distance traveled between farm gate and the subsequent processing or handling may become a critical factor in reducing the cost of transportation. This would also create alternative employment opportunities for the rural population. However, Dardak (2005) points out that the challenge in such rural development program is the small scale of operation that makes it infeasible for a manufacturing industry to operate.

Friedmann and Douglass (1975) propose the Agropolitan concept as an alternative for regional development. The concept relies heavily on the development of an urban growth center, which is located within 5-10 kms or an hour of cycling from its hinterland.

This concept allows the leveraging of investment as more than one village is involved and the investment can be focused on the growth center village that is most accessible, so that the catchment is also optimum. The government of Indonesia adopted this concept in rural development in 2002, with particular focus on the development of infrastructure such as rural roads, market and irrigation (Rustiadi, 2004). This program follows the "trade follows the ship" principle, where infrastructure provision precedes the demand and is expected to encourage economic activities and concentration of post-farm distribution in the growth center by the hinterland villages so that economies of scale can be realized.

1.2 The Challenges Faced in Agropolitan Development

The Agropolitan program has now been in operation for four years, and the evaluation process for the initial phase of the project has been conducted. The agencies involved in the implementation and evaluation are the Ministry of Agriculture and the Ministry of Public Works. Researchers from Bogor Institute of Agriculture, Bandung Institute of Technology and Gajah Mada University, Yogyakarta helped to create the conceptual framework for the Agropolitan. This conceptual framework will be the result of an analysis that shows how an agropolitan system operates in terms of its socio-economic spatial arrangements.

Indonesia is a pioneer in implementing Friedmann's concept of an Agropolitan, but there is still no clear implementation criterion and model for this type of development. A Bogor Institute of Agriculture publication in 2006 discusses the possible concept of an Agropolitan. The author of this thesis was given the privilege to participate in the National Workshop on Agropolitan development in November 2005, where the

Agropolitan concept was defined for inclusion in the government's policy and regulatory framework.

The evaluation by the Directorate General for Urban Rural Development of the Ministry of Public Works (2004) was based on the infrastructural construction and its impact on farmers' revenue. A working example of an Agropolitan growth pole has not been yet properly identified in Indonesia. An Agropolitan is a way of achieving the development of small urban areas in the agricultural-based regions to facilitate rural development. The evaluation system in 2004 focused on the revenue impact without paying much attention to changes in spatial structure. As a regional development strategy, it is important to evaluate the impact on spatial structure, especially in assessing the presence and even further the effectiveness of a small urban area in an agricultural region.

Anwar (2006) defines the agenda of Agropolitan development, which is to develop a small urban function center. This urban function center acts as the service center and should be equipped with urban facilities such as clean water, electricity, a market center, entertainment, financial institutions, post primary education, road network, transportation system, communication facilities and other economic activities. These centers are the critical gatekeepers to filter the rural migration to metropolitan areas as they serve as centers for off-farm employment and services provision.

The fact that the evaluation process tends to exclude the analysis of changes in spatial arrangement, shows the need for a clear working example of an Agropolitan.The November 2005 National Workshop on Agropolitan and Metropolitan, has given a clear direction on the concept of an Agropolitan. Nevertheless, this concept requires a working model that can be obtained only by empirical analysis. This working model should feature a real example of an agro-based small urban function center.

1.3 Research Objective

This research seeks to establish a working model of an Agropolitan. This will help the government in designing Agropolitan projects and evaluating existing projects in terms of the changing spatial arrangements.

The objective is to develop a conceptual framework based on literature review and a theoretical framework, and to use this conceptual framework to identify the research object. The empirical analysis is conducted to find a real life example of an agro-based small city, or at least a small city that is close to being an agro-based small city but lacks certain traits that are required in the conceptual framework.

The research questions are:

For the theoretical and literature review:

1. What are the factors that contribute to the growth of urban areas, in particular the process that takes place for a non-urban area to become an urban area?
2. Has there been any development of agro-based small urban areas in other countries and what are the issues faced?
3. What are the current concepts and ideas for an Agropolitan?

For the empirical analysis:

1. What is the role of accessibility in the development of an agro-based small city in the research object?

2. What is the pattern of agricultural industrial linkages and do they display concentration of activities?

3. How do the socio-economic background and other factors influence the individual villagers' decision to utilize the rural small town?

1.4 Scope of Research

This research looks at urban and regional economic theories as well as related literature in conceptualizing a working model for an Agropolitan. The research selects one project from the list of on-going Agropolitan projects and potential Agropolitan projects. The selection criterion is based on the conceptual framework. A working visit is conducted only to the shortlisted project areas. The focus is on the role of accessibility, villagers' socio-economic background, urban amenities, interaction with other urban areas and the industrial linkages.

1.5 Significance of Research

Many countries place a heavy importance on agricultural sustainability. The empirical-based working model will provide more accurate guidelines for implementation compared to a pure theoretical working model. This research is the first in analyzing the industrial linkage pattern of a small agro-based city in Indonesia, and the role of accessibility. The role of accessibility is also important in designing spatial plans and road network as well as urban interactions.

The research also takes into account socio-economic factors that influence villagers' decision to utilize the small city for employment and access to services. The working model can also serve as a guideline for potential development of similar rural development projects in other Asia Pacific countries. The industrial linkages analysis is limited to the flows of goods within the region, and only includes the sectors related directly to the main commodities produced in the region. The exports from the region are not included in the analysis.

CHAPTER 2

THEORETICAL FRAMEWORK

2.1. Introduction

Theoretical studies form an integral part in understanding the processes leading to the emergence of an urban area. This chapter discusses theories of urban and regional development to depict an overall picture of the various intellectual interpretations of the mechanisms behind the emergence of an urban area. The research objective of this dissertation is to analyze the development of agriculture-based small towns. Hence there is a heavy emphasis on understanding the mechanisms of an urban area formation.

In relation to an Agropolitan, the role of agriculture-based small towns in facilitating a balanced rural-urban linkage pattern is very significant. The intense interaction between the hinterland villages and the market town, which is created through backward and forward linkages, is the most important characteristic of an Agropolitan region. The market town is basically a central point in the region that serves as a market center to collect the produce from the rural villages and distribute urban services. This market center develops into an urban center or market town through concentration of secondary and tertiary activities as well as a certain degree of population concentration. However, we can narrow the scope of population concentration to day-time population, instead of night-time population. Day-time population includes those who live in the hinterland villages but work in the market town while night-time population excludes such people. The assumption that the market town has high accessibility from every point in the Agropolitan region also means that the villagers do not need to reside in the market town because travel is easy.

We look at various theories that explain the mechanisms of urban growth. The processes that lead to urban growth will serve as useful inputs to construct a working model for an Agropolitan. Most of the theories are within the field of urban and regional economic development. There are various names for urban and regional economics field, which include among others, urban economics, regional science, regional economics, economic geography and spatial economics. All the theories in urban and regional development try to integrate spatial aspects in explaining the process of economic development. We discuss the process that leads to the establishment of urban area, in particular, the criteria in terms of economic activities and spatial arrangements.

2.2. The Early Location Theories

The major original spatial economic theories were all outside the Anglo-Saxon tradition, mostly due to the fact that these works were written in language other than English. They were mostly in German. The major spatial economists were von Thunen (1826), Weber (1909), Christaller (1933) and Losch (1938). Although these theories adopt different approaches, there is a common feature shared by these theories as they all are directed towards understanding how the behavior of economic agents in making location decision for economic activities leads to the emergence of activity centers as embryos of cities. Section 2.2 discusses the early attempts in integrating spatial dimension with economic development. These include the works of von Thunen’s work on isolated state, Weber’s work on industrial location theory and the theories of market area of Christaller and Losch.

2.2.1 von Thunen and Weber

von Thunen (1826) observes the pattern of land use in an agricultural economy by referring to his own managed plantation. His work was the first to explain the spatial mechanisms that lead to the emergence of an urban area. According to von Thunen, the urban area is at the core of the agricultural economy, which acts as the market area. This market area is surrounded by agricultural rings where each ring cultivates a specific crop associated with the highest bid rent made for that particular ring. This bid rent is calculated on the basis of revenue and expenses, including cost of labor and transportation. The main idea of bid rent is that the activities that take place in a particular ring will have to generate revenue sufficient to cover the operational cost, in particular transport cost. Thus, the farther away the agricultural ring from the core, the more revenue it has to generate to cover the transport cost.

The trade-off between transport cost and bid rent is the main feature of an agricultural economy's land use. Commodities such as vegetables and fresh milk are produced in the agricultural ring that is nearer to the core, because these products are highly perishable and require minimum transport time. In contrast, commodities such as wheat can be located farther from the core because they can withstand long haul. It is important to note that transport cost is not only seen from the perspective of monetary cost, but also time cost. Hence, products that cannot withstand long haul, such as vegetables and fresh milk, need to be located in the agricultural ring closer to the core, which requires higher bid rent. This shows that it is not only the crops' relative price that determines the ability of the farmers to pay for the land rent. The inherent characteristics of the crop such as its perishability, determines whether it needs to be located nearer to the core or not, and thus determines the price received and the potential revenue gained.

Although inherent characteristics of crops affect the price due to the necessity to locate nearer to the core area, those located farther from the core area need to incur higher transport cost and this also translates into a higher price. Therefore, it is not acceptable to judge the commercial value of a crop based solely on their location decisions. The benefit of locating near to the core market, according to von Thunen, is strictly confined to the transportation of farm produce. Nevertheless, activities that are not dependent on the market area have the freedom to pursue the lowest possible land rent without any worry about transport costs.

There are some exogenous factors that may affect the operability of farms. Demand may affect the price of the commodities and the possible intensification of farming may reduce the need for larger land space. In the presence of intensification, the sacrifice of paying higher rent can be offset by reductions in transport costs. Higher demand for a product may also lead to a disproportionate trade-off between transport costs and bid-rent because the savings in transport costs may exceed the higher bid-rent paid as the quantity of goods transported is higher.

von Thunen showed that market function plays a significant role in creating an urban area. The presence of a core market affects productive activities and their respective locations relative to the distance from the core area, which is further influenced by the demand for the product and the possible intensification measures. He explains the spatial arrangements of a functional region, and simply attributes urban growth to the development of a market for agriculture produce.

Weber (1909) provided a very useful addition that fills the missing piece in the process of urban growth from von Thunen's theory. Weber explains the emergence of a locational structure with particular reference to the general contributing factors. Weber starts with the initial condition where people occupy an undeveloped land area that will later become established as an isolated economy. The first phase is the establishment of agricultural stratum that produces the necessary items required for human survival. The people who are engaged in farming will then demand consumer goods. To satisfy this demand, surplus labor from the farming sector will be engaged in primary industries that are located away from the first stratum. This location where industrial activities take place becomes the second stratum and is called the primary industrial stratum. The combined demand for secondary industrial goods from the people working in the agricultural stratum and the primary industrial stratum are then satisfied by the surplus labor from these two sectors who engage in secondary industrial activities. The location for secondary industries is named the third stratum, located away from the second and first stratum.

These three strata are the basis of an isolated economy. The demand for services from the people working in these is satisfied by additional surplus labor that engages in central organizing activities. These service and administrative activities take place in the fourth and fifth stratum. As we can see, the farm activity extends economic activities outward and as the location goes outward from the farm, the economic activities that take place shift to secondary and tertiary sectors. If we assume that more than one farm activity unit is doing the same thing, and these farm activities are located within a concentric line, there are directions where the outward movements of these units will converge and the further the outward movement, the more farm units are included in the converged points. If we further assume that the secondary activities will take place in locations where the most number of people can be served, we can see the agglomeration of activities taking place through this outward movement. As a farm unit decides to extend its economic activities in establishing a second stratum for primary industries, another adjacent farm unit may decide to do the same thing and thus the second stratum may involve more than one farm unit.

As the second stratum comprising of two or more farm units expands into the third stratum, two or more second strata may have a point of convergence. Thus, the third stratum may involve more than one second stratum. As this process continues, the final point will be a convergence of all the farm units that can be connected in one concentric or circular line located in the outermost of the circular region (refer to appendix 1 for detailed illustration of this process).

Weber (1909) follows the concentric pattern of land use that von Thunen uses, but explains in detail how the core area is created. von Thunen created the impression that the market place is the central point in the isolated economy, and insisted that activities originate from that point. In contrast, Weber’s theory can be interpreted as an outward movement, where the region gets developed initially from the outermost circumference of the circle, which depicts the region, and as it extends outward from the farm points, this extension instead becomes an inward movement as all the points within the circumference line converge into the central nucleus or core of the circular region. This explains how conglomeration or agglomeration of activities takes place and how economies of scale contribute to the creation of human settlements and urban areas. The central organizing strata or the fourth and fifth stratums, are most likely the urban core which von Thunen is referring to in his theory.

However, if we note that the locations where second or subsequent stratums take place were initially used also as farm locations, we can see how agricultural activities get driven away. As the point of convergence between two or more farm units create economic value of land, farm activities are no longer profitable because of the low value-added. Thus, primary industries that offer higher value-added and is able to produce at the demand required for more than one farm unit is considered more suitable to be located in the land with a higher economic value. This process continues until the core area, where all the possible points have converged is formed, and the highest value economic activities take place in this area. This explains how competition for land use as hypothesized by von Thunen, is also applicable to Weber's theory.

From both Weber and von Thunen's theories, we can see endogenously derived creation of cities that takes place due to agglomeration of activities[2]. The surplus labor to be had because of intensive farming or population growth can be engaged in primary industries. This process continues until it is possible to produce tertiary goods and services. Thus, the pre-conditions of an urban area is the sufficient catchment area or population size that it can serve, which is largely determined by the location. The process takes place naturally where locations that can serve more people will have higher economic value and thus higher value activities that satisfy the demand of more people replace the primary activities that have lower value added.

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[2] It is important to note that growth of cities can also be derived exogenously through the existence of other economic centers, which will be explained in other theories to be discussed later in this chapter.

Weber (1909) also developed a location theory that is based on the following assumptions: firms exhibit constant return to scale along with technological improvements; factors of production are infinitely available anywhere or be located at certain locus of production or supply; the demand is known and fixed in terms of space and amount, and the transport cost for the commodities increase in proportion to the increase in weight and distance of the goods being transported. Based on this theory, the location that gives the optimum profit for the firm is determined by minimizing both production and transportation costs.

This theory is also well known as the Weber triangular problem. The problem is that a firm that is faced with the decision to locate its factory to minimize the cost of serving a particular consumption site. The problem is named the triangular problem because there are two sources of raw materials that are required for the production activities–and there is a market center located at the third point. Hence, if linked, these three points form a triangle.

Weber shows that the location giving optimum profit is located within the triangle, and this location is determined on the basis of the relative strength of the pull forces for the two sources of raw materials and the market center. This theory is the main point of discussion of regional science scholars, including Isard (1956). Isard's theory on Weber's triangular problem is discussed in a later section of this chapter.

2.2.2 Christaller and Losch

This section looks at the central place theory developed by Christaller (1933) and Losch (1939) that build on Weber and Thunen's theories. The central place theory is, however, constructed under strict assumptions. Newer theories such as those developed by Isard (1956) and Alonso (1964) have been constructed under a more relaxed assumption in updating the central place theory. These newer theories will be discussed in the later sections of this chapter.

Christaller (1933) provided an empirical analysis to further explain and build on Weber and Thunen's theories. Christaller studied a large number of market towns in South Germany where every group of market towns were focused on a larger administrative center. This center is also a market town, but is larger in scale and scope. This relationship continues as the smallest market towns are linked to the second smallest market town, and this second smallest market town is linked to the larger market town until the second largest market towns are linked to the largest market town. This hierarchy of relationship is the main point of Christaller. The inward centralistic manner of relationship shows that a hierarchy exists in the settlement pattern. Christaller also found that settlements of typical size tend to be spaced regularly. The empirical findings show that population of several sizes of typical settlements tend to bear a regular relation between each other, and the distances separating any pair of similar size settlements tend to increase by $\sqrt{3}$ as one proceeds from a given settlement size to a settlement of the subsequent higher size.

Losch (1938) added another important dimension to Christaller's findings. Losch looked at the process of urban settlements by collecting additional empirical evidence. His finding is also a rebuttal to Palander's (1935) view that in the absence of pure competition in modeling spatial economics, general equilibrium can never be obtained.

Losch's work features a highly simplified static model of a space economy that operates under monopolistic competition.

It is, however, important to note the strict assumption by Losch of a broad and homogenous plain economy with uniform transport features in all directions and with an even scatter of industrial raw materials in quantity sufficient to facilitate production activities. The economy also has a uniform distribution of agricultural workers as well as population that have the same set of tastes and preferences. Losch also assumed that each farmhouse is self-sufficient in the beginning and technical knowledge gets disseminated throughout the economy with production opportunities available to all the people.

Economies of scale is assumed to be the inducing factor for production of a commodity that is beyond the farmhouse's basic needs. Thus, if the farmhouse finds production of a secondary or tertiary commodity to be profitable, it will produce the commodity to serve a certain market area that is depicted to take a circular form. However, since production opportunities are available to all farmhouses, if a farmhouse finds it profitable to produce a commodity in surplus, so will the others, and thus the force of competition will eliminate excess profits and alter the market area. This alteration not only leads to smaller market size for each farmhouse, but also changes the shapes of the market.

Ultimately, the market area transforms from a circular form into a hexagon form. The hexagon market area is seen as an ideal economic form of market area, and is sustainable because the net of the hexagonal market will completely cover any area under consideration. In contrast, a circular area will still leave empty untouched corners. Other possible shapes may be triangles, squares and octagons. But, only a hexagon deviates the least from the circular form and at the same time allows minimization of transport costs in supplying a given demand. Thus, a hexagonal form has a circular form's advantage of allowing maximization of demand from the population in the given area and at the same time, is better than the circular form because it does not leave any empty untouched corners.

As conceptualized, Losch's argument is that for each commodity, the economy can be depicted in the form of a geometric plane that is dissected into a honeycomb or a net of hexagons of market areas. Losch further groups these honeycombs according to the size of the respective market units. The varying sizes and the relationship between the smaller and the larger markets create a system of nets that conforms to Christaller's hierarchy of market centers.

The combination of the system of nets and the hierarchy of market area is well-known as Central Place theory. The strength of this theory is its ability to help simulate how shocks, shifts or changes in the economy can affect the economy from a spatial perspective. This effect takes place as producers, retailers and service providers from each hierarchy interact with one another in a vertical and horizontal manner. Horizontally, they interact with activities at the same hierarchy or size. Vertically, they interact with activities at the smaller and larger sizes or lower and higher hierarchies.

However, as discussed earlier, this theory is based on a very strict assumption of an even distribution of opportunities in a homogeneous place, which is contradictory to the fact that people tend to cluster in areas where more facilities and amenities are available. One way to overcome this possible drawback is to relax this assumption and to adjust the system of hierarchy with possible variations in opportunities along the homogeneous plane. Despite this drawback, it is important to recognize the fact that Christaller and Losch provide an answer to how economies of scale and transport costs interact in determining the spatial structure of an economy.

Another possible drawback of Central Place theory, according to Krugman et al (2000), is its failure to explain how individual actions also play an important role in causing the hierarchy and how this hierarchy is sustained once created. The theory fails to acknowledge the fact that dynamisms in the economy may emerge from the actions of economic agents. Krugman et al (2000) suggest the use of Central Place theory as a classification scheme and a way to organize perceptions and data, but warn against using this theory as an explanation of the economy's spatial structure.

2.3 Major Works on Spatial Economics in the 1950s and 1960s - The Classical Location Theories

This section will mostly be focused on Isard's (1956) seminal work on general theories of location and his disciple Alonso's (1964) work on urban land use. Both these works were path-breaking in regional science. They successfully assembled previously scattered theories and studies.

2.3.1 Empirical Regularities in Space-Economy

Isard investigated empirical regularities in the spatial economy as a justification for the need to develop location theory. Isard also refers to Losch (1933) and Christaller (1938) where as one proceeds from smaller to larger class sizes of cities, the distance separating cities of like class size increases, although with considerable variation around an average.

Isard (1956) refers to Zipf (1949), who conducts a study on the association between city size and the market area complex. Zipf used a graph that plotted the weight of shipments between any pair of cities and the corresponding P_1P_2/D (P_1 and P_2 represent population of two given cities and *D* represents distance) distance factor. Zipf found a definite inverse relationship between tonnage of railway cargo and distance. Stewart (1950) used Newtonian physics in observing the relationship between volume of trade and spatial distance. Stewart's theory was that the demographic (gravitational) force F of attraction between two groups of N_1 and N_2 average Americans separated by *r* distance is given by $F = N_1N_2/r^2$ where F acts along the line joining the two groups. Stewart's theory is also known as the gravity model.

According to Stewart, the "gravity potential energy" that a group of N_1 individuals exerts on the location where the second group is located is given by $V_2 = GN_1/r$ where G is a constant that determines the demographic energy when multiplied by N_1N_2/r. The term "gravity potential energy" refers to the influence that one area has over the other area. When referring to the influence one area has over a certain region, Stewart used the equation $V = \int \frac{1}{r} DdS$ where D refers to the density of the population over area, *dS.* The integral in this equation covers all the points within the region where the density of the population is not zero. According to Stewart, the influence that one area has over a certain region is also an inverse measure of the area's proximity to the total population. In other words, this influence over a certain region also indicates how accessible the location is, relative to other locations. Accessibility is discussed in detail in a later section.

The empirical regularities present in Zipf and Stewart's findings led Isard (1956) to the conclusion that the friction of distance is present and affects the spatial structure of an economy. Therefore, transport infrastructure plays an important role in altering such a structure. Isard incorporated transport into his model by treating transport as a production input. The transport input is seen as a derived input obtained from the service of the basic production inputs, which are labor and land. In other words, the producer has to choose between allocating the labor and land inputs for transportation or for cultivation. Thus, any decision to produce within a greater distance from the market implies that the producer anticipates greater returns. A greater return is obtained as the investment in labor and land inputs for transportation of products is offset by the savings in transportation cost[3]. In Isard's model, the transport input is seen as an indirect labor input that is a substitute of the direct labor input.

2.3.2 Transportation Input and Agglomeration Economies

Isard (1956) simulated a condition where a firm is faced with more than one point of raw materials or input source and market points. This simulation shows the problem where a firm has to substitute a closer distance to one input source at the expense of longer distance to the other input source. If the firm decides to locate near the market, the firm also has to substitute closer distance to market at the expense of longer distance to raw material sources. The main objective of this simulation is to find the location that

[3] There is trade-off between the investment in labor or land inputs for transport and the labor or land inputs for product cultivation.

minimizes the overall transport costs. Transportation cost is a function of distance and mass of the inputs or finished products.

It is important to note the elasticity of transport cost to distance, whereby the increase in transport cost from zero distance to a distance slightly more than zero (i.e. from 0km to 0.1km) is significantly higher compared to the increase in transportation cost from distance more than zero to a slightly longer distance (i.e. from 1km to 1.1km). Because of the elasticity of transportation cost to distance, Isard argued that the most efficient location is located in the corner of the polygon rather than the middle because it is always more efficient to have one of the inputs or outputs free of transport costs.

Isard (1956) also found that transport costs are the most important determinant of spatial structure. This finding was based on the analysis of relationship between three locational factors and the distance of settlements. The three locational factors are transportation and transfer costs, labor, utilities and financial service costs and factors that give rise to agglomeration and deglomeration. He found that only transport and transfer costs have regular variation with the distance of settlements, while the other two locational factors do not have any regular variation. This shows that transport costs are the main determinant in the formation of an economy's spatial structure.

Nevertheless, this does not necessarily imply that agglomeration economies have no influence on the spatial structure of an economy. Isard explains how despite the lack of regular variation between spatial structure and the agglomeration economies, the factors of agglomeration can influence spatial structure. Hoover (1937) classified agglomeration factors into three categories, which are large-scale economies, localization economies and urbanization economies. Isard explains the relationship between the factors of agglomeration and the creation of spatial structure. According to Isard, the relationship between large-scale economies as an aglomeration factor and the spatial structure of an economy, can be explained with reference to Losch's (1938) hexagonal market area theory. Isard refers to the case of two different commodities with different marginal costs. The marginal cost of one of the commodities may increase sufficiently to allow for the division of market while the other commodity may have economies of scale extended over much larger range of products. In this case, for the commodity with economies of scale extended over much larger range of products, if the market area is enlarged, the gain in revenue outweighs the loss from incurring higher transportation costs. In contrast, the commodity with significant increase in marginal cost cannot have a larger market area since transport costs are higher. Therefore, a hierarchy of small and larger markets are created through a system of economies of scale, which conforms to Losch's theory of market area hierarchy.

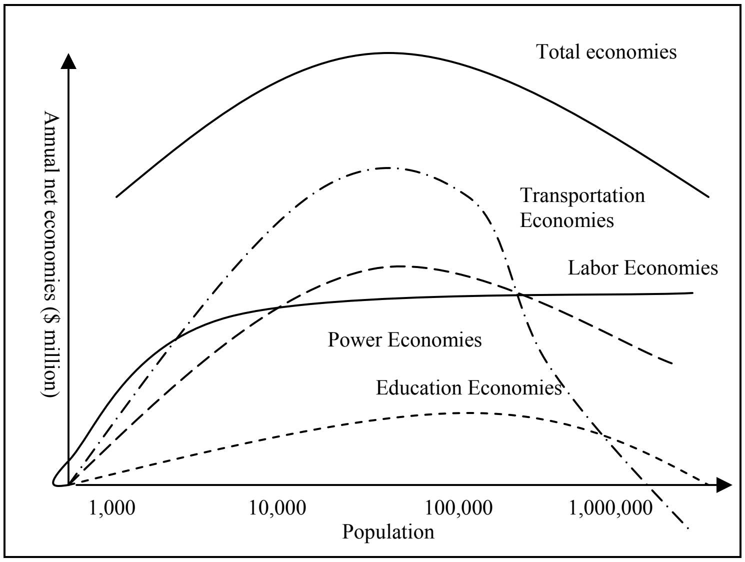
Isard refers to Weber's (1909) theory on the reasons behind clustering of several firms or units, in explaining the relationship between localization economies and spatial structure. Weber sees the intersection of critical isodapanes' between two or more firms as the condition for clustering. However, it is important that when clustered together, the unit can produce the requisite quantity in serving the combined market area efficiently. An isodapane consists of points of equal transport costs from the point of distribution. The critical isodapane is reached when savings in labor cost are just off-set by the increased transport costs (Pinto, 1977). When agglomeration takes place through clustering, the benefit of agglomeration economies that the firm gets is equivalent to the extra profit gained from serving the market beyond the critical isodapane.

According to Weber (1909), when two or more production activities have intersecting critical isodapanes, there lies a point where one larger unit of production can cover more than one of the production activities' market areas. The point should have the lowest transport costs in relation to the total agglomerated output. However, Isard sees a possible weakness to Weber's approach. Weber fails to explain the possible reluctance of firms to move to a new location, especially when the plants are already constructed. The significant opportunity costs in moving to a new location may create a strong bargaining power for existing plants so that new firms cluster around these existing plants. In addition, Isard argues that each production activity is reluctant to locate far away from its own optimum transport point. Thus, firms with greater bargaining power would be able to maintain their optimum transport point while those with less bargaining power would be forced to relocate near firms with greater bargaining power. However, Isard admits that Weber's theory may be relevant for new development areas such as government-induced local actions, since bargaining power and existing preference of locations are not issues and can be altered through the government's intervention. It is also important to note that transportation cost may not in all cases be an overriding factor for locational consideration, particularly when considering the contribution of transportation cost to the total cost that may vary from product to product.

Hoover's (1937) third classification of agglomeration category, urbanization economies, involves the presence of localization economies or diseconomies. These localization economies or diseconomies include the larger pool of skilled labor, higher utilization of specialized and auxiliary industrial and repair facilities and large-scale buying and selling through brokers. Isard sees urbanization economies as playing a significant role in determining the spatial structure. The localization economies encourage higher concentration or clustering of activities. However, localization diseconomies such as higher costs of living costs and congestions may limit the clustering of activities.

Weber's isodapane approach can be used to explain how localization diseconomies and economies can influence the spatial structure. According to Isard, the use of isodapane is especially useful for development of new areas. Given the full knowledge of existing technology and possible changes to the technology, planners have an opportunity to plan the area based on the optimal spatial distribution and the hierarchy of cities with different sizes. However, isodapanes can also be used in existing land use if the objective is to alter the channels in the structure of the network to attain a situation closer to the optimum. Isard (1956) draws a graph that summarizes the economies and diseconomies in urban economic activities. This graph also shows the optimum urban population size for the respective economic activities to have efficient and feasible operations. Figure 2.1 shows Isard's graph. Based on figure 2.1, the average optimum city size for all the urban economic activities is about 100,000 people. A later study by Fuguitt and Zuiches (1975) discovers that most of the residents living in rural areas prefer to be within 30 miles of a city over 50,000, which shows that the 100,000 people optimum city size standard in 1950 remains relevantly high if compared to the standard in the later years.

Figure 2.1. Economies of Scale for Urban Activities



Source: (Isard, 1956, p.187)

2.3.3 Agricultural Location Theory

Isard (1956) also deals with agricultural location theory. He argued that rent differentials have always played an important role in determining the location of agricultural activities. However, the location theories for agricultural activities and industrial activities are still similar with regard to the trade-off between labor costs and transport costs. The only significant difference is the fact that agriculture producers are small in size and their markets are concentrated at particular points. Such a condition allows deeper locational analysis.

Isard's disciple, Alonso (1964), focused on the agricultural location model. Alonso's model features a single market for selling agricultural products and the land around the market are assumed to have similar potential for cropping. The model introduced the concept of bid rent whereby the more distant the land is from the market, the lesser is the bid rent as the producer has to incur more transportation cost. The amount of bid rent will be limited to the difference between the market price and the total production and distribution cost. The competition among farmers will bring the bid rent to the level where farmers earn only normal profit (compensation for labor). The formula for rent at any location is:

$$P_c(t) = N\left[P_c - C - K_c(t)\right] \tag{2.1}$$

Where $P_c(t)$ is the rent per unit of land at a distance t from the market, N is the number of units of crop produced per unit of land (land productivity), P_c is the price per unit of the crop, C is the cost of production for one unit of the crop and $K_c(t)$ is the cost of transporting one unit of crop from distance t to the market.

The total production of the crop is:

$$\text{Total production} = N \times S(te) \tag{2.2}$$

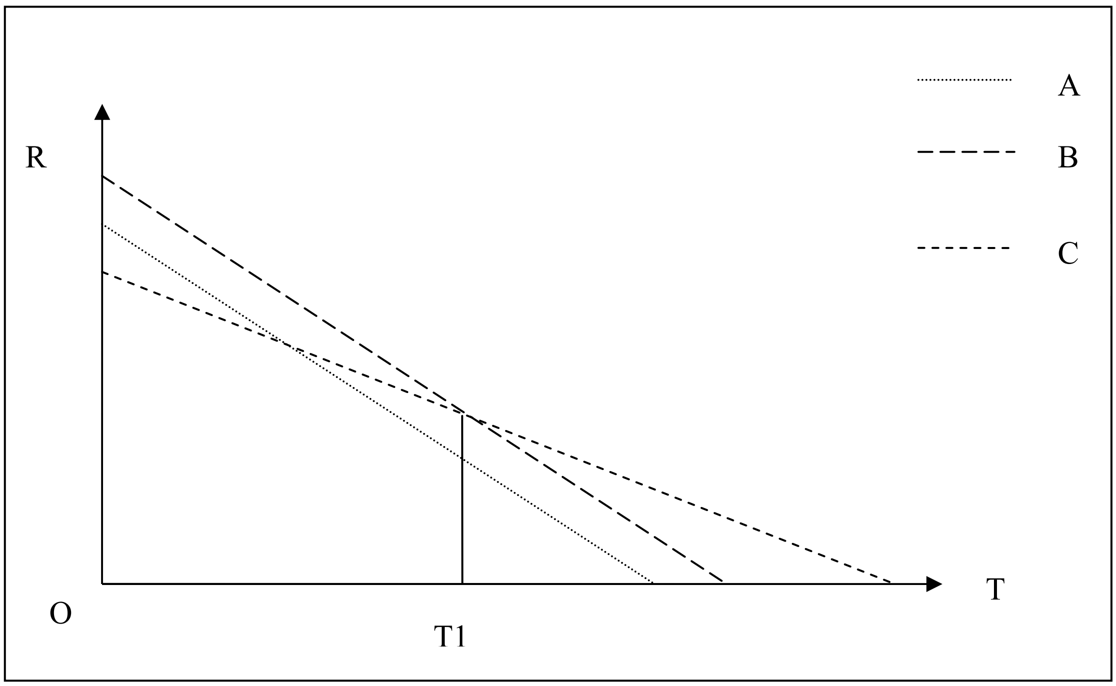
where *te* is the most distant location at which the crop is grown and *S(te)* is how much land bounded by a circle of radius *te* around the market.

Through the concept of total production using a circular area, the mechanism of spatial extension of agriculture can be understood. When production of crops exceeds the demand in the market, price will decrease. Thus, the bid rent will also decrease causing the farthest distant of crop production to move closer to the market to compensate for the lower bid rent.

This system is based on the landlord and farmer relationship where farmers set aside some of their profit as rent for the landlord. Thus, farmers are indifferent to the location as long as the rent reflects the fair costs involved in production and transport of products given that the land is a featureless plain and the time concept is not yet incorporated in this model.

This model can be developed further to include more than one agricultural commodity. In this case, the bid rent function for each commodity is assumed to be different in terms of gradient or slope and thus, there will be a point where one commodity can bid for a higher rent. Thus, assuming that there are two commodities, the area where the first commodity can bid for a higher rent than the second commodity shows the area of the first commodity's successful bid or second commodity's unsuccessful bid.

Figure 2.2. Alonso's bid rent curve



Source: The author of this thesis' modification of Alonso (1964) bid rent curve

The area where the second commodity can bid a higher rent than the first commodity shows the area of the second commodity's successful bid or the first commodity's unsuccessful bid. When the highest bidders are taken together, the actual rent structure is formed.

Figure 2.2 looks at a three-commodities model. Alonso interprets von Thunen's (1826) model in such a way that the commodities have different rent on certain land. Alonso's interpretation shows the existence of a point where one commodity that was outbid in a location nearer to the market will be able to outbid the other at a farther distance. However in this figure, there will be a commodity that is unable to become the highest bidder. Commodity B is the highest bidder from point O to point T1. Thereafter, commodity C becomes the highest bidder until the maximum or farthest T. Thus, commodity A is never the highest bidder anywhere even at its maximum or farthest distance where farmers can cultivate the crop at zero rent. This may lead to an outcome where commodity A will not be produced in the economy.

However, the scarcity of commodity A will lead to pressure for a higher price in the market that will lead to the higher rent curve for commodity A as shown in an upward shift of commodity A's bid rent curve. This will alter the rent structure. This process may continue until the market is relatively stable or where changes in the price will not induce farmers to alter their location.

2.3.4 Urban Location Model

Alonso (1964) continued his agricultural rent model development by adapting it to urban location decisions. Alonso cited Chamberlin (1950) with regard to the difference between the farmers and the retailers in terms of locational decision. Farmers bid for productive ability whereas retailers bid for selling ability. In other words, farmers are more concerned with land and farm input availability, while retailers prefer locations that can give them the most access to potential buyers.

If under the assumption of land being a featureless plain, farmers are indifferent to locations as far as rents are concerned, retailers are not. The selling ability of land is considerably different from the production ability of land. The proximity to the center of a market plays a more important role in the firm's selling ability. However, this view contradicts the earlier discussion on land bid rent where agricultural activities also bid for a location nearer to the market center. It is important to note that under the agricultural bid rent model, taking the example of commodities B and C, if commodity B is outbid by commodity C in a location nearer to the market, there is still a possibility that commodity B can outbid commodity C in a location farther from the market. This is because different commodities have different profile of costs. For commodity C, the need to locate nearer to the market is higher and this leads to a higher price for the commodity to compensate for the higher bid rent. In contrast, commodity B may need to have larger areas and thus, locating nearer to the market is less important. Thus, farmers do not bid just for locating nearer to the market, but also for a certain land size to facilitate production. In the case of retailers, locating farther from the market center will sacrifice the potential sales.

Isard (1956) simulated a condition where an urban business faces a trade-off between savings in expenditures for rent and the revenue potential. Alonso (1964) cited Isard (1956) with reference to the determining factors in the urban business rent decision. The determining factors are the effective distance from the core area, the accessibility of the site to potential customers, the number of competitors, the intensity of competition for sales and the proximity to supporting business services. Under a monocentric city model with population concentrated in the CBD area, the more distant the firm locates from the CBD, the less accessible the firm is from potential customers.

Under a model of city with scattered population and varying density, each firm's unique location may lead to a certain degree of monopoly power. Alonso modeled the urban businesses in a similar manner as residential households. The urban business is faced with the given structure of prices for land according to distance in which it will decide on the location and the lot size that yields the greatest possible profits.

$$G = V - C - R \qquad (2.3)$$

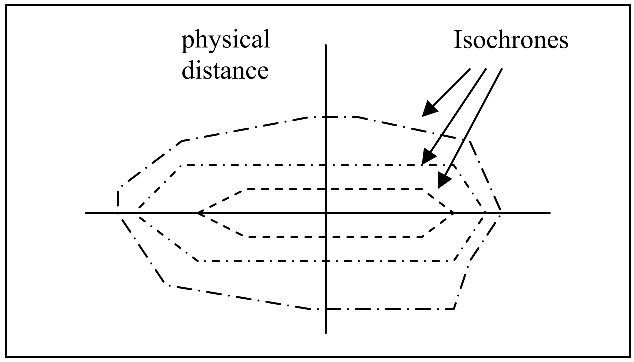
Where *G* represents profits, *V* represents volume of business, *C* represents operating costs and *R* represents land costs. The volume of business (*V*) will depend on the location (*t*) and the lot-size (*q*). The operating cost (*C*) will depend on the location (*t*) in terms of distance from warehousing or transportation terminals, the lot-size (*q*) and the volume of business (*V*). The rent will be the lot size (*q*) times the rent rate (*P*). Thus, we have:

$$G = V(t,q) - C(V(t,q),t,q) - P_q \qquad (2.4)$$

To solve this equation, Alonso combined diagrammatic with mathematical methods. This method allows simultaneous solution of the variables by using differential calculus. For the retailer, location will affect business volume and thus the partial derivative of V with respect to distance will be negative. In the case of the manufacturer, the business volume is not affected by distance. Thus, the partial derivative of V with respect to distance is zero. There are separate solutions for the locational equation and for the size of site equation.

Another important finding by Alonso (1964) was about city shape, in which cities emerge not just in the form of concentric rings. Cities can also emerge in other shapes through the use of isochrones. These isochrones are drawn based on the travel distance and the rent patterns. The use of isochrones provides closer approximations of the reality in urban and regional modeling (refer to Figure 2.3 for illustration).

Figure 2.3 - Isochrones



Source: Alonso (1964)

2.4 Major Works on Spatial Economics after the Classical Location Theories: Modern Regional Economics

This section discusses a wide range of studies conducted after the 1960s. Economists have further developed the original and classical locational theories. The new studies include Krugman et al (2000), Fujita (1989), Fujita and Thisse (2002) and Henderson (1974). Most of the modern works, particularly those by Fujita (1989) and Krugman et al (2000), focus on mathematical modeling of the regional economy from the perspective of consumer utility.

2.4.1 Fujita's Model of Urban Economics and Agglomeration

Fujita (1989) presented the basic theory of urban land use and city size in a microeconomic framework using mathematical tools that incorporate the bid-rent approach. The model assumes individuals or households to be utility-oriented with consumption of goods and housing being constrained by income and transportation costs. The model is further extended for various conditions. These include the trade-off between space for living and accessibility to work, the time cost of commuting in terms of leisure time being forsaken, the application of Herbert Stevens' model to find the optimum land use pattern, the use of exogenous parameters such as population, transport costs and income to equilibrium land use changes and how capital intensity on land varies with distance from the city center.

Fujita and Thisse (2002) studied the economics of agglomeration by using mathematical models. Among the conditions included in the model is the competition among land developers that allows for the decentralization of efficient allocation of public goods when the economic agents are identical in preferences and incomes. Thus, a competitive land market is a pre-condition for an efficient allocation of resources in a space-economy. By studying clustering of firms in the cities, Fujita and Thisse (2002) also found that product differentiation reduces price competition and allows firms to attract more consumers as compared to when they choose to stand alone.

2.4.2 The Henderson Study on Urban Systems

Henderson (1974) made an important contribution to the study of urban economics. He focused his idea on the tension between external economies of scale associated with geographic concentration of industry within a city and the diseconomies such as commuting costs associated with large cities. This tension would result in an inverted U-shaped graph when the size of a city is plotted against the utility of a representative resident. However, Henderson himself acknowledges the fact that his argument may not be easily applicable in the actual system of cities due to the fact that many cities tend to be already at optimal size. Thus, his work focuses instead on altering the model to understand multiple sizes of cities.

In reality, there are large cities that may have gone beyond their economic size. Despite the fact that their size has led to diminishing utility, residents in the large cities still have no incentive to move to a new location. This lack of incentive is due to the fact that any existing large cities would still give higher level of welfare than a new location with less amenities. Henderson argues that this situation is a vicious cycle that can only be broken by involving forward-looking large land development agents. These agents capitalize on the profit opportunity arising from the existence of too few cities with excessive sizes by organizing "city corporations". These "city corporations" move a number of people to a new city of optimal size and earn profit from possibly higher land prices. According to Krugman et al (2000), in the United States, major private developers have been playing a significant role in the urban growth in this way.

In explaining the existence of varying city sizes, Henderson argued that external economies of scale tend to be specific to particular industries but diseconomies tend to depend on the overall size of a city, regardless of whatever it produces. Thus, as there are diseconomies to the city size, there is no economic justification to locate more than one industry without mutual spillovers in the same city. Industries that have low linkages between each other or share no similar outputs should not be located in the same area. This is because the benefit of their co-existence is outweighed by the diseconomies arising from their co-existence that may result from congestion and higher land-rent as well as wages and utility costs. This situation would force a city to specialize in a particular industry or few industries that have external economies of scale, and make these industries the "export" industries. The "export" industries serve as the local economic base, which is expected to generate a multiplier effect on the local economy.

Henderson also explains the differing extent to which external economies of scale takes place across different industries. Krugman et al (2000) illustrate Henderson's (1974) idea with examples of a textile company and a banking center. In the case of a textile company, it makes no economic sense to include more than a handful of mills. However, in the case of a banking center, it will be best if it contains practically all of the financial businesses that take place in the country. This difference in economies of scale thus leads to the varying sizes of cities, and explains Henderson's argument that the optimal size of a city depends on its industrial role. Eventually, all residents in different cities will possess similar utility levels, but the size of cities will vary depending on the role of the cities.

Krugman et al (2000) criticize Henderson because Henderson's argument on the emergence of new cities relies heavily on the role of large scale developers. This heavy reliance gives less emphasis on the invisible hand that has played an important role in the emergence of big spatial structures such as metropolitan areas, regions or even nations. Krugman et al also argue that Henderson's approach is non-spatial. This is because Henderson does not explain the internal structure of cities, although one can assume that the activities which have externalities must be concentrated in the central business district. There is also no explanation on where cities themselves are located relative to each other.

Another important attempt to describe the urban systems is the work of Fujita and Ogawa (1982). Fujita and Ogawa assume external economies of scale between producers that decline with distance. The external economies of scale provide the centripetal force that pulls employment into a concentrated district. However, workers require living space and must commute to the district. This creates a von Thunen-type trade-off between commuting costs and land rent that further creates a centrifugal force. Therefore, businesses can attract workers at lower wages by locating in low-rent locations nearer to where these workers reside. This is important in explaining the actual formation of cities as they do not only come in monocentric structure. Instead, cities can take the form of a polycentric structure.

2.4.3 Spatial Version of Dixit-Stiglitz Monopolistic Competition Model

Krugman et al (2000) develop a spatial version of the Dixit-Stiglitz (1977) monopolistic competition model, which involves multiple locations with transport costs between the locations. The model is based on a two-sector economy, which includes the perfectly competitive agricultural sector producing a homogeneous product and the imperfectly competitive manufacturing sector with increasing-returns producing highly differentiated products. The consumers in the economy have a Cobb-Douglas utility function for the two types of goods (agricultural and manufacturing) as follows:

$$U = M^{\mu} A^{1-\mu} \tag{2.5}$$

where *M* represents the composite index of consumption of manufactured goods, *A* is the consumption of agricultural goods and μ is a constant representing the expenditure share of manufactured goods. *M* itself is a sub-function of *m(i)*, which is a function of consumption of each available variety of manufactured goods. In *m(i)* function, the range of varieties produced is denoted by *n* and *M* is defined by a constant-elasticity-substitution (CES) function as follows:

$$M = \left[\int_0^n m(i)^{\rho} \, di \right]^{1/\rho} \qquad , \mathbf{0} < \rho < 1 \tag{2.6}$$

In this function, the parameter ρ represents the intensity of preference for variety in manufactured goods. When ρ is close to 1, the differentiated goods are nearly perfect substitutes of each other. If ρ is close to 0, the desire to consume a greater variety of manufactured goods increases. Thus, this function shows the degree of consumption that affects the demand for manufactured goods. If $\sigma = 1/(1-\rho)$, then σ is the elasticity of substitution between any two varieties.

Thus, this model focuses on the maximization of consumer utility subject to the budget constraint as follows:

$$p^A + \int_0^n p(i) m(i) \, di = Y \tag{2.7}$$

where p^A represents the price of the agricultural good and $p(i)$ represents the price of each manufactured good.

With respect to manufactured goods, the minimization of cost is done for each variety of good such that:

$$\min \int_0^n p(i) m(i) \, di \quad \text{s.t} \quad \left[\int_0^n m(i)^{\rho} \, di \right]^{1/\rho} = M \tag{2.8}$$

From the first order derivative of the expenditure minimization problem using pair of goods i and j, we find the following marginal rates of substitution to price ratios:

$$\frac{m(i)^{\rho-1}}{m(j)^{\rho-1}} = \frac{p(i)}{p(j)}, \tag{2.9}$$

By substituting equation 2.9 in equation 2.6 and by multiplying the right hand side of the equation by *M*, Krugman et al (2000) get equation 2.9. In the right hand side of the equation, *M* is the quantity demanded. Thus, the right hand side of equation 2.9 is the multiplication of price index and the quantity, which gives the expenditure, which is denoted as G in the left hand side of the equation.

$$G = \left[\int_0^n p(i)^{\rho/(\rho-1)} di \right]^{(\rho-1)/\rho} = \left[\int_0^n p(i)^{1-\sigma} di \right]^{1/(1-\sigma)} \tag{2.9a}$$

where ρ=(σ-1)/ σ or σ=(1/(1- ρ). The price index G measures the minimum cost of purchasing a unit of the composite index *M* of manufacturing goods. Equation 2.9 is an expenditure function.

After finding the equation for the price index of manufactured goods, the next step is to find the combination of consumption of agricultural and manufactured goods that maximizes utility and is constrained by the income. This function is expressed as equation 2.10.

$$\max \ U = M^{\mu} A^{1-\mu} \text{ s.t } \ GM + p^A A = Y \tag{2.10}$$

From this equation we can obtain the consumer's demand function for the agricultural goods, which is:

$$A = (1 - \mu) Y / p^A \tag{2.11}$$

and for each variety of manufactured goods:

$$m(j) = \mu \mathrm{Y} \frac{p(j)^{-\sigma}}{G^{-(\sigma-1)}} \text{ for } j \in [0, n] \tag{2.12}$$

As a function of income, the price of agricultural product and the manufacturers' price index, the maximized utility of the consumer can be expressed as follows:

$$U = \mu^{\mu}(1-\mu)^{1-\mu} YG^{-\mu}(p^{A})^{-(1-\mu)} \qquad (2.13)$$

Therefore, from the spatial version of the Dixit-Stiglitz monopolistic competition model, we can identify the impact of consumers' product variety preferences and manufacturers' variety of supply activities. The balance between the demand for agricultural and manufactured goods will determine the pattern of spatial activities in the region. Assuming that manufactured goods are produced in the core area and agricultural goods are produced in the periphery, we can find the interaction between the core and the periphery from this spatial version of Dixit-Stigliz monopolistic competition model.

Krugman et al (2000) discuss the iceberg transport technology[4] involved in multiple locations and transport cost so that the need to model separate transport industry can be avoided. If a unit of good is shipped from location *r* to another location *s*, under the iceberg technology approach, only a fraction $1 / T_{rs}^{A/M}$ of the original unit actually arrives while the rest "melts" away during the journey. Thus $T_{rs}^{A/M}$ represents the amount of goods dispatched per unit received.

For a manufactured good which is produced at location *r* and sold at price p_{r}^{M}, the delivered (c.i.f) price p_{rs}^{M} at consumption location s is given by:

[4] This model uses an iceberg as a metaphor for transport cost. As the iceberg melts along the journey, the iceberg transport technology expresses transport cost as a sacrifice in the product amount. This reduces the number of variables in the model because the transport cost is expressed as the sacrificed amount of products for transport.

$$p_{rs}^{M} = p_{r}^{M} T_{rs}^{M} \tag{2.14}$$

By adjusting the price index (G) equation with the iceberg transport technology, the consumption demand for location *s* for a product produced in *r* can be expressed as follows:

$$\mu Y_s (p_r^M T_{rs}^M)^{-\sigma} G_s^{(\sigma-1)} \tag{2.15}$$

where Y_s is the income for location s. 2.15 shows the level of consumption, but for obtaining the quantity delivered, this has to be multiplied by the function $T_{rs}^{A/M}$**.** Thus, it is clear that sales depend on income and the price index in each location as well as on the transport costs and the factory or farm price of the products.

2.5. The Economic Base Model and the Multiplier

The multiplier effect of an economic base is particularly important in analyzing the role of an economic sector in promoting urban growth. The dominance of an economic sector that acts as an economic base for a region is not seen merely from its quantitative contribution to the economy, but also from how it facilitates the creation of other economic sectors both directly and indirectly. This employment multiplier effect leads to the diversification of an urban economy. According to Davis (1990), the employment multiplier is associated with a particular regional stimulus designed to yield and estimates the total employment attributable to the stimulus per job or man-year of employment directly created.

Isard (1960) defines the multiplier to be equal to the total (or increase in) employment in both basic and service activities divided by total (or increase in) basic employment. Regional development can be modeled using the economic base multiplier approach. In this approach, the components of the multipliers and the role of these components determine the structure of an economy.

Total Employment (T) = Basic Employment (B) + Nonbasic Employment (N) (2.16)

Basic employment involves activities such as export (including export services and tourism), investments in housing or businesses, government expenditures for investment, operation and transfer payments. These activities are considered to be exogenous to the model. The non-basic employment is local service oriented activities that is induced by the basic employment activities. The non-basic employment is endogenous to the model. Krumme (2002) has three models of the multiplier effect. The first is the non-basic employment (NE) generated by basic employment (BE):

$$T = B + N \longrightarrow \frac{T}{B} = \frac{B+N}{B} \longrightarrow T = \frac{B(B+N)}{B}$$

$$T = B\frac{T}{B} \longrightarrow MultiplierEffect = B\frac{T}{B} - B \rightarrow M1 = \frac{T}{B} \tag{2.17}$$

The second formulation defines the multiplier as the basic employment (BE) multiplied by non-basic employment per basic employee:

$$\frac{T}{B} = \frac{\frac{T}{B}}{\frac{B}{T}} = \frac{1}{\frac{T-N}{T}} = \frac{1}{\frac{T}{T} - \frac{N}{T}} = \frac{1}{1-\frac{N}{T}}$$

$$M2 = \frac{1}{1-\frac{N}{T}} \tag{2.18}$$

where the denominator of this multiplier is the leakage coefficient in which the larger the coefficient, the smaller the multiplier. N/T is the retention coefficient, which is:

$$N/T = plc \; x \;\; iclcs \qquad (2.19)$$

where *plc* is the propensity to consume locally and *iclcs* is the income generated per local consumption dollar.

The third formulation defines the multiplier as basic employment multiplied by the multiplier minus basic employment:

$$T = B + ME \longrightarrow T = B + B\frac{N}{B} \longrightarrow T = B(1+\frac{N}{B}) \qquad ME = B\frac{N}{B}$$

$$M3 = (1+\frac{N}{B}) \qquad (2.20)$$

This formulation places a heavy emphasis on the *N/B* ratio in determining the multiplier effect. However, the above methods simply focus on how to find the size of multiplier in a region by using the available economic data on employment. What is more important is to find the factors that can lead to a higher multiplier. According to Tiebout (1963), there are several factors that affect the size of the multiplier. These include the size of a region by population, income and area, degree of geographic isolation, transport and communication costs for exports and imports, specialization and the economic structure of the region, social and economic attributes, time-horizon, local protectionism and "import substitution policies" and the community power structure.

With regard to the size of the region, while holding other things equal (*ceteris paribus*), Tiebout sees that the larger the region, the larger the expected multiplier. This is because more of the imports ("leakages") would become intra-regional transactions. With more activities expected to reach their threshold level, sufficient demand within the region would increase the operational viability and thus, less goods and services have to be imported into the region. The larger percentage of expenditure staying in the region leads to further linkages and these will induce other income generating activities in the region.

With regard to degree of geographic isolation and transport and communication costs for exports and imports, Tiebout argues that the higher the degree of isolation or transport and communication costs, the higher the propensity to consume locally and thus, the higher the income created per dollar of local consumption sales. In terms of specialization and economic structure of the region, having strong comparative advantage in the export sector may lead to non-competitiveness of some non-basic activities for local factors of production such as land and labor, which leads to more consumption of imported goods and services than if there is a weak comparative advantage that leads to higher self-sufficiency and thus, a higher multiplier.

As indicated earlier, the other factors influencing the multiplier include socio-economic attributes, time horizon, local protectionist and import-substitution policies and community power structure that affect the economic structure of the community. However, it is interesting to observe that regions are, in fact, trying to break their isolation, focusing on comparative advantage and refraining from local protectionist policies. This trend contradicts Tiebout's argument. Despite the higher competition for available labor caused by the comparative advantage, it is important to take into account the in-migration from nearby areas as this may neutralize the crowding-out effect. Having a high degree of isolation and refraining from inter-regional trade to contain the spending of income in the local economy may not be feasible as this leads to inefficient allocation of resources. Thus, strengthening of the economic structure and facilitating stronger intra-regional linkages may be crucial in improving the magnitude of the multiplier.

2.6. The Concept of Accessibility

One of the main objectives of this research is to examine how a rural economy is able to evolve into an urban economy through improvements in accessibility. Thus, it is pertinent that the concept and measurement of accessibility be clarified in the theoretical framework. According to Rodrigue (2004), accessibility can be defined as the degree of mobility. Mobility can be expressed in terms of people, freight or even information. The relationship between transport amenities and accessibility is undoubtedly positive when impacts of congestion are not taken into account. Therefore, the adequate provision of transport infrastructure is central to the accessibility of an area.

According to Rodrigue, when an area is considered more accessible than others, the factors that are usually considered are location and distance. Location is a relative position that is estimated in relation to the transport infrastructure. Distance is measured with respect to the connectivity between locations where connectivity can only exist in the presence of transport. Distance is conventionally expressed in units such as in kilometers or in time and cost of travel.

Rodrigue categorizes accessibility into two main types, which are topological accessibility and contiguous accessibility. The first one is related to measuring accessibility in a system of nodes and paths (a transport network), assuming that accessibility is a measurable attribute that is significant only with reference to specific elements of the transport system such as terminals, airports, sea port or station. The second type is contiguous accessibility that involves measuring accessibility over a surface, assuming that accessibility is a measurable attribute of every location. Accessibility is a good indicator for the underlying spatial structure as it considers both the location and the inequality arising from distance to other locations.

Rodrigue uses network connectivity as a basic measurement of accessibility. This involves using a matrix that expresses the connectivity of each node with its adjacent node in the network. The number of columns and rows in the matrix represents the number of nodes in the network, and the value of 1 is assigned to the cell when the pair of node that is not connected by transport network and the value of 0 if otherwise. The values of the cells are summed to provide the basic measure of accessibility in the network that can be called the degree of the node.

However, the above methods exclude the possibilities for indirect paths between the nodes. Thus, to include the direct as well as indirect paths between the nodes in the network, the total accessibility matrix is used. By calculating the total paths in the network, the matrix can provide a more comprehensive accessibility measurement as compared to the network connectivity.

Going beyond merely calculating the number of available paths in the network, Rodrigue proposed that accessibility be measured by the shortest paths between the nodes. The Shimbel index is a measurement of accessibility that calculates the minimum number of paths necessary to connect one node with all the nodes in the network, in which the D-matrix is used to express the shortest path between each node. However, both the Shimbel index and the D-matrix fail to incorporate the notion of physical distance. To overcome this problem, the valued graph matrix or L-matrix can be used so that instead of the minimum path in each cell, the minimum distance is used to measure connectivity.

From the above measurements, accessibility boils down to two practical measures, which are geographical accessibility and potential accessibility. Geographical accessibility is a summation of all distances between other locations that takes into account the number of locations. The lower the sum of distances, the more accessible is the location. This can be measured using a combination of the Shimbel Index and the L-Matrix (Rodrigue, 2004) represented by *A(G)* (geographical accessibility matrix) as:

$$A(G) = \sum_{i}^{n} \left(\sum_{j}^{n} d_{ij} \right) \Big/ n$$
$$d_{ij} = L \qquad 2.21$$

where d_{ij} is the shortest path of distance between location i and j, n is the number of locations and L is the valued graph matrix.

Potential accessibility (Rodrigue, 2004) is relatively more complex to measure as compared to the geographical accessibility, as it simultaneously considers the distance weighted by the attributes of the place as all places are not equal.

Some places are more important than others. Potential accessibility can be measured as follows:

$$A(P) = \sum_{i}^{n} P_i + \sum_{j}^{n} P_j / d_{ij} \qquad 2.22$$

Where *A(P)* is the potential accessibility matrix, d_{ij} is the distance between place i and j, P_j is the attributes of place j, such as its population, fertile land surface and n is the number of places. The value of this matrix reflects the emissiveness and attractiveness and it is non-transposable. The emissiveness is the capacity to leave a location as indicated by the summation of values in the row of the *A(P)* matrix, and the attractiveness refers to the capacity to reach a location as indicated by the summation of values in the column of the *A(P)* matrix.

CHAPTER 3
LITERATURE REVIEW OF EMPIRICAL STUDIES

3.1. Introduction

This chapter discusses the findings from recent studies on secondary urban area or small urban center development. The previous chapter discussed basic theories of regional and urban economics and identified the mechanisms that are important in the emergence of an urban area. The literature review in this chapter is directed towards understanding the challenges and prospects of the development of new urban areas, specifically of the development of secondary urban areas or small urban centers or rural towns. From now on, we will use the term small urban center.

The initiative to develop small urban centers in improving rural-urban linkages has been discussed since the late 1980s. This initiative was inspired by the limited nature of the traditional perspective in regional planning that has led to a fragmented approach in rural and urban policy making. Rural areas are generally seen as the laggards in economic development. Hodge and Monk (2004) question such common perception in England's policy making in the rural areas that associates rural areas with economic decline, low incomes and lack of services. They argue that one cannot generalize about the rural areas as there are differences among the areas currently grouped as "rural". There are certain circumstances where some rural areas can be grouped with urban areas and this depends on an area's specific characteristics.

Hoggart (1990) has a similar view as he criticizes regional planners and scholars for the lack of theorization about the structural differences across rural areas. This view contradicts the common perception among economists that rural areas are simply economically inferior compared to urban areas. It suggests that some rural areas may in fact have stronger economic activities compared to some urban areas. This will be largely determined by the rural-urban linkages with respect to the economic structure of the rural area.

The idea of a rural area being economically superior to an urban area may sound peculiar. However, we should not view this idea only in terms of economic superiority of rural areas. Instead, rural areas should be seen as inseparable from urban areas and thus, comparing rural areas with urban areas is inappropriate. Caffyn and Dahlstrom (2005) suggest the integration of rural and urban areas for regional development. Instead of focusing on the differences between rural and urban areas, the focus should be on interdependences and commonalities. They point out the trend in Europe's policy papers towards stressing interdependencies and in moving the emphasis towards functional regions rather than separating town and country.

Development of secondary cities or small urban centers is one way of implementing rural and urban integration. Rondinelli (1991) looked at government policies of Asian countries aimed at creating a "balanced" pattern of urban development and how these had largely failed. These failures led to the recognition of the importance of diffusing urban growth rather than controlling or suppressing it. In light of this, Asian governments have refocused their urban development policies, one of which is towards investing in secondary cities and towns with growth potential that allows the integration of urban and rural markets.

The following sections discuss in detail existing works with respect to the regional economic concept of small urban centers as growth poles, and the empirical findings on the benefits of establishing small urban centers as well as the challenges faced. Solutions to the challenges and the pre-conditions for an effective small urban center are also discussed.

3.2. Regional Economic Development

The development of small urban centers or small urban centers leads to the integration of rural and urban area into a functional region. In understanding the inseparability between rural and urban area from an economic perspective, it is useful to first analyze the process of regional economic development. From a regional perspective, we can view economic development from two dimensions. The first dimension is economic growth and the second is spatial structure (Parr, 1979)[5]. As far as regional economics is concerned, both these dimensions are inter-related without any exact sequence. In other words, economic growth may influence spatial structural change and vice versa[6]. In understanding the mechanism of rural-urban integration, the emphasis is placed on how economic growth influences the spatial structural change.

Parr (1987) gives an example of a regional economic development involving spatial structural change. The case study is that of a newly growing economy with per capita income initially at a relatively low level. Parr uses population density as an indicator to measure the spatial structural change. In the case used in the model for Parr's study, economic growth induces population growth where growth rates are highest near

[5] Social structure as another possible dimension of economic development will be discussed later in section 5.3.3. on the social economy.
[6] Parr (1979) refers to a case where the nature and pace of regional economic change over a given period can be influenced by the form of spatial structure at the start of the period.

the center of the region and the rates steadily decline as we move away from the center. Parr uses the term metropolis to refer to the center of the region and considers the metropolis as an emerging growth pole. There are two possible cases that may conform to such a spatial development model, which Parr refers to as the model of Regional Concentration with Metropolitan Centralization.

The first is the case of a region where the economy was formerly based on traditional activities and it undergoes industrialization. In this case, according to Lampard (1955), the difference in transport costs are not substantial, and thus, economic activities no longer need to be located near each market. This, in turn, leads to a more concentrated pattern of location for production activities. It is important to note that the absence of substantial transport costs allowing for concentration of activities is only for the surrounding area that is within a certain radius from the metropolis.

In the non-metropolis part of the region or the areas outside the growth pole, there is also economic growth, but the rate is slower. The growth in the non-metropolis part of the region can be attributed to the income earned by commuters working in the metropolis as well as to the increased demand of the metropolis population and economic activities for raw materials and food that are supplied from the non-metropolis part of the region. Therefore, in this case, the process of economic growth originates from the industrialization that takes place at the center or growth pole area of the region, which later trickles down to the hinterland or the non-metropolitan area surrounding the metropolis.

The second case is that of a region with growth occurring initially in the non-metropolitan part of the region, which in turn provides the stimulus for the metropolis part of the region. Such is likely to be the case for newly settled regions. The advancements in agriculture and resource-based activities in the non-metropolitan part of the region create substantial demand for goods and services that are only available in the metropolis part. These goods and services usually include manufactured goods to be used as inputs to production or for final consumption, as well as services such as banking, financial, wholesaling, transportation and consumer-oriented services.

The nodal location of the metropolis and the economies of scale that are present in economic activities that take place in the metropolis, lead to a disproportionate multiplier effect experienced by the metropolis from the growth that originates from the non-metropolis part of the region, as stated by Parr (1973). In other words, as the surrounding hinterland composed of agricultural or primary resource extraction economic activities experiences growth, leverage is experienced because the metropolis area is able to produce goods or services which are in demand in the surrounding hinterland more efficiently.

However, in this case, there is an important pre-condition if economies of scale are to take place. This pre-condition can be explained by depicting the region as taking a circular form with the metropolis forming the nucleus of a smaller circular area in the middle of the larger circle representing the region. If growth originates only from some parts of the hinterland located within the larger circle but outside the nucleus, maximum leverage cannot be achieved. Economies of scale requires that growth originates from a substantial proportion of the hinterland. The degree of leverage will determine the potential economies of scale. The degree of leverage may be expressed as a product of the proportion of hinterland experiencing growth and the maximum spatial leverage.

The degree of leverage can be expressed using the following equation:

$$\frac{A}{\pi R^2 - \pi r^2} \times \frac{\pi R^2 - \pi r^2}{\pi r^2} = \frac{A}{\pi r^2} \qquad [3.1]$$

Where:

A : area of the hinterland that experiences economic growth

R : radius of the whole economic region

r : radius of the nucleus or growth pole or metropolis

Although the final ratio can be obtained in a straightforward manner without having to compute the other ratios, it is important to note that the other ratios have a crucial role in determining the optimality of the spatial arrangements in terms of resource utilization for the whole region. The ratio of the hinterland area experiencing economic growth to the total area of hinterland represents the proportion of hinterland experiencing growth. On its own, this ratio gives the degree of optimality of the leverage. The closer it is to one, the more optimum is the leverage. The maximum spatial leverage is the ratio of the hinterland area to the nucleus area. The product of these two ratios is the ratio of the hinterland area experiencing growth to the nucleus area. This ratio shows the degree of leverage based on how large is the area of hinterland experiencing growth as the potential market for the nucleus in comparison the the area of the nucleus itself. However, this calculation may not take into account population density and natural resource disparity. Thus, the size of the area in this formula can be substituted with other indicators such as the number of population, agriculture produce, or fertile land area (refer to appendix 2 for illustration).

According to Parr (1987), in any of the two cases of regional economic development, there are likely to be several migration streams. For the first case, where growth originates from the economies of scale experienced in the metropolis part of the region, the expected net migration will be from the non-metropolis to the metropolis part of the region as well as from some other interregional and international migration mainly to the metropolis part of the region. For the second case where growth originates from the non-metropolis part of the region, instead of a net migration from within the region, the expected net migration is the result of inter-regional or international migration to the metropolis as well as to the non-metropolis part of the region.

Within the metropolis, there is also a tendency for a centralization of population. The rapid expansion of economic activities in the metropolis part of the region leads to an increasingly centralized pattern of employment as the agglomeration induces centralization. Intra-metropolis freight transportation cost tends to be high. Coupled with the existence of a passenger transportation system that does not allow for separation of location between residential area and workplace, partly also due to the low level of per capita income, the increased centralization of employment will inevitably lead to a more centralized pattern of population.

Parr (1987) gives a useful grounding for the investigation of how spatial structure can change following economic growth. If we assume the migration flow to include non-permanent migration such as commuting, we can adapt this model to the small urban center model. This model strengthens the view on the inseparability of rural and urban areas as the urban part of the region that is represented by the growth pole benefits from economies of scale due to the degree of leverage on its surrounding hinterland.

However, the circular region model may have some limitations in delineating the sphere of influence for the growth pole, especially in case of terrain variations that may lead to variations between the sky distance from one point in the nucleus to the point in the hinterland and the actual transportation cost and time. Therefore, modifying the model by replacing circular radius with isochrones [7] can make Parr's model more applicable to the real world.

3.3. The Social Benefits of Establishing Small Urban Centers

The establishment of growth poles in the form of small urban centers can create leverage effect to catalyze regional economic development. The idea is to capitalize from the urban benefits that are brought nearer to the rural areas through encouraging certain forms of urbanization. The development of a small urban center is also expected to contribute to rural development by linking rural areas with the larger market and creating employment opportunities. The economic and social rationale for establishing small urban centers has been the subject of many studies, in particular, among rural and regional development scholars and researchers. This section discusses the empirical works on the role of small urban centers or small urban centers as one way of overcoming the challenges faced in rural development.

3.3.1. Market Linkage and Employment Creation through Market-Based Small Urban Center Development: Growth Poles as Service Provision Centers

Trager (1988) studied what an African rural population would call "hometowns". These hometowns are small urban centers located within close proximity to rural areas such that

[7] Alonso (1964) defines isochrones as the points with the same travel distance or the same commuting cost from the center of the city that may be connected by iso-access lines.

these rural people are able to claim the small urban centers as their hometowns even though they do not permanently reside in these hometowns. The focus of Trager's study (1988) was on the role of these small urban centers in the economic and social activities of the rural hinterland, in particular, the pattern of rural-urban linkage that the rural hometown system exhibits.

An interesting aspect in Trager (1988) is the role of markets that encompass a significant portion of rural population activities. Adalemo (1979) and Bromley (1984) propose the empowerment of existing market centers to become the center for provision of other urban services to the rural populations. These studies also found that such markets conform to the central places hierarchy system. The presence of a market therefore shows some degree of centrality that can be measured by analyzing the level of activities, functional relations, flows, linkages and area of influence.

Recognizing the conformance of marketplaces to the central place hierarchy, Adalemo (1979) and Bromley (1984) argue that these marketplaces can serve as a base for other developmental activities. Trager (1979) uses the analysis of a central place hierarchy to identify how the system of periodic markets in Southwestern Nigeria allows periodic markets to become provider of services. An example is the provision of health services in these markets during market days.

Trager (1988) shows that the markets in the Ijesa area of Nigeria serve a variety of functions for traders, farmers and consumers. The markets serve as retail distribution points for sellers of manufactured goods and other goods not produced locally. The markets are also the place where rural farm products can be purchased and gathered for redistribution in bulk elsewhere. Traders in the market include those coming from local area as well as those coming from other, usually large, centers. Thus, farmers utilize the market as a place to sell their products as well as to buy other necessary goods. Ukwu (1969) describes such a market as a rural central market. As opposed to a rural local market that serves only the village in which it is located, a rural central market serves the surrounding villages or the hinterland.

Thus, markets play an instrumental role in rural areas as they become places where people and goods move and lead to the establishment of economic and social relationships. Trager (1979) points out that, in general, the marketplace facilitates the creation of economic links in two directions. The first is by linking small centers and rural areas with the larger urban centers and the second is by linking the small centers with their rural hinterlands. In brief, these marketplaces located in the small urban centers provide access for selling the locally produced goods of the rural people as well as providing access points for purchasing goods that are not produced in the local area.

Gaile (1992) also looked at the role of such small towns in Africa. This recent study shows that through market-based development small towns have become effective instruments to improve rural-urban linkages by expanding market-based agricultural activities and they stimulate non-farm employment opportunities. Aeroe (1992) looked at the industrialization programs that took place in the small towns of Makamboko and Gutu in Zimbabwe. Small towns are relatively less attractive compared to large towns as a destination for investment and a place to live, and thus they cannot be expected to replace industrialization in large towns.

Nevertheless, Aeroe points out that small town industrialization can supplement large town industrialization. Aeroe refers to the surveys in African countries that have shown how small enterprises are often more efficient and are able to create more employment as compared to the larger enterprises within the same industry. There is a similar finding in the discussion of urban to rural shift of business activities and employment in England. Keeble and Tyler (1995) refer to a survey of over 1,000 manufacturing and service businesses in remote rural, accessible rural and urban settlements. The survey shows that rural firms achieve faster employment growth. In the case of small enterprises in Makamboko and Gutu towns, the development is mainly contributed by the intense interaction between these towns and their respective rural hinterlands.

Rondinelli (1988) also looked at the role of Africa's small urban centers in facilitating agricultural production as well as stimulating the growth of enterprises and jobs related to agricultural marketing, processing and exchange. These small cities are also called market towns and are proven to play important roles in linking rural areas with urban markets. The expansion of the market-based linkage plays a crucial role in promoting regionally equitable economic development.

In China, the rural industries are known as town and village enterprises (TVEs). Southall (1988) cites The Beijing Review (1987), which questioned whether relying on two pillars, which are the development of large-scale modern enterprises in the urban areas and the village and township run enterprises based on traditional technology in the countryside, can lead rural population to achieve urbanization. The Fei Xiaotong lecture in 1988 as quoted by Southall (1988) answers this question by suggesting that: "China should preserve and expand the collective production to promote rural industries based on scattering industry and technology to the countryside with the ultimate aim of avoiding excessive concentration of population in urban centers and creating a mass of laborers divorced from agriculture" (p. 2).

According to Guldin (1997), the dimension of rural transformation in China has been characterized by a move out of agriculture into nonagricultural occupations. In addition, there has been a demographic shift of villagers to towns, and the remaking of rurally oriented towns into more urban centers of production and communication. Chinese rural industries are thus a major feature of its fifteen-year economic boom that marked not only a process of urbanization characterized by rural-urban interaction, but also a rural transformation into an industrialized rural-urban area that has discrete distinction between being rural nor urban.

The benefits arising from development of small urban centers have been mainly associated with employment creation. The market linkages between rural agriculture and urban outlets are intermediated by the presence of the small urban center. Under the constraints of infrastructure, a small urban center becomes an efficiency enhancing intermediary by pooling the rural produce to achieve economies of scale.

3.3.2. Do Small Urban Centers Cannibalize Larger Urban Centers?

Whether or not development of small urban center can be cannibalistic to the current development in the larger urban centers is a possible challenge to the idea of developing a small urban center. If development is a "zero-sum game" where there is always a winner and a loser, then one may find that the development of a small urban center will eat out the share of growth of the urban centers. Thus, in aggregate, there is no change to the economic development of the country.

Owusu (2005) looks at the promotion of small towns in Ghana, in particular the district capitals. Owusu concludes that such development is a positive response to rural development and the development of dispersed urbanization in the long run. Owusu highlights the significant growth in both the number and population of small towns over the last three decades and how these have not brought about significant changes to the proportion of urban population in urban centers, thus contradicting the widespread view that such proliferation and growth of small towns leads to a decline in growth rates of larger urban centers.

3.3.3. The Social Economy in Rural Areas

Another argument against the establishment of a small urban center is the existence of a social economy in the rural areas. A social economy is believed to help rural people overcome the challenges in their economic and social activities through collective efforts and cooperation, without the need to actually have an urban center to facilitate such infrastructural activities.

Williams and White (2001) looked at how the social economy is utilized by rural residents in overcoming their disadvantage in terms of transport. The social economy refers to the community function in fulfilling the rural needs. Using a study from five contrasting localities in rural England, Williams and White found that despite the wide usage of social economy in tackling transport problems, the system is unstable. In addition, there is still a significant minority of households that cannot use private cars and public transport and thus, cannot utilize the social economy to solve their transport problems. Therefore, the social economy in itself cannot guarantee the self-sufficiency of rural residents and immediate access to service providers and market centers are the first priority in promoting rural development.

Amin et al (1999) also looked at the social economy and examine the three central claims made for the social economy, which are empowerment, economic sustainability and a capability to provide real alternative to the "mainstream/formal" public and private sector economies. However, the finding of this study shows that these claims are not true. This study supports the view of William and White (2001), indicating the difficulty in leaving rural developments to rely solely on the social economy in coping with the lack of infrastructure.

3.4. Challenges and Possible Drawbacks of Small Urban Centers

The development of small urban centers is not free of shortcomings and challenges. This section focuses on the challenges and possible drawbacks in the development of urban centers by looking at empirical works on the effectiveness of small urban center development strategies.

3.4.1. Policy Challenges

Otiso (2005) looks at the secondary cities' growth strategy in Kenya. In Kenya, the promotion of equitable urban and regional development started way back in the 1970s. The program involves mainly the promotion of secondary cities to relieve the population pressure in the countryside, help to better integrate the nation's rural and urban economies, and help to reduce congestion and increase the spill-over of modernization that urban centers provide to the surrounding rural areas.

Through an examination of the current state of Kenya's secondary cities with respect to its urban and regional development strategies by using the recent census and economic survey data, Otiso looks at the reasons behind the failure of these cities to meet the planned targets. The development of secondary cities faces great challenge due to insufficient decentralization of power and fiscal responsibility. In addition, the dominance of the capital city cannot be simply dismissed by secondary cities. This is because the investments in the country remain concentrated in the capital city.

3.4.2. Limits of Employment Creation for Food Manufacturing

Kilkenny and Gale (1999) emphasize the potential of rural areas in attracting manufacturing activities based on the fact that during the 1990s, food manufacturing employment in the USA grew by more than 70,000 jobs with non-metros accounting for most of the new jobs. In the 1990s, in the USA, non-metro areas accounted for more than 50 percent of the national employment for meat products, more than 30 percent for grain mills and fats and oils and more than 25 percent for fruits and vegetables, dairy, sugar and confectionary. Non-metro areas accounted for a lower proportion of national employment for bakery products and beverages, both of which require large amount of non-agricultural inputs. During 1991-1996, across 357 non-metro job-gaining areas in the USA, the average gain in food processing jobs was about 291 jobs per county. It is important to note that the job gain was more predominant in the midwestern and southern states.

However, Kilkenny and Gale (1999) point out how food manufacturing does not contribute significantly to total employment as it provides only 1.7 percent of all non-metro jobs. They even calculate the case where all the 1 million jobs in food manufacturing in the USA are moved to the non-metro areas. In this case, food manufacturing would still only account for 4 percent of the total non-metro jobs. They point out that the largest and fastest growing agriculturally related employment sectors are, in fact, the food retail and marketing sectors. Unfortunately, these businesses tend to locate in urban locations to gain access to consumers.

In addition to food retail and marketing, service industries are the fastest growing sector of most economies. This includes transport and communication, public utilities, wholesale and retail trade, finance, insurance and real estate, personal, business and health services. However, in participating in service industries, rural areas again face a big challenge as these industries tend to agglomerate in urban area as their viability depends on the potential market size.

3.4.3. Equitable Participation of Rural Population in Urban Development

From an example in Latin America, Southall (1988) found that small urban centers contribute to rural underdevelopment. His argument is that the change in the way of life brought about by the forces of capitalism is an inseparable feature of urban life. It has eroded the beneficial traditional culture and led to disillusion among the rural population. He cites in his Latin America example, an urban person working as garbage scavenger who still feels better off than living in the impoverished, deprived and oppressed countryside. However, his argument goes back to the conventional reasons for rural-urban migration, which is the feeling of being better-off in the urban area because of lack of health, education and welfare services in rural areas.

If the argument narrows down to the problem of unequal distribution of services, there can be a rebuttal to such an argument. The presence of small urban centers should instead allow the leveraging of public service investment depending on the accessibility of the location relative to the rural hinterland, whereby investing in public service in that particular center would have an impact on its surrounding hinterland. Nevertheless, Southall acknowledges that his findings are focused on the cases where the development of small urban centers are initiated through foreign development assistance.

According to Southall, it is only where the stimulus to urban growth results in activities primarily by the people and for themselves that small scale urbanization may be beneficial locally. Otherwise, the result may be exploitative. Southall uses the analogy of TV soap operas' rising popularity over rural rituals and dramatic performance in explaining how the aspect of "city lights" and urban excitement attract rural people to experience urban life. This is particularly the case when the promotion of urban dynamism has killed the creative entertainment, rituals, vibrant arts and crafts of rural areas. Thus, the essence of Southall's thesis is simply that the reason for rural urban migration may not be the superiority of urban centers in comparison to rural areas, but instead it is the mentality and needs of the rural area that is altered towards favoring urban lifestyle.

Therefore, a more careful analysis of Southall's claims that establishment of small urban centers become an exploitative process that drains rural resources is necessary. Southall denies that his view is based on sentimental, romantic or chauvinistic ideas or it is anti-urban. Southall points out that the "high culture" appeal of urban area is, in fact, far beyond the reach of the rural people as they have no skills and are generally poorly paid or unemployed. Southall argues that when small urban centers are established by foreign investment, the more efficient exploitation of local resources increases wealth for the few elite people who are in a position to profit by it.

In giving a good example of small urban center development, Southall cites Trager's (1988) idea of "homeboys". According to Southall, when the source of investment is the emigrants of the area who work in the cities and channel their savings towards building highly profitable breweries, food processing, garages and service stations including roads, churches, hospitals and schools, the result is an increase in urban employment and expanded outlets for rural produce.

Therefore, a pertinent issue to be considered in the establishment of small urban centers is the participation of the local community in the development of the urban area. Unless a participatory approach is pursued, these rural people may end up being the victims of capitalism and thus remain impoverished and deprived of the urban excitement and "city lights". Although these urban features are now in closer proximity to the rural people, they can only be the audience and not the beneficiary. To avoid this, a collective system as practiced in Chinese town and village enterprises may provide a desirable example of rural industrialization triggered by the development of skills and entrepreneurship of the rural population.

The early theories of economic development, which include the linear stages of growth, emphasize the importance of savings in economic development. These theories may be outdated, but the role of saving and investment as drivers of growth has never been contested. Therefore, unless rural people can generate savings from the surplus of their produce, the extent of growth for the area will depend on the mercy of external investors. Government intervention in redistributing investment returns through taxation or incentives to local entrepreneurs through microfinance seems to be a feasible policy option in creating a desirable small urban center. Southall's study has indeed provided great insights on how rural people have the desire to transform into an urbanized society. Southall points out what kinds of urban features should be present in the small urban area so that it can effectively function as a filter to the rural-urban linkages. This becomes particularly important because rural-urban linkages have been characterized by the imbalance in economic bargaining power.

3.5. Pre-Conditions for the Effective Functioning of Small Urban Centers

There is a vast literature that deals with the conditions necessary for urban centers to function effectively. These conditions include endogenous and exogenous factors. Endogenous factors include the amenities and services present in the small urban center as well as its economic role. The exogenous factors include the presence of larger urban center and the national economic policy.

3.5.1 Exogenous Factors

3.5.1.1. National Economic Policy

Pedersen (2003) looked at the implications of national-level policies on the development of small and intermediate urban centers in Eastern and Southern Africa. The small and intermediate urban centers are part of both the local/regional economy and rural areas where they are located as well as the national and international hierarchy of urban areas. The development of these centers depends largely on the national agricultural policies and development in their hinterland as well as on the development of industry and services. The national policy of import-substitution led to concentration of economic activities in the capital cities, which further resulted in an urban bias in the development decisions that negatively impacted rural areas and the development of the small urban centers.

Agricultural deregulation as part of the structural adjustment policies introduced by the Eastern and Southern African governments in the early 1990s led to a balancing of regional development as the urban bias was generally reduced. The agricultural deregulation has given way to an increased diversification into both agricultural and non-agricultural activities that led to rapid growth in the small urban centers of Africa.

However, the devaluation of national currencies and rising food prices became a limiting factor to Africa's major urban growth, leading to a stagnation and even regression in the formal economy and forcing people to rely on the informal small-scale economy. Apparently, the formal economy's stagnation hit the small and intermediate urban center harder than the capital cities, although few details about this are known. The reduction in the demand for intermediate products produced by the small urban centers may be a possible cause. In contrast to the larger urban centers with greater diversity in work opportunities, the small urban centers have to rely heavily on these intermediate agriculture-related sectors. Therefore, the informal economy in the small urban centers is not ready to absorb the idle labor, which may explain why small urban centers are hit harder compared to the capital cities.

The case of Eastern and Southern Africa has shown how national economic policies play a major role in the growth of small urban centers. Concentration of economic activities in the capital cities tends to hinder growth of small urban centers. When the economic policy encourages higher value added activities in the agricultural sector, the small urban centers will benefit from the growth of agriculture-related processing activities. However, the agricultural sector remains prone to any downturn in the economy due to the massive reliance to the intermediate processing sector.

3.5.1.2. Relationship with Larger Urban Centers

Firman (2004) examined urbanization patterns in Indonesia using data from the National Population Census of 2000. Although urbanization in Indonesia is still characterized by a high concentration of urban population in few large cities, the small towns and intermediate cities in the outer islands are experiencing higher population growth compared with those in Java. This might suggest that these towns and cities are playing a more significant role in regional development. From another angle, such a trend may also show that in the absence of a mega-influential urban area such as Greater Jakarta and Greater Surabaya, small towns and cities can flourish better and play a more significant role in regional economic development.

Titus (1991) investigated the economic structure and role of four small towns in Central Java, Indonesia. Titus presents a structural model explaining the small town's production structure through its dominant modes and forms of production as well as the functional relationships between these small towns and their rural hinterland and to other urban centers. Titus's findings show that the town-hinterland relations seem to be determined by higher-order centers and by rural development process largely influenced by national policies, rather than by the small town's own functions. Titus highlights the many cases of "bypassing" experienced by these small towns in terms of marketing and distribution that reduce these towns' potential development.

The presence of mega-urban areas is a big issue in achieving equitable regional economic development. Zoomers and Kleinpenning (1996) look at the welfare impact of large urban centers to rural farmers. They study the impact of rural-urban relations on the livelihood strategy and income level of peasants by focusing on whether small farmers within close proximity to a large city or large urban center are better off compared to those living outside the urban sphere of influence. The case study of Asuncion city in Paraguay shows that Asuncion plays a crucial role in the livelihood strategy and income level of small farmers in the surrounding area. However, Asuncion does not improve the welfare of farmers through catalyzing agricultural intensification and spread of innovations. Instead, Asuncion provides a safety valve for the rural poor through additional non-farming sector income sources.

Pedersen (2003) reaffirms the role of small urban centers as providers of links between the local/rural and the national/global economies, based on the economic dynamics of these small urban centers in reacting to the changes in economic policies and environment. In overcoming the challenge, there needs to be a policy that focuses on the development of a small enterprise sector with the main goal being the more efficient development and integration of the rural market into the national market. The key is to shift the focus from mere concentration on production towards trade and networking. Pedersen highlights the possible temptation to concentrate activities in capital cities as a result of globalization and how this may defeat the policies of small and intermediate urban center development. Strong commitment at the national decision-making level is needed in ensuring the stable growth of these small urban centers.

3.5.2 Endogenous Factors

3.5.2.1 Rural-Urban Linkage Pattern

The relationship between the small urban centers and the larger urban center as well as the rural hinterland plays an important role in the effective functioning of these small urban centers. Evans (1992) looked at the virtuosity of rural-urban development in Kenya, where the tasks of the small towns can be effectively played when they connect external demand from the markets to the farmers and help farmers raise agricultural productivity by allowing them to spread risk through diversification of incomes. Based on his observations in Africa, Rondinelli (1982) acknowledges that growth poles within the rural regions are unlikely to have much impact if they are isolated. Rondinelli stressed the importance of linking these growth centers with the immediate cities in order to promote development of their hinterlands and for integrating urban and rural areas. He argued that the presence of employment in services, distribution, commercial, marketing and agro-processing offers a far better base for such a rural growth pole compared to large-scale manufacturing.

Trager (1988) cited McNulty (1985) in defining the rural-urban linkages as the multitude of formal and informal flows of goods, services, messages, capital and people between the rural and urban areas. These linkages consist of various types of activities including among others, migration, flows of goods and information and administrative ties. Trager (1988) builds on McNulty's definition of rural-urban linkages with specific attention being paid to two types of linkages that were considered pertinent in terms of the role played by small urban centers in Southern Nigeria. These linkages are economic linkages through the market system, and the social and economic ties maintained by those who are originally from one place but now residing elsewhere.

Evans (1992) stressed the possible proliferation of such non-farm activities under a vibrant agriculture, in which such non-farm activities will, in turn, create a demand for farm produce. This virtuous cycle of rural-urban development shows an idealistic model of interaction that a small and intermediate urban center should create. Haggblade et al (1989) show how the evidence from Asia might suggest that agricultural growth through a network of consumption and production linkages can generate significant income and employment multipliers in the rural non-farm economy.

Douglass (1998) looked at the regional network strategy for reciprocal rural-urban linkages in Indonesia. Douglass lists five types of rural-urban flows, which are flows of people, production, commodities, capital and information. These five flows are the baseline determinants of the pattern of rural-urban linkages. When all these five flows are present, and both rural and urban areas benefit from these linkages, the rural-urban linkages are in a healthy state.

Illgner and Nel (2001) observe the shopping habits of people living within and around Cleobury Mortimer town, Shropshire, United Kingdom. They suggest a change in retail strategy of small country towns from a market place to become a marketing place is required. With this change, small country towns are no longer placed in the lower hierarchy of the distribution of services and urban goods.

According to Fletcher and Badger (1971), the growth of existing small towns in viable areas will depend on the attitudes of the people and actions of policy makers at all levels of government. If a city relies heavily on local retailing with only very small firms as its industrial base, it will tend to deteriorate. If it relies mainly on manufacturing, it may become middle-sized. If, in addition to having several medium-sized manufacturing plants it has a good industrial mix of other activities, it can become a viable growth center.

Fletcher and Badger (1971) list the following industries as the mix that provides job opportunities for both blue collar and white collar workers, retains homegrown talent and attracts middle and higher income earners: agricultural processing, chemicals, metal, machinery and equipment, other manufacturing. It is important to note that Fletcher and Badger did not include service industries, which is however the largest economic sector nowadays, in particular tourism. Service industries may also attract both blue collar and white collar workers.

Roberts and Thomson (2003) look at the sources of structural change in peripheral rural areas and distinguish between changes in real output depending on the causes. The causes include changes in local sourcing patterns, changes in technology and changes in final demand. From the economic data of Western Isles in Scotland, the results obtained show the importance of export demand as drivers of structural change. Therefore, small urban centers should develop strategic economic sectors that can sustain their importance in the regional economic linkages.

3.5.2.2. Rural-Urban Migration

3.5.2.2.1. Factors Influencing Migration

It is also useful to observe the trend of rural urban migration to study the factors that may affect rural peoples' decision to utilize small urban centers. Lee (1966) lists four general factors that influence rural people's migration decisions. The four general factors are origin factors, destination factors, intervening obstacles and personal factors. Origin factors refer to the factors in every area that tend to hold people in the area and factors that tend to repel them. Destination factors refer to the conditions in the potential migration destination that attract rural people to migrate. Intervening obstacles refer to the factors other than origin and destination factors, which affect the migration decisions. Distance is the most obvious obstacle and distance can be further grouped into sociocultural and physical distance. Physical distance is related to time and cost of travel. Sociocultural distance includes the differences between origins and destinations with regards to the lifestyle and social behavior system as well as the absence of the next of kin.

Development has led to the reduction of these distances. Construction of roads and better public transportation have brought about reduction in physical distance. The sociocultural distance is reduced through better education in the rural area that improves literacy and shapes the attitudes to better suit urban life. Personal factors and characteristics are also very important as these will affect how the individuals perceive the origin, destination and intervening obstacles factors in making their migration decisions. Again, development plays an important role in the personal factors. Increased level of education, aspiration, awareness of urban opportunities and general level of modernization tend to stimulate migration.

3.5.2.2.2 Economic Models of Rural Urban Migration

In analyzing the process of rural-urban migration, economists have developed various models of migration. According to the human capital or cost-benefit migration model developed by Sjaastad (1962), the benefits of migration are defined as the present value of potential income gains as a result of the difference in income between origins and destinations. The model also recognizes the non-monetary benefits that arise from locational preferences. The costs incurred include moving expenses, opportunity costs of foregone earnings between jobs and the non-monetary "psychological cost". The non-monetary "psychological cost" can take the form of the disutility of leaving a familiar environment to settle in an unfamiliar environment. Under this model, the development of rural areas may encourage migration by reducing the "perceived" costs of migration as well as the increase in the "perceived" benefits of migration. This happens when the development leads to the modernization of rural residents while at the same time not being able to increase rural residents' income. Thus, the important factor in increasing rural retention rates is increase in income. Nevertheless, the recognition of non-monetary benefits may also require the improvement of rural conditions by bringing rural people closer to the conditions in the urban area. This is to anticipate the increased demand for urban lifestyle due to the modernization of rural residents.

Todaro (1969) explained continued rural-urban migration as the result of "expected" income in urban areas perceived by the rural residents. The "expected" income is a function of the relatively high urban sector minimum wage and the probability of one's securing urban employment. This model also proposes the increase of rural income to bring it closer to the "expected" income in urban areas.

The intersectoral linkage model is another approach that looks at the interconnection between rural and urban areas by systems of backward and forward linkages (Bell and Hazell, 1978). The development of rural areas will affect urban areas by creating demand for farm inputs as part of the backward linkages. These include banking services, farming tools and consulting services. Through forward linkages, rural areas supply their products for further processing in agro-industries located in urban areas. The demand for urban goods increases due to higher rural income and strengthens the intersectoral linkages. The model assumes that an increase in rural income will result in an increase in the proportion of spending of the added income for urban goods and services. Therefore, the increase in demand will induce urban development and create employment opportunities that will increase the attractiveness of the urban areas. This will, in turn, induce rural-urban migration.

According to de Jong and Gardner (1981), rural-urban migration can be motivated by the desire for educational opportunities offered in the urban areas. However, in the case of rural poor, economic considerations such as expected income are still the main reason for migration.

3.5.2.2.3 Empirical Research on Factors Affecting Migration Decision

Rhoda (1983) looks at empirical research on migration. The research has been unable to explain the relationship between level of rural development and rate of out-migration. In Asia, most of the rural-urban migrations tend to originate from rural areas with low incomes. In contrast, there are high rates of out-migration originating from the rural areas with higher income in Africa and Latin America. This indicates the presence of a strong influence of other factors in the decision to migrate. However, Findley (1977) and Lipton (1980) showed that rural areas with high population densities or high ratios of labor to arable land have higher rates of out-migration. Rhoda (1983) summarized the empirical generalizations in rural-urban migration. Rural out-migration is positively correlated with higher population density, unequitable land distribution, access to cities, rural-urban integration and commercialization of agriculture, level of formal education and occupational skill levels.

The development of small urban centers helps in addressing the migration factors related to origin conditions or push factors. This is because small urban centers can provide employment opportunities and services. This will lessen the gap between the origin and the destination. The intervening obstacles and personal characteristics are very important and cannot be easily altered by the presence of small urban centers. However, small urban centers should cater to these factors in such a way that these factors will not lead to rural-urban migration. The improvement in education and modernization may require the provision of higher quality services in the small urban centers. In addition, the creation of jobs requiring higher skills is the key to retain local skilled workers. Empirical research has confirmed the positive relationship between migration and the access to cities, rural-urban integration, level of education and occupational skill level. Therefore, by observing the factors that lead to rural-urban migration, and the economic models of such migration, the pre-conditions for the small urban center to function effectively can be deduced.

Rhoda (1983) also pointed out the challenge faced in rural education and how it affects rural development. The fact that many of the subjects taught in schools are not relevant to the rural areas has led to the desire among educated youth to apply what they have learned to urban areas. Coombs (1974) and Findley (1977) proposed the incorporation of subjects and topics that are relevant to rural life and would support the increase of youth interest in developing the rural economy. However, there is opposition from parents who prefer their children to attend formal education that does not deviate from the curriculum taught in urban schools. Therefore, there is still a need to develop jobs that would cater to the occupational skills of educated rural residents. The availability of skilled labor as well as greater access to raw materials is the basis for attracting agriculture-related manufacturing activities to the rural areas.

In looking at rural-urban migration, Southall (1988) argued that it is not the superiority of work that these rural migrants look for. Instead, they perceive their home villages as impoverished and backward, which may be due to the lack of facilities, apparent lack of alternative employment other than on-farm jobs as well as the attraction of city lights and urban excitement. For some rural residents, the lifestyle in rural areas can be monotonous because the population is sparsely distributed and amenities are lacking. In addition, with most of the people working on the farms, that such lifestyle may no longer appeal to some rural people. The dissemination of information from audio and visual media has encouraged the rural people to transform themselves into urban individuals, despite the presence of other forms of information transfer such as the rural traditional rituals and the frequent gatherings at the village halls. There are endless debates on whether such transformation is beneficial and reflects the true process of modernization. However, from an economic point of view, when rural people are discouraged to stay back in rural areas, the rural economy tends to degrade. Direct migration to large urban areas is the most likely outcome under this condition, especially when there are no small urban centers to filter the migration.

In Africa, marketplaces located in the small towns and urban centers perform the role of providing urban services to the rural area through their marketplace (Trager, 1988). The effectiveness of these “hometowns” in serving as provider of urban services to the rural population can serve as a measure of the retention rate of rural population. Trager also identifies the key elements that would influence the behavior of the rural people in their interaction with the "hometowns". In the absence of effectively functioning urban centers, the forces leading to rural-urban migration are stronger.

3.5.2.3. Expectations of Available Services in Rural Towns

Trager (1979 and 1988) finds that a service-providing marketplace is an attractive thing in keeping the rural population from migrating. Thus, urban centers must be able to serve as outlets for the distribution of farm produce of the rural population. The urban centers must also be able to serve as outlets for the distribution of consumer goods which are not locally available. In addition, what are most needed are the inputs that are not locally produced such as fertilizers and pesticides. This will create a backward linkage between the rural farm activities and the urban centers in terms of purchases of farm inputs and a forward linkage in terms of sales of farm produce.

In addition, the need for urban center in the rural area may also indicate the desire among rural people to gain access to urban amenities. Amenities are abstract and difficult to measure. They vary according to the perception of each individual. However, there appears to be no study yet that has focused on the pattern of rural-urban small center linkages that is based on individual perspectives on urban amenities. Recent works on amenities (Bell (2000), Cavailhes et al (2003)) focus more on rural amenities in the urban areas, which include among others, fresh air, congestion-free traffic and greeneries.

Thus, on one hand, rural people need access to urban amenities and on the other hand, urban people also need access to rural amenities. There is a common need for both types of amenities. However, the degree of utility trade-off between the two types of amenities may vary between individuals. According to Trager (1988), one of the most important urban amenities is the availability of goods and services not locally produced for both consumption and farm inputs.

Owusu (2005b) analyzes the role of district capitals in regional development. According to Owusu, there have been only a few studies on the role of district capitals and the linkages between these centers and their hinterland as basis for evaluating the effectiveness of regional development strategies. Owusu's work provides a conceptualized and analytical model for examining the role of district capitals and rural-urban linkages in regional development in Ghana. Apart from the proximity and accessibility to higher-order centers, the small towns' production and service functions are among the four critical factors in this model.

Hardoy and Satterthwaite (1988) conducted a study on small and intermediate urban centers in the Third World. They looked at most of the Third World's population who live in rural areas but depend on small and intermediate urban centers for access to goods and services, markets for rural produce and government facilities. Their work highlights the main factors that determine the effectiveness of small and intermediate urban centers. These factors are largely influenced by the expectations the rural people have about these urban centers.

Owusu and Lund (2004) looked at the role of markets and women's trade in district development in Ghana. Their study shows that for many people, the markets in the district capitals serve as the main platform for interaction with the larger urban center, thus promoting rural-urban interactions. Therefore, these underdeveloped markets require improvement of infrastructure, which is believed to generate more revenue for district development, improve agriculture, increase income and reduce poverty, especially among women. Most importantly, upgrading these underdeveloped markets generally provide alternative means to district development.

Apart from industrial linkages, it is also useful to look at housing. Although many would believe that small rural communities are the ideal places to live, Ziebarth et al (1997) find that rural households are more likely to live in unsuitable or inadequate human settlements and earn lower incomes, thus creating a self-reinforced situation where rural people find it difficult to obtain affordable decent housing. They also highlight the rising concern among the rural community about the housing amenities that they have. The urban centers are expected to contribute to the improvement in rural housing amenities.

Moseley (2000) reviewed the provision of six key services in England's villages. The six key services include village shops, post offices, village halls, schools for 5 to 11 year olds, pubs and public community transport. The main challenge often faced in providing such services in rural areas is the sparse population. The solutions include encouraging public-private and community partnerships, introducing information and communication technology and providing subsidy. The villagers in England require these six services to be within immediate access. Looked at from another angle, rural people do not expect these services from small urban centers. Rural people will however seek higher level services that include among others, secondary education institutions, and shops with wider range of goods and intra-regional transport from such centers.

3.5.2.4 Socio-economic Factors Affecting the Utilization of Small Rural Town Services: Commuting Issues

The socio-economic condition of the rural population plays a very important role in the effective functioning of small urban centers. These conditions may affect an individual's utilization of small urban center services. Pinkerton et al (1995) examine the effects of consumers' socioeconomic characteristics, personal location situations and community satisfaction on buying within the local community (in-shopping) against buying in other communities (out-shopping) for selected goods and services. The background of this study is the improvements in transportation and communication, which have expanded the choice for rural consumers in terms of shopping destination. Their data were obtained from two small rural communities in Northwestern Missouri in the USA. Their findings show that age is the socio-economic variable that is strongest in terms of its relation to satisfaction in shopping locally. Other variables included residential location, which can either be in the center or in the open country and the location of jobs.

Moseley (1979) points out the relationship between accessibility and the utilization of small urban centers. When rural residents own their cars, they tend to travel farther to gain higher order services. Nevertheless, there are some services that cannot be compromised with respect to distance. These include health and school services. Rural people usually prefer to have higher quality for services that are infrequently used. The utilization of these services is not so dependent on physical distance. Therefore, residents with higher mobility tend to out-shop or by-pass the small urban centers' services. Residents with limited mobility remain dependent on the village and market town services. In addition, if the service levels in the hinterland villages are lower compared to market towns, the transport links to market towns become more essential for rural people.

The issue of service level or quality difference also varies between each type of services (Powe and Shaw, 2004). In line with Moseley's findings, car-owners tend to seek higher quality of service in non-food retailing. This explains why they tend to bypass market town centers and shop in larger urban centers. However, the quality difference is not so much of a concern with respect to general practitioners or school services. Food retailing is also not sensitive to quality differences and thus, rural areas should try to have more of food retailing businesses. It is also important to carefully select the site for the supermarket, because it can become an anchor location for other services.

The deterrent of a late journey back from larger urban areas for evening entertainment may also provide opportunities to claw back services such as clubs, restaurants, cinemas and theaters. In addition, what is most important is the expectation that the rural people place on the services required. This will be determined by the level of modernity and the age. It is important to note that the more accessible the other towns are to the rural population, the higher the tendency for rural people to out-shop.

Bromley and Colin (2002) looked at the impact of the establishment of a new food superstore in Llanelli, South Wales UK, on shopping behavior. The disadvantaged consumers, consumers without cars and the elderly were already heavily reliant on town center shops prior to the opening of the superstore. From the survey, it was also found that the social "vitality" of the Llanelli town has increased. That is also the case for the shoppers' satisfaction with their shopping experience in the town. However, Bromley and

Colin have not found any sign of the multiplier effect such as the growth of related industries. The study confirms the relationship between mobility and utilization of services. In addition, the increase in social vitality shows the higher degree of expectation the population has placed on services, which can be satisfied through establishing a new superstore.

Findlay et al (2001) analyzed the mobility of rural residents in commuting to service provision centers and focuses on the association between migration, travel to work and travel to shop. Using a log-linear regression, they found that the journey to work is a defining variable in mobility. It was also found that commuting to work is likely to be associated with commuting for other activities such as shopping.

Moss et al (2004) investigated the employment commuting patterns of individuals living in the disadvantaged rural areas of Northern Ireland. The objective was to identify the key explanatory variables that are related to commuting distances. The study found that females tend to be working in the nearest towns rather than the village. They usually have public sector jobs, in particular in the health and education sectors. For males, employment tends to be concentrated in declining traditional industries and the distance traveled to work is considerably longer. The study suggested that mobility is crucial in providing access and maintaining employment for rural dwellers. Therefore, there is a need to have policies that improve the mobility of rural dwellers.

The location of employment greatly determines the patronage of local town centers by the rural population (Pinkerton et al, 1995 and Findlay et al, 2001). The location where people work affects the extent to which they out-shop. Out-shopping is defined as shopping activities outside the residents' small urban centers and villages.

Therefore, those who are retired tend to purchase goods and services in the town centers as they are within the close proximity.

Brueckner et al (2002) modelled local labor market by linking workers' skills and the physical space of cities. They found that firms tend to exploit the workers from both aspects. This is done by setting wages below the competitive level. This monopsony power is due to the fact that size of the firm's labor force is inversely related to the costs that the workers incur in commuting and acquiring skills. Therefore, the low waged workers are caught in the dilemma of not being able to invest in acquiring higher skills and traveling farther for work. This explains the emergence of socioeconomic ghettoes, because workers who possess low skills are unable to cope with high commuting costs.

Hazans (2004) found that in the Baltic countries, commuting leads to a reduction in the rural-urban wage gap and contributes to the increase in national output. This effect was quantitatively measured by estimating two sets of earning functions with location variables measured at the workplace and at the place of residence. For the Baltic countries, in places where commuting activities take place, the wage gap between the urban and rural areas is significantly lower. However, the actual outcomes also depended on the area-specific spatial patterns such as educational and occupational composition of the commuting flows as well as the presence or absence of wage discrimination against rural residents when competing in urban labor markets. Gender, ethnicity and local labor market conditions were also included in this study as the underlying factors that determine commuting decisions.

Powe and Shaw (2004) conducted a survey on Alnwick town in England. They observed the usage of the town for shopping and other services and related this usage with origin village amenities and personal socio-economic characteristics. The village amenities were measured by the population density, deprivation index, road distance, general store availability, pubs, general practitioners, meeting places and maximum days with bus to Alnwick. The socio-economic characteristics included employment status, place of work, occupation and journey to work. The services accessed included supermarket, other food shops, non-food shops, pubs, general services (district councils, health, insurance, solicitors, travel agents or banks), post-offices, markets, cinemas, theaters, cafes and restaurants. For evening entertainment, the usage was divided into theater, eating out, pubs, cinema, clubs and petrol/takeaways.

The motivation to visit is thus divided into going to the supermarkets, going to work, visiting other food shops and meeting friends. Their findings showed that 98% of respondents visited Alnwick in the past month and most had used a broad range of its services. The highest destination was the supermarket (78%), followed by general services (67%), other food shops (61%), non-food shops (46%), post-office (35%), market (30%), cafes and restaurants (28%), theater (18%), pubs (14%) and cinemas (13%). 86% of the respondents considered Alnwick as an important place to shop and 79% agree that Alnwick is an important place to access services. 42% of the respondents visited Alnwick in the evening and the mean age of these respondents was 51 years. For the whole sample, the mean age was 53. Going to the supermarket was the most popular motivation to visit the town (49%), followed by work (12%), other food shop (11%) and meeting friends (11%). Age and mobility were found to play an important role in the utilization of services.

When asked about suggestions on any improvements that would make Alnwick more desirable to visit, the proportion of residents that suggested improvement of the supermarket was 33%, parking (29%), shopping in general (17%), non-food shops (15%), bus service (8%), opening hours (5%), facilities for disabled (4%) and restaurants (3%). 61% of the out-shoppers for food were willing to shop in Alnwick if the supermarket is improved. 36% of the out-shoppers for non-food were willing to shop in Alnwick if shopping is improved.

These empirical findings have shown how personal socio-economic characteristics play a major role in the decision to utilize urban centers. There is a certain degree of expectation that a rural resident places on small urban centers and this varies between individuals according to their personal socio-economic characteristics.

3.6 Prospects Ahead & Strategies for the Development of Rural Towns

The idea of developing small urban centers is supported by various studies that show how it can provide leverage to the region's development. There are challenges and there are pre-conditions that must be met for such urban centers to function effectively. This section discusses the prospects ahead and the strategies to seize the opportunities and overcome external threats and internal weaknesses.

3.6.1 Off-Farm Employment

According to Esman (1978), in most developing countries, in addition to farming, rural workers spend 20 to 25% of their working hours in off-farm primary and secondary employment. These activities are very often closely linked to agriculture. Rhoda (1983) discussed two types of rural off-farm employment development activities. First was the rural nonagricultural enterprise which requires rural infrastructural development and are most likely to locate in small towns and market centers in order to gain access to other goods and services required as part of their backward and forward linkages. Second was the labor intensive rural public works that can provide jobs and satisfy the rural infrastructural needs such as roads, dams and irrigation, electricity, potable water, schools and other physical amenities. The maintenance activities needed to keep the infrastructure in proper condition can also create long term employment.

An interesting insight on the off-farm farming sector related industries can be found in the work of Broadway (2002). Broadway looked at the slaughtering industry in Great Britain and how it has evolved along with the changes in industrial hygiene regulations. In the past, slaughtering of cattle, sheep and pigs was an activity that could be widely dispersed with much of the work being completed in small butchers' shops. The demand for standardized products from restaurants, the hospitality industry and supermarkets, all of which have replaced butchers as consumers' primary source of meat, has encouraged the emergence of highly specialized companies to dominate the slaughtering industry. In addition, stricter industrial hygiene regulations also played a dominant role in the rise of these specialized companies. It is interesting to note that Broadway's findings indicate that despite these industrial changes, sheep and cattle slaughtering remains widely dispersed and only pig slaughtering has become more specialized with high level concentration in the western counties of England. The fact that these slaughtering activities remain dispersed is favorable to the effort to promote small urban centers. The economies of scale may still be unable to justify the escalations in transportation costs and thus, these industries may find it more profitable to locate nearer the animal farms.

Broadway (2002) also looked at the rural farming communities throughout the Prairies and Great Plains in the United States that have sought to attract value-added processing of agricultural products as means of economic development. The availability of cattle in the area has attracted the meatpacking industry and created thousands of low paying jobs. It has boosted the local agricultural industry through an increased demand for animals and feedstuff. Dalla et al (2005) also looked at the food industry. They used more recent data and found that stable year-round employment in the food-processing industry is the most significant factor in attracting immigrants to the rural Midwest in the USA.

3.6.2 Participating in the Service Industry

Kilkenny and Gale (1999) suggest possible market opportunities that may allow rural areas to participate in the service industry. As consumers in urban areas are demanding more intangible attributes in their food products, they are willing to pay a premium for these attributes. An example of such an attribute is organic farm products. Business and communities can tap this opportunity by creating brands associated with their particular region, production practice or other attributes that may allow for premium pricing. Rural areas can also utilize the advances in information technology to be in direct contact with urban consumers in selling their products and services.

In addition, the base employment in the food manufacturing sector can create more employment opportunities through the multiplier effect. The presence of food manufacturing leads to higher income for rural farmers due to higher margins arising from lower transport costs. The creation of employment also leads to creation of income for some members of the rural community. Both these activities result in higher income for rural people that increases spending and potential savings. Through the employment multiplier, food manufacturing will create demand through backward and forward linkages. Thus, despite generally low direct employment generation from food manufacturing, rural areas can still develop their economy through the employment multiplier effect. Rural areas should be able to tap this opportunity by supplying services to the food manufacturing or to further process the products of food manufacturing.

In addition, the increase in spending creates demand for more products and services. Rural areas should also be able to tap this opportunity. This can include the opening of services of higher quality that can satisfy the new demand from the employed rural population such as that of real estate, restaurants, supermarkets, entertainment, retailing and other services.

The potential saving can also be utilized by channeling them to finance investment in the rural areas. If we look at the rural area as an economy, saving serves as an important factor in the economic development of the rural area. The presence of financial institutions such as local banks plays an important role in keeping the surplus funds in the rural economy. Entrepreneurship is also an important ingredient in ensuring that surplus funds can be invested in the rural areas.

3.6.3 A Success Story from Thailand

Epstein and Jezeph (2001) looked at the Wangala area in Thailand and how the focused rural development project that utilizes the growth center has contributed to the rapid development of Wangala. According to Epstein and Jezeph, rural people usually prefer social cohesion in their small rural communities as opposed to the individualistic lifestyle prevailing in large cities. Therefore, to retain them in the rural area, access to sufficient income generating activities and reasonable standard of living are the necessary pre-conditions.

During the past 20 years, Wangala's economy has diversified in terms of tertiary industrial development. Wangala has managed to sustain the service sector because of the sufficient demand from within the village and the surrounding areas. The farmers enjoyed the higher profit reaped from higher soybean price and initiated the establishment of soybean mill to cut the costs of transporting the soybean to the mills in the other cities. The soybean industry eventually developed and the town is now equipped with modern banks, schools, traders, an extensive service industry and first class hospitals. Development strategies included the strengthening of local community organization, expansion of off-farm employment and rural enterprises, strengthening of rural finance market and improvement of natural resources management.

Epstein and Jezeph (2001) cite other examples of rural-urban industrial linkages in Taiwan and South Korea. In these countries, the urban manufacturing industry that produce consumer goods and small goods mainly for exports, rely on small factories with low overheads. This is made possible by linking the factories with rural domestic productive units. Villagers come to the cities to be trained in operating the machines and upon completion, the trained villagers return to their villages and use the machines for production on a hire-purchase agreement. To succeed, the rural area must have adequate infrastructure, which includes road networks, access to education, sanitary water, the primary health center, hospitals, banking and a stable supply of power.

According to Jezeph and Epstein, there are three levels in growth center strategies, which are the growth area, the growth center and the urban center. At the growth area, the strategy is to calculate the most effective and appropriate size of individual growth areas. Then, the growth center as the nuclei of the growth area is established to perform a two-way socioeconomic relationship with surrounding hinterland villages and to link the villages with the larger markets. The growth center also provides formal services to the villagers. For the urban center, the network linkages with the growth center are very important.

From the success story of Thailand's Wangala and the rural-urban industrial linkages in Taiwan and South Korea, we can observe the prospects in the development of small urban centers as growth centers for their respective growth areas. The key is to create a mutual linkage in human resources development that is facilitated by proper growth area strategy and adequate rural infrastructure.

3.7. Summary

The development of small urban centers or small urban centers is a way to integrate rural and urban areas into a functional region, thus facilitating more rapid growth of rural areas. The rural and urban centers as the growth centers are inseparable because a growth center enjoys economies of scale from its leverage as a service provider and from the industrial linkages with the surrounding hinterland.

The small urban center is a part of the hierarchy of urban centers. This allows small urban centers to participate as centers for urban service provision as one considers the relative centrality of the small urban centers to the hinterland. Small urban centers develop from value-added activities related to the primary activities in the hinterland, which in most cases is agriculture. Food manufacturing can only offer limited employment and thus, there is a need to channel local saving and attract investment to develop the service sector and marketing or retail activities. Empirical findings have shown how rural people are increasingly demanding better housing and amenities (refer to appendix 3 for a summary of this literature review).

The challenges are not easy to overcome, but the key is to simply come up with a clear policy and strong commitment on the part of the national government. The policies in developing small urban centers should involve participation from the rural population and the focus in national economic policy must not deviate away from encouraging diversification of the rural economies.

CHAPTER 4
THE CONCEPTUAL FRAMEWORK OF AGROPOLITAN DEVELOPMENT

4.1. The Definition of Agropolitan Development

Rural development initiatives are a response to the failure of urban-biased interregional developments (Lipton, 1977). The facts show that over-concentrating investments to the urban areas did not lead to a trickle down effect to the rural areas. To the extreme, there are ideas to minimize linkages with the urban economy, and to make the rural areas pursue self-sufficiency by maximizing its potentials. However, Rondinelli (1985) is against this idea. He argues that rural areas cannot replicate an urban economy, because population concentration is needed to justify the production of various goods and services needed to fulfill the people's needs and wants. Instead, sustainable rural economic growth should be pursued through specializing in the commodities in which the area has comparative advantage. By specializing, rural areas will also increase their market competitiveness. Nevertheless, specialization requires trade activities. Thus, rural areas must enhance their connectivity in the market network in order to bear the fruits of specialization.

Urban areas serve as the main nodes in a market network. Rural area connectivity in a market network will involve the flow of goods, services, people, knowledge and most importantly information. Nevertheless, an imbalanced flow may occur, and rural areas are most likely to be on the losing side for having less bargaining power. Only a balanced flow can contribute to a healthy rural-urban linkage. Under such conditions, rural areas can create the necessary value-addition to their commodities, hence earning sufficient income to further advance their possession of knowledge and information that in turn will help develop the local economy.

One way of overcoming the disparity in bargaining power that may disrupt the balance in the structure of rural-urban interaction is through the development of small urban areas or small urban centers. These small urban centers play a role as the provider of basic urban services and as the collectors and processors of rural produces. Rondinelli (1985) supports the idea of small urban center development in strengthening a healthy rural-urban linkage. He argues that there are three main reasons behind the detrimental impacts of existing rural-urban linkages pattern to the rural areas. These are the lack of accessible small urban centers, the inadequate provision of facilities for the rural areas and the isolation between settlements in the rural areas.

Friedmann and Douglass (1975) propose an Agropolitan approach in developing small urban centers. This approach involves the concentration of development programs to a rural area with a population size between 50,000 to 150,000 people. According to Pradhan (2003), the Agropolitan approach is modeled upon Mao Tse Tung's rural development strategy in China, which decentralized the authority for planning and decision making to rural people. In return, the rural people have to bear full responsibility for their respective area development. This approach also relies on careful location decision, which is crucial in enhancing rural access to urban amenities.

Indonesia was the first country to fully adopt the Agropolitan approach. The Ministry of Agriculture (MoA) and the Ministry of Public Works (MPW) play the leading roles in the development of Agropolitan Centers. However, there have been various perspectives in defining Agropolitan development. The MoA defines Agropolitan as an agricultural-based town that grows and develops to support the development of agro-business system and commercial activities, which in turn serves, attracts, supports and encourages agro-business development in its surrounding rural hinterland. The MoA definition distinguishes Agropolitan development and an Agropolitan region. Agropolitan region is defined as a system of agricultural-based towns and the surrounding rural producers. The region's boundaries are not drawn according to administrative jurisdiction as instead it is determined based on economies of scale. Thus, the Indonesian MoA defines the development of an Agropolitan region as an agricultural-based economic development in an agro-business region, which is designed and implemented through synergizing various potentials to encourage the development of a competitive agro-business system. The system must be people-based, sustainable, decentralized, performed by the local people with the support of the government (*Agropolitan*, 2002).

The MoA definitions tend to show that Agropolitan merely involves the development of urban facilities in rural areas. Provision of urban facilities such as electricity, roads, warehouses, markets are considered sufficient to transform rural areas into agricultural-based towns. Having urban facilities is considered as the main precondition for the development of agricultural activities that in turn improves farmers' welfare. This definition is not incorrect, however, it may be oversimplifying the actual process. The original idea of Agropolitan development is a response to urban-biased regional development, hence the focus on strengthening rural-urban linkages. Thus, the relativity of rural region development in connection with the urban areas must be taken into account.

It is important to consider other definitions of Agropolitan development in finding a richer definition. Saefulhakim (2004) defines Agropolitan development by breaking the term into two terms, agro and metropolis. Agro in Latin means a managed land or crop cultivation. Metropolis refers to a central point of various activities. Therefore, Agropolis or Agro-metropolis can be defined as a central point that serves agricultural-based economic centers. The development of Agropolitan can thus be defined as the development of various aspects that support the role of an Agropolis as a service center for a region consisting of agricultural-based economic activity.

According to Anwar (2004), Agropolitan regions can be defined as central places that have a hierarchical structure. An Agropolis in particular is referred to as micro-urban-villages that can grow and develop due to its function of coordinating the main activities of agro-business main activities. Therefore, an Agropolitan region can be defined as a functional system consisting of one or more agricultural-based urban areas in a particular agricultural region, which is characterized by the existence of a spatial hierarchy for farmers' settlements units. The spatial hierarchy is composed of an Agropolitan center and surrounding production centers.

According to Rustiadi (2004), Agropolitan development is a model that relies on decentralization and urban infrastructure provision in rural areas, all of which lead to urbanization. In this case, urbanization is seen as a positive aspect, in which the rural areas experience transformation towards becoming urban. This in turn helps overcome the diseconomies of scale associated with urban developments, such as excessive migration to the urban areas, pollution, traffic congestions, slums and squatter settlements and resource depletions.

Combining the various definitions, we can define the term Agropolitan as follows:

1. An Agropolitan region is a region based on a functional system that consists of one or more agricultural-based urban areas (agropolis) in a particular agricultural producing region, which is in turn characterized by the existence of a functional linkage system and a spatial hierarchy of settlements, productive units and agro-business systems. This region can be created with or without formal planning.
2. An agropolis is a central location that serves the surrounding agricultural-based economic activities centers.
3. Agropolitan development is a rural development approach that features the development of agricultural-based urban areas (Agropolis) as a part of an urban system, with the objective of creating a balanced regional development through a synergetic rural-urban linkage.

4.2. The Objective of Agropolitan Development

With reference to the background and definition of the term Agropolitan, we can define the objectives of Agropolitan development within the context of interregional development as follows:

1. Creating balanced rural-urban development;
2. Improving the synergetic rural-urban linkages;
3. Developing the economy and environment of agricultural-based rural settlements;

4. Growth and revitalization of small urban centers;
5. Diversification and widening of income and welfare bases;
6. Realizing an autonomous and self-reliant rural area;
7. Filtering the excessive rural-urban migration (contributes to solving urban social problems);
8. Recovering the natural resources and environment;
9. Developing leading processed agricultural commodities;
10. Providing adequate settlement' infrastructure and facilities to an urban standard;
11. Providing adequate production infrastructure and facilities that are accessible to the local people.

4.3. The Criteria of Agropolitan Development

With reference to the definitions and objectives of Agropolitan region development, we can list the criteria in determining the characteristics of an Agropolitan development region as follows:

Agropolitan regions should

1. Possesses adequate carrying capacity including suitability of soil and agro-climate,
2. Have leading processed agricultural commodities,
3. The sizes of the area and population should meet the requirement for economies of scale (ideally with a radius of up to 10 kms and may consist of villages from one or up to three different sub-districts),
4. Urban settlement infrastructure and facilities,
5. Have production infrastructure and facilities that are accessible to the local people,

6. Contain one or more small scale urban function centers that are integrated functionally with the surrounding agricultural producing areas,
7. Have management systems with adequate autonomy,
8. Have a planned and controlled spatial arrangements system,
9. Enable the development of secondary (manufacturing) and tertiary (services) sectors,
10. Have strong local community economic institutions,
11. Have adequate access to economic resources for the local people.

Criteria for an Agropolis (Agricultural-Based Urban Growth Center)

1. The center of settlements with the highest accessibility internally (with other areas within the Agropolitan region) and externally (with other urban centers),
2. The center of activities for processing and distribution of farm produce, which is characterized by the concentration of agro-business facilities and institutions.

4.4. The Components of Agropolitan Development

According to Rondinelli (1985), the development of Agropolitan systems in rural region is basically directed towards increasing agricultural productivity and sales. This is achieved through supporting the growth of small to medium scale agro-processing industries as well as promoting diversification of economic activities in the market center. These activities must however be organized to construct a synergetic linkage between the urban industries and the rural farms. This linkage involves the provision of facilities, services, farm inputs and accessibility for the rural settlements, particularly in overcoming the high cost of provision per resident due to the sparse population.

Road investments are very important in linking the market center with the region's economic centers. However, since the accessibility of the market center or small urban center from the villages is high, the development of roads linking the market center and the villages need not be at a level that is required for interregional transport. Specific attentions must be paid to the provision of water, housing, health facilities and social services at the small urban center, which are crucial in improving labor productivity.

Off-farm employments and urban amenities must also be available, as they help in discouraging migrations to locations outside the region. According to Anwar (2001), small urban areas can be developed through the policy of giving attractive economic incentives. The development of small urban areas (micropolitan centers) involves the provision of public facilities, including also, in addition to the above-mentioned amenities, an entertainment center, electricity, financial institutions, educational institutions, open spaces and gardens, waste disposal system and communication systems.

According to de Jong (1988), the roles that must be played by the small urban center in promoting rural development are as follows:

1. Center to provide durable and non-durable goods,
2. Center for public and private services,
3. Linkage to the larger markets for rural produces,
4. Supply center for production factors,
5. Center for agro-processing,
6. Center for knowledge and information.

Anwar (2001) argues that the most important role of infrastructure provision in small urban centers is in reducing the disparity between the productivity of farming and non-farm sectors through improving human capital, social capital and technological applications in the surrounding rural hinterland. The development of non-farm sectors can contribute to lower unemployment and better trade balance. This is however largely determined by the ability to promote competitive advantages in the area's main products, which should ideally be benchmarked to fulfill not only national standards, but also international standards. There is thus a need to make use of the area's comparative advantages, which are subject to the ecosystem conditions. Therefore, the provision of infrastructure and agro-business system development must conform to the ecosystem conditions and the local needs. The necessary components of an Agropolitan region are listed in table 4.1.

Table 4.1. Systems in Agropolitan Region

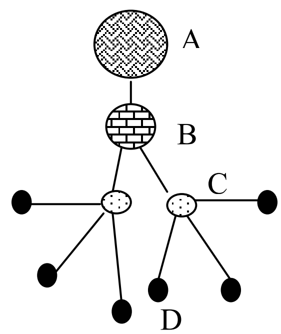
	Settlement System	**Agro-Business System**
Main Urban Function Center	Local Activities Center, Clean Water Provision, Wastewater Treatment, Telecommunication, Detailed Spatial Arrangements Plan	Agricultural Market, Supporting Branch for Banks, Farming Support Center, Agro-industry Center, Agropolitan Management Office

Source: Rustiadi, et al (2005)

Although the existence of small urban center can help promote rural development, another factor that must be taken into account is the spatial pattern that includes the road network within the region and that which links the region and the other cities. According to Smith (1976), the spatial patterns that often put rural areas at the disadvantage are the denritic, solar and network systems.

The solar system is a pattern where a large urban area is directly adjacent to the rural areas. The Network system is a pattern where there is no center of activities. Both these systems are unlikely to appear in an Agropolitan. However, the argument that denritic system may put rural areas at a disadvantage contradicts the concept of Agropolitan. The dendritic system is a pattern that can be illustrated as shown in Figure 4.1. The argument against a dendritic system is based on the assumption that there must be choices present for economic activities center to forward link their products. However, the Agropolitan concept relies on having one small urban center to serve the rural hinterland efficiently.

Figure 4.1. Dendritic Regional System



Legend:
Large City : A
Medium City : B
Small Cities : C
Rural Areas : D

Source: Rustiadi et al (2005)

The argument that a monopoly of power by one market center may put rural areas at a disadvantage is plausible. Nevertheless, the alternative of having more than one market centers to give choices for rural producers may not be feasible. One way of overcoming this is to improve linkages between the rural producers. This may facilitate the seamless flow of information that is crucial in increasing rural bargaining power, and providing choices for forward linkage. Intervillage transport links can however be developed at a later stage, due to the costs involved and the low necessity at the early stage of an Agropolitan development.

CHAPTER 5
RESEARCH METHODOLOGY

5.1 Introduction

This chapter describes the methodologies for the empirical analysis. There are three main empirical analyses in this research. First, the role of accessibility in the growth of the urban area in the research area is investigated. This analysis looks at whether accessibility is an important determinant of urban growth. Second, we analyze the industrial linkages in the research area are analysed in order to look at the spatial pattern of the linkages and how this pattern shows the rural-urban linkages within the research area. Third, we analyze the relationship between the various socio-economic factors and an individual's level of utilization of the small urban center is analysed. The results of this analysis will be used to define an effective agricultural-based small urban center.

5.2 Investigating the Role of Accessibility in Urban Growth

5.2.1 Theoretical Background

There is no dispute about the role of accessibility in urban growth. Accessibility is defined as the degree of mobility, which includes the mobility of people, freight as well as information (Rodrigue, 2004). When an area is considered to be more accessible than other areas, the elements that are usually considered are location and distance. Location is a relativity of space that is estimated in relation to transport infrastructure. Distance is derived from connectivity between locations where connectivity can only exist given the availability of means that link the two locations, which is transportation.

Nevertheless, accessibility does not guarantee that an urban area will automatically benefit from growth. Another important factor is the economic potential of the urban area's hinterland or catchment area. This factor largely determines the economies of scale that can be achieved when the urban area has a concentration of higher order economic activities within the vertical industrial linkage, such as manufacturing using the hinterland's produce as the raw materials. According to Lampard (1955) urban growth that is fueled by industrialization is mainly due to the absence of substantial transport costs that allows for concentration of activities.

Basquero (2006) discussed the development of peripheral cities, taking Vigo city of Galicia, a peripheral region of the European Union, as the research object. Basquero sees the growth of such cities being determined mainly by the inherent development potential and their accessibility to markets. The urban growth in Vigo city is a product of externalities arising from concentration of activities that benefit from significant reduction in transport costs as a result of accessibility. Johnson (2002) also observed the effect of geographical accessibility by using data from Multi-City Study on Urban Equality (MCSUI) Household and Employer Surveys in Atlanta, Boston and Los Angeles. However, this focus is more on the employment opportunities. Johnson found that job search outcomes are affected by the interaction of the degree of residential location constraints and the proximity to employment opportunities. Yan (2005) looked at the five dimensions of a compact urban development, which include street network connectivity, density, land use mix, pedestrian walkability and accessibility. Using Portland, Orange County and Montgomery County in the USA as the study areas, Yan found that all three areas showed similar development patterns, indicating accessibility as being important among the factors inherent in these three areas' urban growth.

In India, the prohibitive costs of setting up shops in urban areas have led to industries relocating to smaller and medium towns. The improvement in physical infrastructure that leads to greater accessibility, for example, the Airport Road link experienced by the Whitefield area in the peripheral of Bangalore, brings about urban growth to these periphery areas. This shows the importance of accessibility not only between the urban area and its catchments, but also between the urban area and the regional growth center. Industries locating in semi-urban areas and rural areas also benefited from the large pool of labor that would usually migrate to urban areas in search of jobs as indicated by the National Institute of Urban Affairs' 1991 data (Sridhar, 2001). Therefore, the government's investment in accessibility-improving infrastructure would indirectly benefit firms in real estate and induce growth in new urban areas.

An interesting study by Kumar and David (1997) analyzed the commuting behavior across US cities. It shows that markets react to high interaction costs in large cities by increasing density rather than density being a cause of high interaction costs. Kumar and David saw density increase as a way of substituting for city size. By regressing the mode of travel on commuting time, speed and distance, they found that the higher the density, the lower the speed and the shorter the distance required. The significance of Kumar and David's study is the possibility that as a substitute to city size that is limited by the degree of accessibility, a process of density increase will take place to augment city size. Nevertheless, it is important to keep in mind the trade-off in terms of congestion and thus lower speed for journey to work.

Appraisers have included accessibility among the major forces to be considered when forecasting urban growth paths. Four theories of land use patterns may explain the directions of such growth (Martin, 1984). The four theories include concentric zone theory, sectoral theory, multiple nuclei theory and radial corridor theory. These theories predict the directions of urban growth. As far as accessibility is concerned, the concentric zone theory and the radial corridor theory are consistent with the idea of extending a radius line and drawing a circumference to identify the areas of potential growth.

The 1950s and 1960s were the era when many manufacturing businesses in the USA moved from the urban centers to the suburban sites and smaller cities. Some urban cities, however, remained attractive for manufacturers because of the centrality of the location to a large pool of workforce, the proximity to research and knowledge centers as well as good transport and accessibility to markets and suppliers (Martin, 1983).

During the 1970s, non-metropolitan areas in the US experienced population and workforce growth. This was due to the desire of the residents to benefit from urban or urban-type services and the preference to avoid the difficulties associated with urban residence, such as congestion. Herzog and Bjornstad (1982) tested the migration decision model based on the proximity-centrality relationship using gross migration rate as the dependent variable and age as one of the independent variables. The result conforms to the proximity-centrality hypothesis on the relationship between age and migration decision. The younger citizens are willing to compensate for the lack of accessibility as opposed to the older citizens. The changes of spatial patterns of accessibility in the 1960s also helped trigger the rural renaissance in the 1970s.

Gamzon (1981) looked at the meshing of urban and suburban real estate markets due to the changes in the corporate perspectives. Companies have begun focusing on the inner cities or the core of the region as the solid corporate base location. The core area has also become an important source of tax revenue. At the same time, companies have improved the accessibility of the suburban areas or the hinterland to the core area to allow for the distribution of benefits of economic and social development. This is facilitated by the growth of residential areas in the hinterland. For Gamzon, the accessibility is not seen from hinterland to the core area, but rather from the core area to its surrounding hinterland. The diffusion of growth will be determined by the accessibility of a particular area within the hinterland to the urban core of the region. Gamzon also states that the firms with industrial or manufacturing operations will be particularly attracted to cities offering accessibility.

5.2.2 Methodology for Investigating Accessibility

Based on these considerations, geographical accessibility can be measured using various methods. These methods have been discussed in Chapter 2. This thesis uses the geographical accessibility matrix to measure the accessibility of each village within the region and to see whether the villages that constitute the small urban center[8] have the highest accessibility. There are limitations to this model, as a detailed analysis would involve looking at conflict areas that would arise due to intersections and other hindrances. The physical contour of the area would also determine the accessibility. The quality of pavements also serves as an important indicator for accessibility.

In addition, the measurement of accessibility should consider the importance of each node in the region, which in this case, is the village. Each village may differ in importance as they have different population sizes and fertile land. Therefore,

[8] A rural town is the small urban part of the region that is surrounded by rural villages as the hinterland. The small urban center is usually composed of one or more villages within the region that is characterized by the presence of urban amenities.

accessibility is also measured relative to each node's importance. According to Rodrigue (2004), such a relative measurement of accessibility is called the potential accessibility (refer to equation 2.21 and 2.22 in Chapter 2 for the measurement of accessibility).

5.3 Analysis of the Spatial Pattern of Industrial Linkages

5.3.1 Theoretical Background

Weber (1909) looked at the locational structure of an urban area that shows a correspondence between the concentric layers or rings[9] and the types of economic activities that take place in the respective layers. Both von Thunen (1826) and Weber related the type of economic activities to the concentric rings. However, von Thunen focused more on the existing arrangements while Weber described more the process of growth of the settlements. In von Thunen, secondary and tertiary economic sectors are the main features of the economy's growth center, but Weber shows that initially, low value added activities began at the future center of the economy. In Weber's model, the growth of an urban area takes place starting from the outer concentric ring and progresses to the inner concentric ring along with the creation of secondary activities. As the process continues, a growth center is created from the meeting point in the center point of the urban region which is depicted as taking a circular form. In Weber's model, the growth center arises out of the need for secondary and tertiary goods and subsequently, the need to organize these economic activities.

These two pioneer theorists of urban development show the importance of industrial linkage in facilitating the growth of an urban center. In the absence of industrial linkages, urban growth is unlikely to happen. The growth of an urban area requires that

[9] An urban area is depicted to be composed of a growth center at the center of the circle and concentric rings starting from the innermost to the outermost part of the urban area.

there are derivative economic activities[10] in the main economic sector of the area. Therefore, an analysis of industrial linkage is important in identifying whether an area demonstrates the characteristics of a functional region, with local resource-based urban area as the growth center. Weber (1909) also developed the location theory to investigate the location decision of industrial firms. Weber found that firms choose their location based on two objectives, which are minimizing cost of serving a particular consumption site and minimizing the cost of raw materials or input acquisition. This choice has its trade-off that leads us to the classic Weber triangle problem. The role of a growth center in solving Weber's triangle problem is in minimizing the overall cost. However, even with the presence of a growth center, the two conditions of cost-minimization cannot be satisfied simultaneously. Hence, it is important to look at the nature of industry to prioritize which cost is to be minimized.

Christaller (1933) and Losch (1938) used the central location theory to maximize the numbers of consumers under service coverage. However, this view tends to be biased towards the view that market is the most important factor in industrial location. Isard (1956) looked at Zipf's (1949) study on the gravity model, which focuses on population size and distance. Again, this model tends to emphasize the market because population size is an indicator of market size. Weber proposed that location decision of firms be based on the nature of the industry. If the industry has significant cost proportion for raw material input compared to the cost of distributing the products to consumers, the industry should locate in areas near the source of raw materials. In contrast, if the

[10] Derivative economic activities are secondary and tertiary activities that are related to the primary activities. The secondary activities usually use inputs from the primary activities.

industry has significant cost proportion for sales and distribution, the industry should locate in areas that maximize the consumer catchments.

The economic base model and the multiplier model (Davis, 1990) give an explanation on how industrial linkages can lead to benefits from urban growth. Industrial linkages allow for the operations of secondary and tertiary sector activities, which are linked to the primary commodities produced in the area. The spatial pattern of industrial linkages shows how the region functions and the potential urban growth that stem from the linkages. In the case of an Agropolitan region, the location of a growth center that is within close proximity to the rural villages implies that the activities in growth center place heavy importance on locating near source of raw materials. Therefore, the ratio of the industry's acquisition of raw materials to the total cost should be high.

5.3.2 Indices for Industrial Linkage Analysis

The input-output matrix shows a linear relation between inputs and outputs of each sector in the economy and consists of a system of simultaneous equations that describe the supply of and demand for each sector's output (Mouhamed, 2000). This matrix can be used to analyze the structural interdependence among various economic sectors in the local Agropolitan region.

In the case of an Agropolitan regim, the input-output matrix divides the local economy into various economic sectors producing different outputs, in which each sector requires specific amounts and combinations of inputs that are produced by other industries to produce its own output. Thus, the interdependence among the various economic sectors in the local Agropolitan region is investigated by describing the inter-sectoral flows of inputs and outputs in the Agropolitan economy.

The reason for conducting an investigation of interdependence among economic sectors is to analyze the backward and forward linkages. The influence of industrial linkages upon location decisions and economic growth has been the main focus in spatial economic research. This includes previous studies by Britton (1969), Karaska (1969), Richter (1969) and Streit (1969), which look at the relationships between inter-linked economic sectors and the geographical association to investigate the role of such linkages in agglomeration. The force of agglomeration plays a crucial role in planned spatial growth, in particular, for programs involving growth poles. The Agropolitan concept uses the concept of a growth pole by placing heavy emphasis on the development of growth pole villages as the engine of growth for the hinterland villages.

The study by Schmidt (1975) provides great insights on how to conduct input-output analysis to establish the linkage matrix without relying on macroeconomic data, using firm-level data as the basis for survey (refer to Table 1 of Appendix 4). This is also known as the micro-linkage study that helps in understanding the firm's locational adjustment and transmission of growth through the spatial economy. Schmidt looked at the industrial linkages in the production of iron and steel by Pacific Northwest mills, fabricators, and foundries in the USA. These key industry players produced iron and steel by re-melting scraps in electric furnaces. After World War II, steel plates utilized in ship production, which were also the important product of the Northwest Pacific mills, are no longer in high demand. Instead, the market is now dominated by the regional construction sector that is characterized by small regional markets for certain shapes of steel. This changing environment provided an opportunity for Schmidt to analyze the changes in the industrial linkages along with changing market conditions.

Schmidt analyzed the steel industry's industrial linkages by observing the firms' linkage pattern, which he classified into three types, backward-linked, forward-linked or intermediate-linked (refer to Table 2 of Appendix 4). Forward-linked firms supply relatively large amount of output to other firms in the economy. Backward-linked firms purchase large amount of inputs from other firms in the economy. Intermediate-linked firms have a balance between the amount of supply to and purchase from other firms in the economy. The firms included in the analysis were firm A (iron-foundry), firm B (iron-steel foundry), firm C (iron-steel foundry), firm D (iron-steel foundry), firm E (fabricator), firm F (fabricator) and firm G (foundry/manufacturing) in the Pacific Northwest area. Comparison was made with the iron and steel industries in Puget Sound in Washington, Oregon and with the USA as a whole.

In analyzing the linkage patterns, two ratio measures were used. The μ ratio measures the level of dependence of the firm upon other firms for inputs. It is given by the ratio of purchased inputs to the value of total production. The ω ratio measures the level of interdependence of the firm with other firms as consumers of output that is measured by the ratio of intermediate sales to total demand (refer to table 3 of appendix 4). Backward-linked firms would have low values of ω, while forward-linked firms would have low values of μ. A low μ can be an indicator of the high value-added in the industry's outputs.

Schmidt described the spatial interdependence measures indicated by $\boldsymbol{I}_{\mathrm{j}}$ and $\boldsymbol{E}_{\mathrm{j}}$ as measures for the aggregate spatial linkage orientation of the firms. $\boldsymbol{I}_{\mathrm{j}}$ is a measure of the ratio of inputs purchased from firms outside the region to the total purchases. It is called the import coefficient. $\boldsymbol{E}_{\mathrm{j}}$ is the spatial output coefficient that is measured by the proportion of total sales exported by the firm. Using these two indicators, Schmidt was able to determine whether the firm in the region is local market oriented or national/international market oriented. The two indicators also measure the dependence of the firms on the inputs from sources outside the region.

Schmidt identified three basic forms of change in technical orientation of firms, based on the measurement he used for the steel industry. First is the shift in the mix of material purchases and outputs that leads to changes in the sectoral orientation of the firm. Second are the changes in the number of firms or sectors in which the firm maintains contact that is accompanied or unaccompanied by change in the product mix. The last one is the variation in the magnitude or frequency of input-output transactions with an individual firm. All these three changes in technical orientation of firms lead to variations in the length, number and magnitude of input-output contacts in a spatial context.

Schmidt used a more complex measurement of β (beta), ι (iota), π (phi) and η (eta) indices to examine the linkage patterns and changes in the linkage structure of the steel firms. These indices measure the linkage network complexity, the concentration of flows and the spatial expansion of supply areas and markets, respectively.

The β index is a simple measure of the relationship between two individual elements of a network that is given by the ratio of the number of edges (or links) to the number of vertices in the network. A higher β value means a greater number of supply sources and markets. Thus, it measures the complexity of the spatial structure.

The ι index measures the magnitude or density of flows relative to the total mileage within the linkage system. The ι index is the ratio of the total mileage of a linkage network (M) to the level of total purchases or sales (T) of a firm. It can also be defined as the average distance per local currency unit (LCU) of purchases or sales. By computing the reciprocal of the index (1/ ι), we can obtain the average LCU purchases or sales per mile. A larger 1/ ι index indicates greater magnitude of flow per mile of the network.

The π index measures the relationship between the linkage network as a whole and specific edges of the network. It shows the relationship between the total mileage of the network (*c*) and the length of the longest edge or flow (*d*). The π index indicates the shape of the linkage in the network. If the π ratio is high, we can expect a more spatially dispersed flow having more channels of distribution. Thus, the index serves as an effective measure of spatial dispersal or concentration in the linkage pattern of the firms.

The η index measures the average length of network linkages. The η index is simply the ratio of total mileage of the linkage flows to the number of edges. The η index can also be expressed as follows:

$$\eta_{\omega} = \sum[(s)(d)/ke]. \qquad [5.1]$$

Where

s: volume of sales of each link and *d* is the length of the linkage.

k: is the computational constant (10^{-9}) and *e* is the number of edges.

This formula allows the measurement of strength or magnitude of the spatial flows network. The η_{ω} index serves as a composite measure of the geographical market size and volume of sales (or purchases). A higher value of η_{ω} indicates a higher average volume and length of flow.

The work of Schmidt provides useful insights in analyzing the spatial pattern of industrial linkages in an agglomeration economy. The indices and ratios serve as useful indicators in assessing how the spatial industrial linkage pattern in the area conforms to the Agropolitan model. Furthermore, Schmidt's method does not need macro-data. To apply this model, a primary research on firm linkage patterns is necessary.

In this thesis, I used Schmidt's graph theoretical analysis to analyze the Agropolitan's industrial linkages pattern. However, instead of performing the time series analysis or comparison between changing market conditions, this research looks at the existing spatial pattern of industrial linkages. The objective of this analysis is to investigate the spatial pattern of industrial linkages for the economic sectors that are related to the main agricultural commodities of the research area. In an Agropolitan region, the main agricultural commodities must be produced by most of the villages in the area, and the products must be further processed into value-added goods. There needs to be an interaction between the villages and the small urban center or Agropolis. It is the interaction between these villages and the small urban center that is central to the effective functioning of an Agropolitan region.

There are steps to be followed in analyzing the spatial pattern of industrial linkages. Since the focus is on spatial pattern, geographical location is very important. The first step is to define the nodes within the research area. The nodes should include an agropolis or small urban center node and village nodes. The practical application of this step is to assign one node for the small urban center, and one node for each village within the research area that is outside the small urban center. The next step is to define the industrial or economic sectors that are part of the industrial linkages. These usually include farming activities in the villages and post-farming activities that can take place either in the villages or the small urban center. In terms of forward linkages, each activity at the village level has possible actions. These include supplying for local consumption, local processing, consumption in other villages, consumption in the small urban center, processing in the small urban center, consumption outside the small urban center and villages as well as processing outside the small urban center and villages. Each activity has possible links that are counted up as the total possible links. If the activity supplies to all the possible links, its linkage pattern is spatially dispersed and more complex. If it supplies to a small percentage of the possible links, the linkage pattern is spatially concentrated and less complex. This is measured by the β index in Schmidt's graph theoretical analysis.

Since the central element of this analysis is the forward linkage between the activities that take place in each node and the possible links in the network, each node for each village will be further grouped according to the economic sectors that are present in the village. These include one node for each commodity related to the area's main commodity, one node for each supplementary activities or processing activities and one node for the household sector as the consumer of the goods and services. For example, if there are activities 1 and 2 in village *A*, village *A* has two economic units, which are the village *A*'s activity 1 unit and village *A*'s activity 2 unit. If activity 1 also takes place in village *B*, then there is another economic unit named village *B*'s activity 1 unit.

This research also looks at the distance traveled between each links. If activity 1 in village *A* supplies to activity 1 in village *B*, the distance traveled is measured by looking at the actual distance between village *A* and *B*. The value of the supply is also included in the analysis. Since the research area in Indonesia uses rupiah (Rp) as the local currency unit, our research uses rupiah (Rp) in calculating the indices. Thus, if the value of the goods supplied from village *A* to village *B* is Rp1 million, and the distance between *A* and *B* is 10 kms, this means it takes 10 kms to transport Rp1 million worth of goods or in other words, the average rupiah per distance travelled is Rp100,000 per km. In the analysis, the focus is on the aggregated score. Thus, all the supplies (hereto referred as edges) are summed up in terms of their distance and value of goods. The total value for all the edges divided by the total distance gives the economic unit's average rupiah per distance travelled. This is called the 1/ ι index in Schmidt's graph theoretical analysis and is a measure of the magnitude or density of flow.

The measure of spatial concentration can also be expressed by the ratio between the total length that is obtained by summing up the total distance of all the economic unit's edges and the length of the longest edge. A lower ratio shows more domination by one edge or link in the network, while a higher ratio shows lower degree of domination. The more dominant one edge is to the total linkage, the more concentrated the industrial linkage. Similarly, the less dominant one edge is to the total linkage, the less concentrated the industrial linkage. This is expressed by the π index in Schmidt's analysis. The ratio between the total distance of all the economic unit's edges and the number of edges gives the average length of each link or edge for that particular economic unit. This is a measure of the length of flow and is expressed using the η index in Schmidt's analysis of linkages.

The η_{ϖ} index is important as it measures the geographical market size and gives an idea of how big the market is for that particular economic unit. This is measured first by multiplying the value of goods transported for each edge with the distance for each edge. Next, the multiplied values are summed up and divided by the total number of edges for that particular economic unit. A higher η_{ω} index shows a larger market in terms of geographical size and value of transactions.

The hypothesis in this analysis is that rural villages are expected to have linkages pattern characterized by low complexity, high concentration, while the small urban center is expected to have linkages pattern characterized by high complexity and low concentration. However, the concept of an Agropolitan does not require the small urban center to be necessarily more dominant in terms of value of goods supplied. Hence, the forward linkages of the small urban center may not always be higher than those of the rural villages. Instead, if rural villages have higher $1/\iota$ and η_{ω} indices, there is a more balanced rural-urban interaction, because the small urban center does not dominate the economy.

5.4 The Relationship between the Socio-Economic Factors and the Individual's Level of Use of the Rural Town

5.4.1 Theoretical Background

The effective functioning of an agro-based city or small urban center in serving as the collector for rural produce and the distributor of urban services relies heavily on the extent to which the small urban center is being used by the villagers. Gaile (1992) found that market-based development of small towns helps the expansion of market-based agricultural activities and non-farm employment opportunities. Trager (1979 and 1988) sees service-providing market towns as a tool for preventing rural population from migrating to large urban or metropolitan areas. Thus, if the villagers' level of use of small urban center is low, the town may not function effectively, particularly when one considers the need to have enough catchments for a feasible scale of operation.

Hardoy and Satterthwaite (1988) highlight the main issue in the effectiveness of small and intermediate urban centers, which is the expectation that the rural people place on these urban centers. Owusu and Lund (2004) found that for Ghana, the people see the development of markets in the district's capital as a beneficial thing that can lead to increased rural income through agricultural improvements. The expectation of rural people with regard to the effectiveness of small urban center has been a major issue in research on rural economic development.

Pinkerton et al. (1995) found that for Missouri, USA, age is the most important socio-economic variable that determines the satisfaction of shopping for goods and services within the locality. Other variables include the residential and employment locations. Moseley (1979) found that there is a relationship between ownership of cars and the tendency to travel farther to gain access to services that are of higher quality and not routinely consumed. The level of services in the hinterland villages also determines the utilization of services in the small urban center. Powe and Shaw (2004) see a pattern in the villagers' decision to consume higher quality services or wider assortment of goods from larger and farther towns. This pattern corresponds with the varying characteristics of the goods and services.

Powe and Shaw (2004) found that potential services that can be offered by small urban centers to substitute for the consumption in larger towns. These include restaurants, evening entertainments and food retailing. However, the demand for secondary and tertiary goods and services is determined by the level of modernity and age. Higher accessibility of other towns may also create a higher tendency for rural population to shop outside the small urban center.

These findings which are discussed in Chapter 3 are the basis for constructing the present research model, used in investigating the relationship between socio-economic background of the villagers and their respective level of utilization of urban services in the small urban center. I was privileged to have been given the kind support from Neil Powe of the University of Newcastle, UK, of the questionnaire he used in analyzing the small urban center effectiveness in Alnwick. The present research combines the findings from the literature review with the questionnaire from Neil Powe and another questionnaire from Kasikoen (2004) on rural-urban linkages in West Java.

The author is also privileged to have been given the kind support from the National Spatial Planning team of the Indonesian Ministry of Public Works, who made constructive suggestions to improve the questionnaire. The questionnaire is written in Bahasa Indonesia and has been examined to ensure its relevance to the local conditions in the research area. The questionnaire contains eleven main sections. The design of the questionnaire is directed towards providing data for the structural equation modeling (SEM), which is the statistical tool used in investigating the relationship between the dependent and independent variables.

5.4.2 Structural Equation Modeling

According to Bagozzi and Fornell (1982), structural equation modeling (SEM) is a second generation multivariate analysis that allows researchers to test relationships between complex recursive or non-recursive variables. According to Bollen (1989), unlike normal multivariate analysis, SEM can test simultaneously:

1. The relationship between independent and dependent construct[11] variables (structural model); and
2. Relationships (loading factor, λ) between indicators (manifest variable, η) with construct variable (latent variable, ξ) (measurement model)

The combination of structural model and measurement model allows the researcher to test measurement error and to simultaneously perform factor analysis and hypothesis testing. The relationship between the indicators and the construct variable (variables that cannot be directly measured and require proxies) is a fundamental component of SEM. The indicators acting as proxies are called manifest variables. In the model, there are independent variables and dependent variables, which in SEM are called as exogenous and endogenous variables, respectively. Since latent variable measured by many indicators are incorporated in the model, a normal linear regression model cannot be used. The SEM concept relies heavily on error measurement (Ghozali, 2005).

The SEM serves two main objectives. First, it determines the plausibility or how best-fit the model is, based on the data used. Second, it tests the various hypotheses that have been previously constructed. The level of fit is determined by the difference between the sample covariance matrix and the implied covariance matrix. In simple terms, the sample covariance matrix represents the actual data and the implied covariance matrix represents the model or how the data should be if the model is perfectly true. A brief explanation of the SEM is in the Appendix 5.

[11] Construct variables are variables that cannot be directly measured and require some indicators or proxies to allow measurement.

According to Hair et al (1998), SEM involves 7 steps. These are: (1) develop the model based on the theory, (2) develop a path diagram for causal relationships, (3) express the path diagram in terms of the structural equation and measurement model, (4) choose the input matrix and the proposed model estimation, (5) analyze the possibility of the model being able to be identified, (6) analyze the criterions for goodness of fit and (7) interpret the results.

This research has developed a research model based on these theoretical findings. The research model includes the manifest variables, construct variables and the relationship between the construct variables. The variables however need to be defined in terms of their relevance to this research. Most of the variables have already been used in the previous studies cited.

5.4.3 Variable Definition

The analysis has one dependent variable and four independent variables. The independent variables are the relative accessibility of the village to the small urban center, the level of amenities in the rural village, the respondents' willingness to travel and the respondents' desire to consume urban services. The dependent variable is the respondents' level of utilization of the small urban center's services and economic opportunities such as employment and business opportunities.

The four independent variables are latent variables, each having three proxies. The dependent variable, which is the level of utilization, is not a latent variable and has only one indicator. A single indicator can be used for the dependent variable because the level of utilization can be measured solely by looking at the number of visits made to the small urban center. The level of utilization is measured using a Likert scale on a range of

1 to 5, where 1 represents very few visits and 5 represents very frequent visits. The Likert scale is used because of two reasons. First, the respondents may have difficulties in exactly recalling the number of visits to the small urban center. Second, use of the Likert scale addresses the issue of scale and allows compatibility with the type of data used for the independent variables, which are also measured on a Likert scale.

5.4.3.1 Accessibility

Accessibility is included as an independent variable in the Agropolitan research model based on the findings of other studies. These studies show that accessibility determines the extent to which villagers would consume services and goods from the small urban centers. The variable is measured using two main indicators. The first indicator is the distance of the small urban center from the village. The second indicator is the availability of transport between the small urban center and the village.

Since it is assumed that villagers perceive distance as a measure of accessibility, a similar answer to the first and the second indicators for every respondent may be expected. In the questionnaire, these indicators are measured using a Likert scale with score ranging from 1 to 5.

The question on the distance from the small urban center is:

How do you see the distance between your village and the small urban center?			
a.	very far (1)	c. not near nor far (3)	e. very near (5)
b.	far (2)	d. near (4)	

The question on the availability of transport is:

How do you see the transport facilities linking your village and the small urban center? a. very inadequate (1) c. acceptable (3) e. very adequate (5) b. inadequate (2) d. adequate (4)

5.4.3.2 Rural Village Amenities

The level of amenities in the respondents' village also determines the extent to which villagers will utilize urban services. The better the rural village amenities, the less likely the villagers will spend more time on consuming goods and services from the small urban center. This variable is measured using two indicators, which are the availability of goods for consumption in the rural village and the relative availability of the facilities in the rural village compared to the small urban center. In the questionnaire, these indicators are measured using a Likert scale with score ranging from 1 to 5.

The question for the indicator of relative availability of goods for consumption in the rural village compared to the small urban center is:

How do you see the availability of goods in your village? a. very adequate (5) c. acceptable (3) e. very inadequate (1) b. adequate (4) d. inadequate (2)

The question on the relative availability of facilities in the rural village compared to the small urban center is:

What is the availability of facilities in your village compared to the small urban center? a. very adequate (5) c. acceptable (3) e. very inadequate (1) b. adequate (4) d. inadequate (2)

5.4.3.3 Willingness to Travel

Willingness to travel has strong impact on how the villagers will perceive the relative accessibility. If the willingness to travel is high, the level of utilization tends to be higher. A high willingness to travel means that the villager is willing to travel beyond the rural village to consume goods and services. The willingness to travel is measured using two indicators. The first indicator is the mode of transport used for non-food shopping. The second indicator is on how the respondents consider themselves enjoying traveling. In the questionnaire, these indicators are measured using a Likert scale with score ranging from 1 to 5.

The question on the mode of transport for non-food shopping is:

How do you usually travel for non-food shopping a. walk (1) d. private transport (motorbike) (4) b. go with other people who own vehicle (2) e. private transport (car)(5) c. public transport (3)

The question on the willingness to travel outside the village is the first question in the fifth section of the questionnaire. The question is:

Do you agree that you like to travel?		
a. strongly disagree (1)	c. neutral (3)	e. strongly agree (5)
b. disagree (2)	d. agree (4)	

5.4.3.4 Desire to Consume Urban Services (Level of Modernity)

The desire to consume urban services reflects the level of modernity. This is particularly important in determining whether the villagers demand urban services or not. Those who are traditional and prefer simple goods and services that are readily available in the village would have lower demand for urban services. There are various indicators that can be used to measure the desire to consume urban services.

This research uses two indicators to measure the desire to consume urban services and the level of modernity. The first indicator is the respondents' access to information, which includes the ownership of electronic media such as television, radio, communication device as well as the access to printed mass media such as newspapers. This indicator is measured by summing up the answer to four questions.

The first question is on the ownership of communication device. Since hand phone has become affordable and can be accessed using prepaid card, we assume subscription to landline telephone to indicate higher level of modernity.

What communication device do you own?	
a. landline telephone (3)	c. none (1)
b. hand phone (2)	

The second question is on the usage of public phone. This is only applicable if the first question's answer is none.

If you do not own any communication device, do you use the public phone service?	
a. yes (1)	b. no (2)

The third question is on the access to latest information.

Where do you usually obtain the latest information?.	
a. newspaper (2)	c. television (3)
b. magazine (4)	d. internet (5)

The fourth question is on the ownership of computer.

Do you own a computer?	
a. yes (5)	b. no (1)

The aggregate score is then converted into a Likert scale score ranging from 1 to 5. The conversion is as follows:

< 7 = 1	9-10 = 3	>12 = 5
7-8 = 2	11-12 = 4	

The second indicator is the usage of financial services. This reflects how advanced these residents are in transactions and their work activities. In the questionnaire, this indicator is measured using the Likert scale with score ranging from 1 to 5. The question on the usage of financial services is:

You often use financial services to aid your transactions.		
a. strongly disagree (1)	c. neutral (3)	e. strongly agree (5)
b. disagree (2)	d. agree (4)	

5.4.4 The Path Diagram and Causal Relationship

There are various types of relationships that can be explored in the research model for structural equation modeling. This research initially used the indirect relationship model, but from the field survey and discussion with Prof. Imam Ghozali, the author of a SEM book from the University of Diponegoro in Semarang, Indonesia, the decision was to use the SEM with the moderating variable. The indirect relationship model involves relationship between one variable and another variable. The latter variable is related to another variable which is the dependent variable. The moderating variable model involves having a variable that influences the strength of the relationship between two other variables. The moderating variable model suits the research objective much better because all the hypothesized independent variables have relationships with the dependent variable. However, independent variables previously hypothesized as having indirect relationships with the dependent variable do not "cause" the other independent variables. Instead, these independent variables affect the relationship between the other independent variables and the dependent variable.

According to Ghozali and Fuad (2005), the moderating variable model is a recent development in SEM. For brevity, the moderating variable model in SEM is called a moderated SEM. Cortina et al (2002) state that the most accurate and popular method to use in moderated SEM is the interaction form. This interaction form is obtained by multiplying x_1 with the moderator of x_2. According to Ghozali and Fuad, the multivariate interaction model can be expressed as follows:

$$Y = a + b_1x_1 + b_2x_2 + b_3x_1x_2 \tag{5.1}$$

As the interaction method will always cause multicollinearity among its independent variables, the best solution is to transform the data into mean-centered values. Ping (1995) proposed the use of a single indicator to assess the impact of a moderating variable in an interaction model. Ping cites the example of applying this method in cases where variable *X* has a relationship with variable *Y* as the dependent variable, and variable *Z* has impact on the relationship between *X* and *Y*. In his example, *Y* is a dependent manifest variable while *X* and *Z* are latent variables both with more than one indicator. According to Ping, the step in using the interaction approach is to use a single indicator as an interacting variable. This is because the moderating hypothesis is analyzed using the interaction approach, which in this case is:

$$Y = a + b_1x_1 + b_2z_2 + b_3x_1z_2 \tag{5.2}$$

where x_1 and x_2 are the manifest variables used as proxies to measure the *X* exogenous latent variable, z_1 and z_2 are the manifest variables used as proxies to measure the *Z* exogenous latent variable and *Y* is the dependent or endogenous manifest variable. The single indicator for interacting variable is calculated using the following formula:

$$moderating\ indicator = (x_1 + x_2)\ x\ (z_1 + z_2) \tag{5.3}$$

To use the moderated SEM using the above method, there are two stages to be followed. The first stage is to use a normal structural equation modeling without including the interaction variable. This stage will give the relationship between the construct or latent variables and the dependent variable. After the loadings and error variances for the independent variables are obtained from the first stage, these values will be inputted to the second stage. The second stage involves the analysis of all the variables hypothesized to have relationship with the dependent variable, including the interaction variable. This is done by estimating and fixing the loading and error variance for the interaction variable indicator using the following formula (Ping, 1995):

$$\lambda \ interaction = (\lambda_{x1} + \lambda_{x2}) \ x \ (\lambda_{z1} + \lambda_{z2}) \qquad (5.4)$$

$$\theta \ interaction = (\lambda_{x1} + \lambda_{x2})^2 \ VAR\ (X)\ (\theta_{z1} + \theta_{z2}) + (\lambda_{z1} + \lambda_{z2})^2 \ VAR\ (Z)\ (\theta_{x1} + \theta_{x2}) + (\theta_{x1} + \theta_{x2})\ (\theta_{z1} + \theta_{z2}) \qquad (5.5)$$

where:

θ = error variance

λ = loading indicator

Since the data used are ordinal data with Likert scales, the appropriate input matrix for the model is polychoric correlation (Wibowo, 2004). After the variables have been identified, the relationship between variables must be hypothesized in order to construct the path diagram.

5.4.5. Hypotheses

According to Joreskog and Sorbom (1989), LISREL works much better if it is used for confirmatory analysis rather than for exploratory analysis if we have many variables and a weak theoretical background. The theoretical aspects for the inclusion of each variable and how they interact with the level of usage of the small urban center services have already been discussed. In conceptualizing the model, the hypothesized relationship between the latent variables must be determined. At this stage, a clear distinction between the exogenous and endogenous variables must be made. In our analysis, the exogenous variables are the four latent variables, each with three manifest variables as indicators. The exogenous variables are rural village amenities, modernity, willingness to travel and relative accessibility. The endogenous variable is the level of usage, which is the dependent manifest variable.

The next step is to determine the relationships between the exogenous variables and the endogenous variables, hypothesizing whether the relationship is positive or negative. In the operational definition of the variables, the hypothesized relationship with the dependent variable has already been pointed out. Since the model used here is the moderated model, there are exogenous variables which have direct relationships with the endogenous variables, and there are also exogenous variables which influence the relationship between the endogenous variables and the exogenous variables in which the endogenous variables have a direct relationship.

Accessibility is hypothesized to have a direct relationship with the level of usage of the small urban center. According to the literature review, the willingness to travel of the residents will influence how strong the relative accessibility will influence the level of usage. If the willingness to travel is high, the influence of the relative accessibility to the level of usage is low. Residents with high willingness to travel will not consider accessibility to be as important in deciding to visit the small urban center. Therefore, the moderating variable in the relationship between relative accessibility and the level of small urban center usage is the willingness to travel.

The rural village level of amenities is hypothesized to have a direct relationship with the level of usage of the small urban center. The higher the level of amenities in the village, the less likely it is for the residents to visit and use the small urban center and vice versa. According to our literature review, the modernity and the desire for urban services have an important role as it may influence how strong the rural village amenities influence level of usage. If the modernity is high, the negative relationship between the rural village amenities and the level of usage will be weaker. However, if the modernity is low, the negative relationship between the rural village amenities and the level of usage will be stronger. Thus, the moderating variable in the relationship between rural village amenities and the level of small urban center usage is the desire for urban services or modernity.

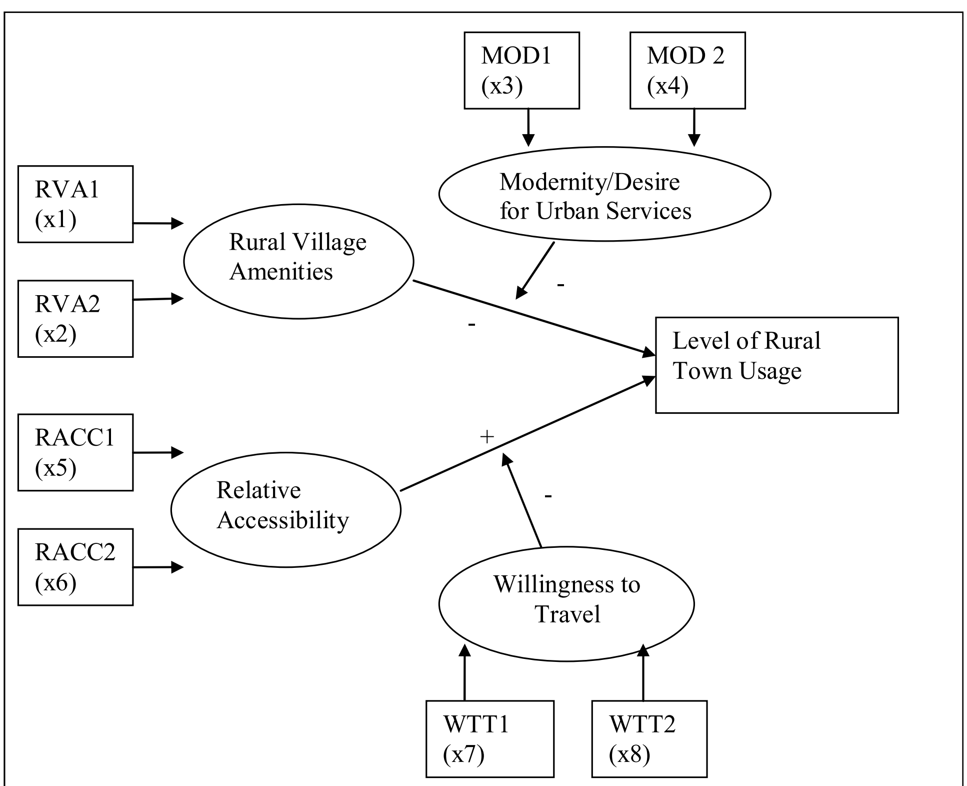
Overall, there are two moderating variables and two independent variables on the right hand side of the equation. On the left hand side of the equation is a dependent manifest variable. This theoretical model sets the basic framework to be further developed into a path diagram. Figure 5.1 shows the conceptual framework for the present research.

The path diagram is a graphical representation about how the variables in the model are related to one another. It provides an overview of the model's structure. The proper construction of the path diagram will ensure that the algebraic equations including the errors for the equations are expressed correctly. In the path diagram, the interacting variable will also be included. This is to explain the structure for the stage 2 analysis in the moderated structural equation modeling. In principle, the path diagram for stage 1 is the same with the exception that the interacting variables are not included in the analysis. Figure 5.2 shows the model's conceptualization in the form of a path diagram.

The path diagram includes the LISREL notation for the algebraic equations that is written beside the actual name for each variable. In the LISREL notation for the structural model, the exogenous latent variable is named ξ. This research has six exogenous latent variables including two interacting variables. These exogenous variables are assumed to be correlated with each other, in which the correlation is expressed with Φ. The endogenous manifest variable is simply expressed by y.

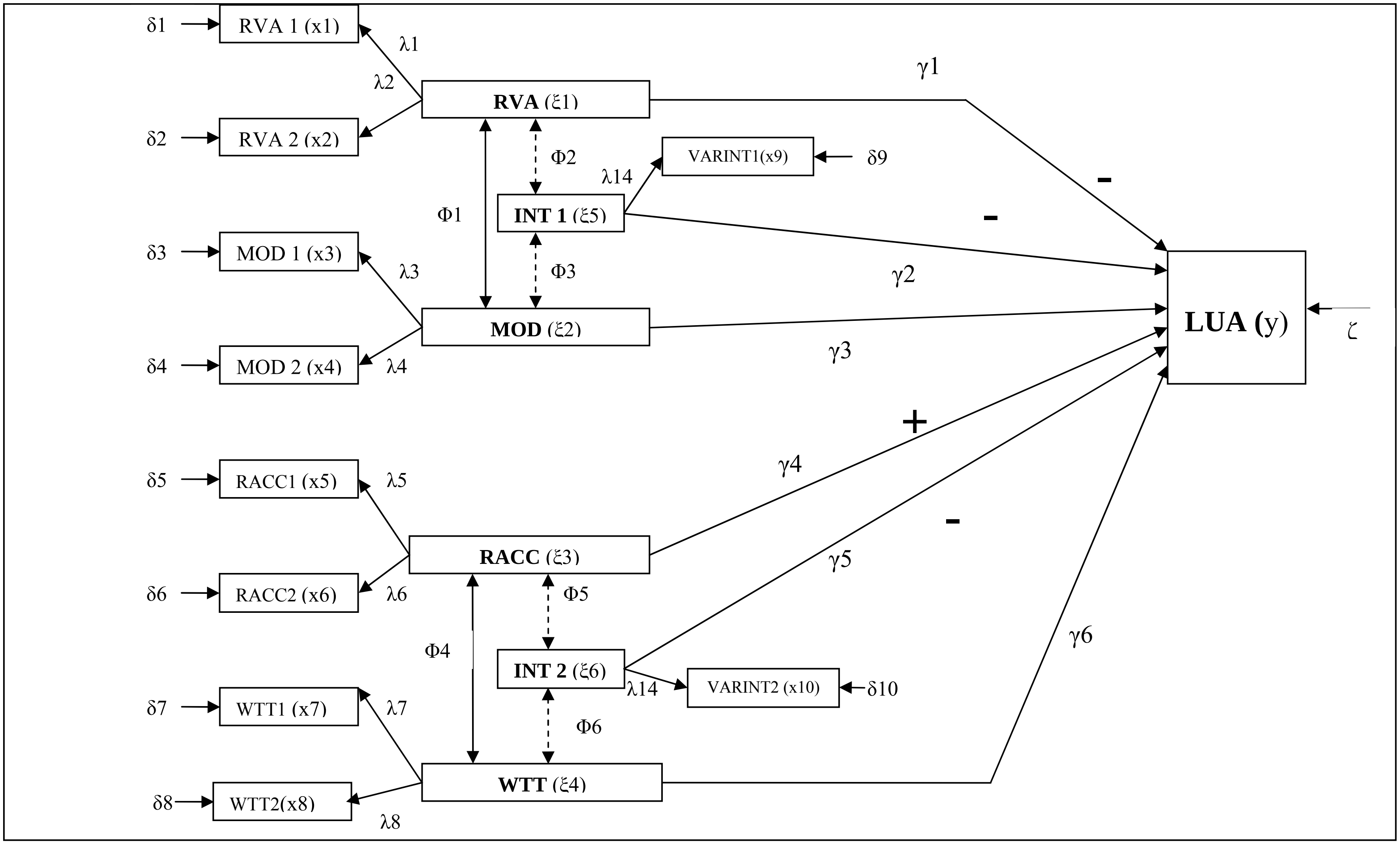
The direct relationships between the exogenous variables and the manifest variable are expressed by γ and the measurement error caused by the influence of the exogenous variables to the endogenous variable is expressed by ζ.

Figure 5.1. Conceptual Research Framework



Source: author's analysis

Figure 5.2. Path Diagram



Source: author's analysis

In the LISREL notation for the measurement model, the indicators for the exogenous latent variables are expressed as *x*. In this research, there are 14 *x* variables acting as proxies for six latent variables in this model. The relationships between the latent variables and their respective indicators are expressed by BDA (λ). The measurement errors for the indicators of the exogenous variables are expressed by DELTA (δ) and for endogenous variable these measurement errors are expressed by EPSILON (ε). Since this research has no latent endogenous variable, EPSILON (ε) is not measured.

Expressing the model in equation forms is an important part of structural equation modeling. The model in Figure 5.2 can be expressed as follows:

Structural Equation:

$$y = \gamma_1 \xi_1 + \gamma_2 \xi_2 + \gamma_3 \xi_3 + \gamma_4 \xi_4 + \gamma_5 \xi_5 + \gamma_6 \xi_6 + \zeta \quad (5.6)$$

Measurement Equation for Exogenous Variables

$$x1 = \lambda_1\xi_1 + \delta_1 \quad (5.7)$$

$$x2 = \lambda_2\xi_2 + \delta_2 \quad (5.8)$$

$$x3 = \lambda_3\xi_3 + \delta_3 \quad (5.9)$$

$$x4 = \lambda_4\xi_4 + \delta_4 \quad (5.10)$$

$$x5 = \lambda_5\xi_5 + \delta_5 \quad (5.11)$$

$$x6 = \lambda_6\xi_6 + \delta_6 \quad (5.12)$$

$$x7 = \lambda_7\xi_7 + \delta_7 \quad (5.13)$$

$$x8 = \lambda_8\xi_8 + \delta_8 \quad (5.14)$$

$$x9 = \lambda_9\xi_9 + \delta_9 \quad (5.15)$$

$$x10 = \lambda_{10}\xi_{10} + \delta_{10} \quad (5.16)$$

Based on the above equations, there are four hypotheses in this research, these are:

Hypothesis 1 *Ho* : Level of rural village amenities has a significant negative relationship with the level of small urban center usage

Hypothesis 2 *Ho* : Desire for urban services or level of modernity has a negative moderating effect on the relationship between rural village amenities and the level of small urban center usage.

Hypothesis 3 *Ho* : Relative accessibility has a significant positive relationship with the level of small urban center usage

Hypothesis 4 *Ho* : Willingness to travel has a significant negative moderating effect on the relationship between relative accessibility and the level of small urban center usage

The next step is to define the goodness of fit indices to be used in this analysis. LISREL generates various indicators for assessing the fitness of the model. The evaluation of the model's fitness in structural equation modeling remains a difficult issue. According to Ghozali and Fuad (2005), there have been different views on the indicators of a model's fitness. This research selects only the most commonly used goodness of fit indices for assessing the model.

Chi-square and the probability value are among the most commonly used goodness of fit indices. Chi-square shows the deviation between the sample covariance matrix and the model (fitted covariance matrix). However, chi-square has many weaknesses when used as a fit index. Bentler and Bonett (1980) argue that it is important to use other indicators to complement the chi-square. According to Jorekog and Sorbom

(1993), the chi-square value will only be valid if the assumptions of normality are met and the sample size is large.

Therefore, this research looks at other goodness of fit indices that are more suitable for assessing the Agropolitan model. The goodness of fit indices (GFI) and the adjusted goodness of fit indices (AGFI) are also commonly used fitness indices. The GFI measures the precision of the model in producing the observed covariance or correlation matrix. The GFI ranges between 0 and 1 and according to Diamantopaulus and Siguaw (2000), a GFI value more than 0.9 shows a good fit. The AGFI is similar to GFI, but is adjusted for the influence of the degrees of freedom in the model. Similar to GFI, AGFI close to 1 shows a good fit. According to Werner (2006), the cutoff value for an acceptable fit is an AGFI of at least 0.85, and a good fit requires an AGFI of at least 0.9.

According to Newsom (2006), the root mean square residual (RMR) does not face the same problems as chi-square. Garson (1998) defined RMR as a coefficient which results from taking the square root of the mean of the squared residuals. These are the amounts by which the sample variances and covariances differ from the corresponding estimated variances and covariances. The standardized RMR is more often used because it considers the standardized residuals in showing the average difference between the predicted and the observed variances of the model. Hu and Bentler (1999) suggested that in a combination of goodness of fit indices, one should include either SRMR or root mean square error of approximation. According to Hu and Bentler, the cutoff for a good fit is an SRMR of less or equal to 0.08.

Another fit index is the Akaike information criterion (AIC) that is used to assess the parsimony problem in assessing a model's fitness, although this value is not sensitive to the complexity of model. However, since AIC is sensitive to the number of samples, it is better to use the consistent AIC (CAIC) that is not sensitive to the number of samples (Bandalos, 1993). The criteria of a good fit is a model CAIC score that is less than the saturated CAIC score.

This research looks at four indices in assessing the model's fitness. They are goodness of fit indices (GFI), adjusted goodness of fit index (AGFI), standardized root mean square residual (SRMR) and consistent Akaike information criterion (CAIC).

Table 5.1. Criterions for Goodness of Fit Indices

Index	**Criteria**
GFI	$\geq$ 0.9
AGFI	$\geq$ 0.85
SRMR	$\leq$ 0.8
CAIC	Model CAIC < Saturated CAIC

5.4.6. Data Gathering

In this SEM analysis, most of the data were obtained by distributing questionnaires. The questionnaire distribution was done with purposive sampling. In order to ensure that there are sufficient variations in the data, questionnaires were distributed by taking into consideration the area characteristics as these characteristics can be good proxies of some variables in the analysis. The questionnaires were distributed in 8 different types of areas. These included:

1. Areas with high relative accessibility and high rural village amenities,
2. Areas with high relative accessibility and moderate rural village amenities,
3. Areas with high relative accessibility and low rural village amenities,
4. Areas with moderate relative accessibility and high rural village amenities,
5. Areas with moderate relative accessibility and moderate village amenities,

6. Areas with low relative accessibility and high rural village amenities,
7. Areas with low relative accessibility and moderate rural village amenities,
8. Areas with low relative accessibility and low rural village amenities.

In distributing the questionnaire attention was also paid to the balance between frequent, non-frequent and average users of the small urban center. This was achieved by looking at the location of employment and timing of the questionnaire distribution. A survey conducted on the small urban center during weekends has greater probability of getting frequent users of small urban center. On the other hand, a survey conducted in rural village during weekends may have greater probability of getting infrequent users of the small urban center.

CHAPTER 6
RESEARCH AREA

6.1 Introduction

The literature review in Chapters 2 and 3 as well as the conceptual framework for Agropolitan Development in Chapter 4 are used as the basis for selection of research area. The conformance of the candidate research areas with the criteria set in Chapter 4 was assessed through first hand observations from field trips, interviews with local officials and the analysis of secondary data from previous studies and official publications.

The fieldtrips to the candidate research areas were conducted from May to November 2005, following the completion of the literature review. There were four candidates for the research area. These candidates were recommended by the Indonesian Agropolitan Development Committee based on their respective progress in small urban center development[12]. The recommendation used as the basis for the shortlist is in line with the research objective of the study. The emphasis is on the presence of an agricultural-based small urban center, and how this town interacts with its hinterland. Ideally, the small urban center should function as a center for collection for rural produce and for distribution of urban goods and services. The four research areas included in the shortlist are Pacet sub-district in West Java's Cianjur district, Batu municipality in East Java, IV Angkat Candung sub-district in West Sumatra's Agam district and Ampel sub-district in Central Java's Boyolali district.

[12] The Agropolitan Development Commitee is an Inter-Ministerial Commitee, which includes among others, the Spatial Planning Division of the Ministry of Public Works and the Center for Regional Studies of Bogor Agricultural University (IPB). The author of this thesis worked closely with the commitee members and obtained recommendations on the best candidates for a research area.

IV Angkat Candung sub-district was visited in July 2005. This sub-district has a market center equipped with a cold storage facility that was installed only a week prior to the fieldtrip. There were collection activities in the market center, and the cold storage was used to store, sort and pack vegetables for shipping to Singapore. However, the new market center still has empty store lots. These lots were previously used for the provision of consumer goods and commercial services. The vacant lots show that IV Angkat Candung has not played the role of a provider of urban goods and services.

The fieldtrip to Pacet sub-district was conducted during August 2005. The area has a considerably steep elevation. The new roads have allowed access to the farms for mini trucks. However, the bulking facilities installed in the designated market center are not used by the vegetable growers. Instead of utilizing the market center for distribution, the harvests are directly transported to the nearby Cipanas market or to Jakarta and Bogor cities. In chapter 3, it was shown that Pacet falls under the influence of the nearby large cities. This explains why the development of new urban function centers in Pacet have failed. The local residents work as landless peasants, since the lands are owned by people from Jakarta. Thus, the benefits of the new developments are enjoyed by the wealthy urban residents instead of the local residents in Pacet.

The fieldtrip to Batu municipality was conducted in November 2005. This municipality was initially a part of Malang sub-district, but was split into a separate municipality due to the growth of economic activities. The areas development is contributed largely by the growth of apple farms. The apple farms' forward linkages are to a certain degree concentrated in the core area of the municipality. The apples are sent to the core area for bulking, and they are either sorted for packaging or further processed into juice, concentrates, cakes and other derivative products. There are also financial services and consumer goods shops in the core area. However, most of the apple farms have been converted into villas. A large number of residents in Surabaya, the nearby metropolitan area, visit Batu during weekends. This trend has shifted Batu's main economic activity from apple cultivation to agro-tourism. The only remaining apple farms are the large farms. These farms produce derivative products of apples mainly for the purpose of attracting tourists. Domestic tourists can visit the apple farm, pick the apples and see the processing of apple into various derivative products. Most of Batu's residents now work in the tourism sector. One of the most common occupations is the housekeeping of the villas.

Batu is therefore a declining Agropolitan that has lost its focus on agriculture. The area may require significant government-driven development projects to revive the agricultural sector. From the field observations, it can also be seen that the decline in apple cultivation is related to land degradation. The practice of over-intensive cropping that was not accompanied by proper land management has led to soil degradation that has reduced the quality and quantity of the harvests. Thus, there are two forces that pressurize the land owners to sell their land. First is the high demand for villas, and second is the degrading quality and quantity of harvests due to soil degradation.

Ampel sub-district was visited in November 2005. Ampel sub-district has a well-developed market center that has two main roles. First, the market center provides financial services and farming equipment. Second, the market center is a center for collection for rural produce and has off-farm food processing activities. The majority of the residents are working in the cattle-related industries. The market center is located in the central part of the area, and the hinterland villages surround the market center. Interviews were conducted with local officials. Ampel is a good example of an Agropolitan region, based on the functions of the small urban center. The area meets the criterion of having an effectively-functioning agricultural based small urban center. Thus, it was decided to use the Ampel sub-district as the research area.

6.2 Ampel Sub-District

The Ampel sub-district is located in the district of Boyolali, which falls under the administrative boundary of Central Java province. It has an elevation of 520-1,840 meter above the sea level. The neighboring area in the north and east of Ampel is Semarang district. The neighboring area in the south of Ampel is the Cepogo sub-district of Boyolali. The neighboring area in the west of Ampel is the Selo sub-district of Boyolali. The distance from Ampel's administrative center to the District administrative center is 11kms and the distance to the Province administrative center is 42kms. The only mode of transport in Ampel is road transport.

The Ampel sub-district comprises of 20 villages, in which five of them are grouped together as the Ampel city. Ampel city's villages are Urutsewu, Gladagsari, Candi, Tanduk and Kaligentong. The total population is 68,817 with 18,572 households. Out of the total population, 10,915 are between the ages of 20 and 30, which is a highly productive working age group. Thus, Ampel has a strong economic potential as far as labor supply is concerned. Out of the 18,572 households, the number of poor households has fallen consistently over the past years. This indicates stronger market potential and the creation of employment opportunities in Ampel.

Ampel has an average population density of 761 people/ km^2. The densest village is Urutsewu with 1,726 people/ km^2. The least dense village is Ngagrong with 367 people/ km^2. Ngagrong is not among the five Ampel city villages. Sampetan village has the largest population with 5,489 people and Ngampon has the lowest population with 1,422 people. Both these villages are not among the five Ampel city villages. Table 6.1 shows the population data in Ampel.

Table 6.1.
Total Population and Population Density in Ampel Sub-District

No	Village	Area Size (Km^2)	Total Population (people)			Population Density
			Male	Female	Total	
1	Ngagrong	8,1530	1,433	1,557	2,990	367
2	Seboto	4,9301	2,260	2,353	4,613	936
3	Tanduk	3,3100	2,664	2,726	5,390	1, 628
4	Banyuanyar	2,9189	1,204	1,331	2,535	868
5	Sidomulyo	4,3976	1,924	2,013	3,937	895
6	Ngargosari	5,1190	1,912	2,100	4,012	784
7	Selodoko	2,6018	1,291	1,382	2,673	1,027
8	Ngenden	1,8299	953	938	1,891	1,033
9	Ngampon	1,8973	718	704	1,422	749
10	Gondang Slamet	1,3500	796	854	1,650	1,222
11	Candi	4,2824	2,467	2,570	5,037	1,176
12	Urut Sewu	2,6705	2,289	2,319	4,608	1,726
13	Kaligentong	3,5000	2,253	2,194	4,447	1,271
14	Gladagsari	2,9821	1,362	1,472	2,834	950
15	Kembang	6,0405	2,448	2,680	5,128	849
16	Candisari	4.8238	1,064	1,189	2,253	467
17	Ngargoloko	3.8900	707	785	1,492	384
18	Sampetan	10.5505	2,712	2,777	5,489	520
19	Ngadirojo	8.9447	1,883	2,013	3,896	436
20	Jlarem	6.1991	1,202	1,284	2,486	401
Total		90.3912	33.542	35,241	68,783	761

Source: Ampel Sub-District Statistical Yearbook 2004

For its geographical condition, Ampel is conducive for agricultural activities. Out of the total land area of 8,468 hectares, around 3,200 hectares are used for purposes other than forestry and farming. However these non-farming land uses still include farming activities carried out in the backyard of the residents' houses. With an annual rainfall of

1,156mms and the large amount of fertile land area dedicated for farming, Ampel has a strong potential to become a major producer of agricultural commodities that are in high demand in the market.

Apart from favorable natural conditions, Ampel also has the support of physical facilities and infrastructure for agro-business. Ampel has a market center that also serves a center for collection of rural produce. This market center has financial institutions, both banks and non-banks, which are effective in supporting the business transactions. There are also established farmer organizations, including farm groups, cooperatives and non-government organizations. The farming assistance body is effective in functioning as a center for information, training, community empowerment and the test of applied technologies. There are adequate road and irrigation infrastructure to support farming activities. Other physical infrastructure facilities available are transport, electricity, telecommunication and clean water.

The major agricultural commodity produced in Ampel is cattle, both meat and milk cattle. The livestock are reared in the villages, and are fed with grasses and concentrates that are locally produced in Ampel. In the industrial sector, there are 12 companies that produce floss and dried meat. These companies are located in Ampel city. These processed food use meat as the raw materials. The meat is obtained from the cattle-rearing households in the hinterland villages of Ampel city. There is also one cooperative in Ampel city that specializes in collecting all the milk from the milk cattle rearing households in Ampel. Apart from these downstream industries, Ampel city also has an established market center. In response to the development of economic activities in

Ampel city, the government has constructed a new market center that started operating at the end of 2005.

Thus, Ampel has strengths in farming, plantation and animal farming. This is supported by adequate labor force, market size, industry and institutional arrangements. With these assets, the local government expects Ampel to continue growing, and be the leading Agropolitan in Indonesia. Ampel has fulfilled the criteria of an Agropolitan, which include the favorable natural conditions as well as the physical facilities and infrastructure.

6.3 Ampel City Development Plan

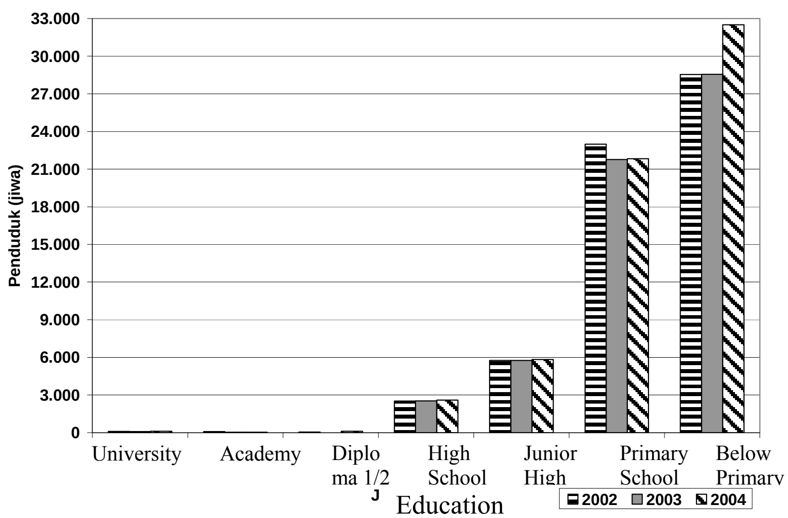
The capital of Ampel sub-district, Ampel City, comprises of five villages. The villages are Kaligentong with a size of 280 hectares, Urutsewu with a size of 267 hectares, Candi with a size of 197 hectares, Gladagsari with a size of 123 hectares and Tanduk with a size of 169 hectares. Ampel city supports its hinterland by playing the role of a center for economic activities, in particular, through the collection and distribution services. The link that Ampel city has with the regional transport path has placed it as an active node in the hierarchy of urban areas.

In the strategic development plan, the development of Ampel is planned to cover 1,037.56 hectares of land, out of which, 36% or 373.52 hectares are dedicated for housing. Apart from housing, 4% will be used for social facilities, 2.5% for sporting facilities, 25% for road network and utilities, 10% for external-related activities such as office, education, trade and industries and 20% for open green spaces.

6.4 Socio-economic Background of Ampel

As far as education is concerned, Ampel has shown a consistent improvement over the years. There are 33 kindergartens and 44 primary schools. Overall, the educational facilities in Ampel are sufficient in meeting the local needs. This shows that the residents of Ampel can accept new values, despite the fact that there are still strong traditional elements in the community's social interactions. However, the number of residents pursuing higher education, such as diploma programs, has not improved for the past few years. Figure 6.1 and table 6.2 show the educational attainment and available education facilities in Ampel, respectively.

Figure 6.1.
The Level of Education Attainment in Ampel



Source: Ampel Sub-District Local Statistical Yearbook 2004

The occupational groups in Ampel are dominated by farmers with a total of 15,039 people. The smallest occupational groups are transport and plantation with 53 and 130 people respectively. The villages with the largest working population are Sampetan with 4,536 people and Tanduk with 4,454 people. The villages with the least number of working population are Ngampon with 1,175 people and Ngargoloko with 1,234 people.

17,841 people or 31.38% of the total working population, work in the agricultural sector. Among this group, the majority are vegetable growers.

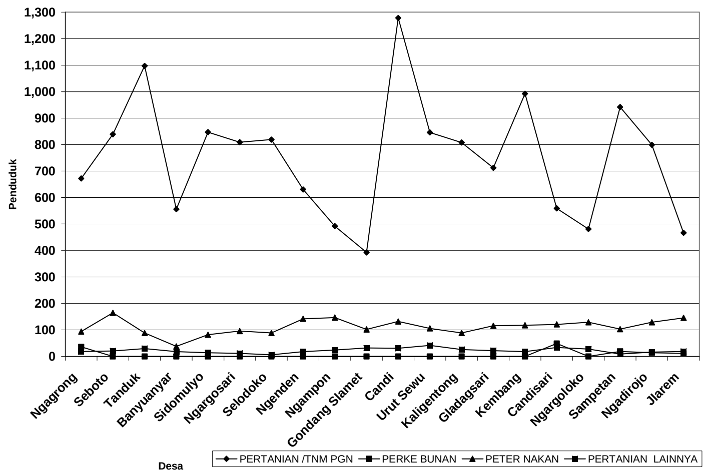
Table 6.2.
Educational Facilities in Ampel

NO	Village	SCHOOL							
		Kindergarten	Primary	Islamic Primary	Junior High	Islamic Junior High	High School	Islamic High School	Higher Education
1	Ngagrong	0	2	0	0	0	0	0	0
2	Seboto	2	2	1	0	0	0	0	0
3	Tanduk	2	2	1	0	0	0	0	0
4	Banyuanyar	1	2	1	0	0	0	0	0
5	Sidomulya	2	3	0	0	0	0	0	0
6	Ngargosari	1	3	0	0	0	0	0	0
7	Selodoko	4	2	0	0	0	0	0	0
8	Ngendem	0	2	0	0	0	0	0	0
9	Ngampon	1	1	0	0	0	0	0	0
10	Gondang Slamet	1	2	0	0	0	0	0	0
11	Candi	2	2	1	4	0	2	0	0
12	Urut Sewu	2	4	0	0	0	0	0	0
13	Kaligentong	3	3	1	2	0	2	0	1
14	Gladagsari	3	3	0	0	0	1	0	0
15	Kembang	1	2	2	1	1	0	0	0
16	Candisari	1	2	0	0	0	0	0	0
17	Ngargoloko	1	1	0	0	0	0	0	0
18	Sampetan	3	2	1	0	1	0	0	0
19	Ngadirojo	1	2	1	0	0	0	0	0
20	Jlarem	2	2	0	0	0	0	0	0
TOTAL		33	44	9	7	2	5	0	1

Source: Ampel Sub-District Local Statistical Yearbook 2004

The second largest farming occupational sub-group is cattle rearing. Cattle rearing involves backward and forward linkages such as forage crops and meat processing. If the other cattle-related sectors are included under cattle-rearing, this sector may dominate the occupational groups in Ampel. The domination of cattle-related occupational groups shows the strong role of this sector in the economic development of Ampel. Figure 6.2 shows the occupations of Ampel's residents.

Figure 6.2.
Agriculture-Related Occupations in Ampel



Source: Ampel Sub-District Local Statistical Yearbook 2004

Financial institutions, including banks, are instrumental in supporting the urban functions. In Ampel, the banking facilities are located in Ampel city's villages. There are five banks, three of which are local credit banks located in Candi, Kaligentong and Gladagsari. There are five cooperatives, all of which are located in Ampel city's villages. Table 6.3 lists the available banking facilities in Ampel.

The economic activities of Ampel city can be gauged from the effective functioning of trade facilities. The trade facilities in Ampel include four shopping centers and two markets, all of which are located in Ampel city. There are 467 small shops. Each of Ampel's villages has small shops. Restaurants are also tertiary activities that can also be the indicator of the level of economic activities. There are 134 restaurants, 88 of which are are located in Ampel city. Table 6.4 lists the availability of commercial facilities in Ampel.

Table 6.3.
Banking Facilities in Ampel

NO	Village	Commercial Bank	Credit Bank	Local Bank	Cooperative
1	Ngagrong	0	0	0	0
2	Seboto	0	0	0	0
3	Tanduk	0	0	0	1
4	Banyuanyar	0	0	0	0
5	Sidomulyo	0	0	0	0
6	Ngargosari	0	0	0	0
7	Selodoko	0	0	0	0
8	Ngenden	0	0	0	0
9	Ngampon	0	0	0	0
10	Gondang Slamet	0	0	0	0
11	Candi	1	1	0	2
12	Urut Sewu	0	0	0	1
13	Kaligentong	0	1	0	1
14	Gladagsari	0	1	1	0
15	Kembang	0	0	0	0
16	Candisari	0	0	0	0
17	Ngargoloko	0	0	0	0
18	Sampetan	0	0	0	0
19	Ngadirojo	0	0	0	0
20	Jlarem	0	0	0	0
	TOTAL	**1**	**3**	**1**	**5**

Source: Ampel Sub-District Local Statistical Yearbook 2004

Table 6.4.
Commercial Facilities in Ampel

NO	VILLAGE	Shopping Centers	Market	Small Shops	Restaurant
1	Ngagrong	0	0	12	2
2	Seboto	0	0	13	2
3	Tanduk	0	0	32	25
4	Banyuanyar	0	0	20	0
5	Sidomulyo	0	0	26	8
6	Ngargosari	0	0	17	6
7	Selodoko	0	0	24	3
8	Ngenden	0	0	13	4
9	Ngampon	0	0	11	2
10	Gondang Slamet	0	0	13	1
11	Candi	1	1	52	25
12	Urut Sewu	1	1	75	22
13	Kaligentong	1	0	27	11
14	Gladagsari	1	0	25	8
15	Kembang	0	0	21	3
16	Candisari	0	0	12	3
17	Ngargoloko	0	0	11	0
18	Sampetan	0	0	29	4
19	Ngadirojo	0	0	17	4
20	Jlarem	0	0	17	1
	TOTAL	**4**	**2**	**467**	**134**

Source: Ampel Sub-District Local Statistical Yearbook 2004

The road transport is well developed in Ampel. The total road network in Ampel is 24.65kms. These roads are well paved and during the past four years, most of the damaged roads have been repaired. This shows the continuous improvements in infrastructure management. The adequate transport infrastructure has given the residents the incentives to own their own transport. In 2004, there were 316 bicycles, 774 motorbikes and 107 cars owned by the residents of Ampel.

6.5 The Cattle-Related Sector in Ampel

In observing the agricultural sector in Ampel, we look at the balance between the local production and demand. The surplus is exported. The pattern for food consumption varies according to income. The production of staple food remains the main source for household food supply. The main source of carbohydrate is rice, although the residents also consume corn and cassava. The main sources of protein are poultry, milk and egg. The main sources for vitamin including minerals and fiber are vegetable and fruits. With the increase in income, the percentage of income spent on staple food will decrease. The percentage of income spent on carbohydrate will decrease and that on protein food will increase.

Table 6.5.
Average Weekly Per Capita Consumption of some Main Food in Ampel in 2003

Type of Food Commodities	Total Consumption
Rice	1,930 kg
Corn	0.044 kg
Cassava	0.162 kg
Sweet Cassava	0.062 kg
Beef	0.012 kg
Poultry	0.075 kg
Egg	0.094 kg

Source: Ampel Sub-District Local Statistical Yearbook 2003

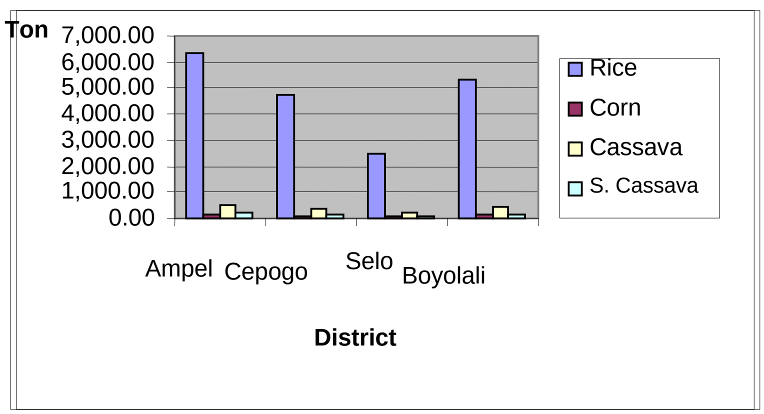
With the assumption on weekly per capita consumption in Table 6.6, the consumption of main food crop commodities in Ampel can be estimated as shown in Table 6.6 and Figure 6.3.

Table 6.6
Estimated Consumption of Main Food Items in 2005

Sub-District	Population (lives)	Total Food Consumption (ton/year)			
		Rice	Corn	Cassava	Sweet Cassava
Ampel	68,783	6,372.06	145.27	534.86	204.70
Cepogo	51,553	4,775.87	108.88	400.88	153.42
Selo	26,580	2,462.37	56.14	206.69	79.10
Boyolali	57,684	5,343.85	121.83	448.55	171.67

Source: Ampel Agropolitan Masterplan Final Report, 2006

Figure 6.3.
Graph of Staple Food Consumption in Selected Sub-Districts, 2005



Source: Ampel Agropolitan Masterplan Final Report, 2006

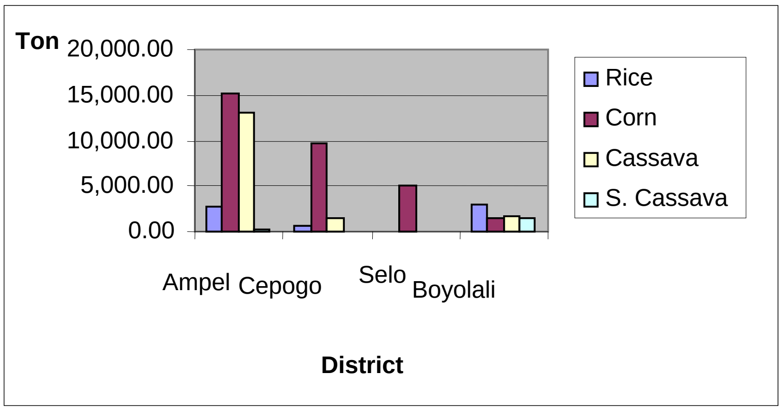
The above table includes the figures from neighboring sub-districts, which are used as a comparison for Ampel's data. The production of staple food crops in Ampel can be outlined as as shown in table 6.7 and figure 6.4.

Table 6.7.
Total Staple Food Production, 2005

District	Population (lives)	Total Food Consumption (ton/year)			
		Rice	Corn	Cassava	Sweet Cassava
Ampel	68,783	2,665.80	15,236.00	13,005.00	192.00
Cepogo	51,553	721.80	9,722.00	1,432.00	14.00
Selo	26,580	26.40	4,990.00	0.00	0.00
Boyolali	57,684	2,915.40	1,400.00	1,701.00	1,469.00

Source: Boyolali District Statistical Yearbook 2004

Figure 6.4.
Production of Main Food Items in 2005



Source: Boyolali District Statistical Yearbook 2004

The production of food commodities is affected by land condition (size, productivity and suitability) as well as the major crops cultivated by residents. The market demand for the commodities and the prices very often influence the residents' portfolio of food cultivation. Unfortunately, the residents often do not anticipate excessive surpluses during harvest time that may lead to lower price. Compared to the other sub-districts in Boyolali district, Ampel has the largest production of food. A large percentage of land area is used for food cultivation and the productivity of land is high. The productivity is subject to soil fertility, crop variety, soil condition, cultivation practices and the handling of weeds and diseases. The balance between food crops supply and demand is shown in table 6.8.

Tabel 6.8.
Balance of Staple Food Production and Demand, 2005

District	Population (lives)	Balance in Food Supply & Demand (ton/year)			
		Rice	Corn	Cassava	Sweet Cassava
Ampel	68,783	-3,706.26	15,090.73	12,470.14	-12.70
Cepogo	51,553	-4,054.07	9,613.12	1,031.12	-139.42
Selo	26,580	-2,435.97	4,933.86	-206.69	-79.10
Boyolali	57,684	-2,428.45	1,278.17	1,252.45	1,297.33

Source: Ampel Agropolitan Masterplan Final Report, 2006

Ampel has a deficit in rice and roots, but has a surplus in corn and cassava. Corn is one of the most common food crops in Ampel. Paddy, both wet and dry paddy, cannot be found in all the villages of Ampel. Corn is cultivated in all the villages of Ampel, and is produced both for household consumption and cattle feed. The production in 2004 was 15,236 tons with a total land area of 3,511 hectares.

The largest corn producer was Kembang with a total production of 1,386 tons. There are also other villages that produce more than 1,000 tons of corn. These are Ngargosari, Ngargoloko, Sampetan, Ngadirejo and Jlarem. The surplus corn can be processed into concentrates for cattle feed. Other alternatives include producing corn oil, corn snacks and corn flakes. The surplus cassava can be processed into dried chips, cassava flour, tapioca flour, cassava fried chips and high fructose syrup.

Table 6.9.
Harvest Area, Average Production and Production of Corn in Ampel

NO	VILLAGE	LAND AREA (Ha)	AVG PRODUCTION (Kw/Ha)	PRODUCTION (Ton)
1	Ngagrong	163,00	45,17	738,00
2	Seboto	213,00	35,66	759,00
3	Tanduk	105,00	41,22	434,00
4	Banyuanyar	142,00	35,67	508,00
5	Sidomulyo	153,00	41,07	627,00
6	Ngargosari	283,00	37,26	1,056
7	Selodoko	105,00	40,57	427,00
8	Ngenden	127,00	46,52	592,00
9	Ngampon	113,00	47,41	534,00
10	Gondang Slamet	29,00	42,01	122,00
11	Candi	167,00	48,36	808,00
12	Urut Sewu	98,00	45,10	442,00
13	Kaligentong	182,00	37,26	677,00
14	Gladagsari	144,00	38,84	559,00
15	Kembang	302,00	45,98	1,386
16	Candisari	182,00	38,05	691,00
17	Ngargoloko	240,00	47,40	1,136
18	Sampetan	247,00	50,73	1,253
19	Ngadirojo	262,00	48,36	1,265
20	Jlarem	254,00	47,97	1,220
	TOTAL	**3.511,00**	**43,40**	**15,236**

Source: Ampel Sub-District Statistical Yearbook 2004

The consumption of animal farm products also depends on the size of the population and the level of income. Based on the weekly per capita consumption, the consumption pattern for meat can be estimated as shown in table 6.10.

Table 6.10.
Estimated Consumption of Animal Farm Products in 2005

Sub-District	Population (Lives)	Consumption (ton/year)		
		Beef	Poultry	Egg
Ampel	68,783	39.62	247.62	310.35
Cepogo	51,553	29.69	185.59	232.61
Selo	26,580	15.31	95.69	119.93
Boyolali	57,684	33.23	207.66	260.27

Source: Ampel Agropolitan Masterplan Final Report, 2006

Since the level of income is still relatively low, most residents consume egg and poultry, which are relatively cheaper than beef. Overall, the residents still spend a large proportion of their income on carbohydrate consumption The national average monthly per capita spending on food for 2003 was Rp 127,950. Only Rp6,524 was spent on beef and Rp6,828 on milk (Ampel Sub-District Statistical Yearbook 2003). Nevertheless, the improvements in education and the increasing awareness of proper nutrition along with the increase in income are expected to bring about changes in the consumption pattern. The residents are expected to shift from a carbohydrate- dominated consumption to a consumption with larger protein intake. This shift in consumption pattern will consequently lead to a higher ratio of animal farm products consumption compared to the consumption of food crops. The animal farm production is outlined in table 6.11.

Table 6.11.
Total Production of Animal Farms in 2005

Sub-District	Population (Lives)	Consumption (ton/year)		
		Beef	Poultry	Egg
Ampel	68,783	1,054.51	109.43	1,272.68
Cepogo	51,553	1,285.48	23.25	142.93
Selo	26,580	199.82	8.25	2.11
Boyolali	57,684	513.88	42.02	301.28

Source: Ampel Sub-District Statistical Yearbook 2004

Ampel's main product is beef, because the main livestock is cattle. This includes both meat and milk cattle. This explains why Ampel has a surplus in beef production. Initially, animals are used for cultivation, mostly as ploughs. However, the development of plough machines has made animal farming more profit-oriented. Animal farming has become a source of income as well as nutrition intake. The population of livestock in Ampel is listed in table 6.12.

Table 6.12.
Population of Livestock, 2004

Sub-District.	Livestock				Total
	Meat cattle	Milk Cattle	Buffalo	Horse	
Ampel	8,358	9,231	73	37	15,933.78
Cepogo	10,274	10,491	0	16	18,700.66
Selo	1,597	9,695	0	23	10,180.28
Boyolali	4,039	6,092	71	167	9,318.31

Source: Ampel Sub-District Statistical Yearbook 2004

The products of animal farming include both edible and non-edible items. The edible products include meat, milk and fats. The non-edible products are dung, skin and bones. The estimated edible production from animal farming is as shown in table 6.13.

Table 6.13.
Estimated Edible Animal Farm Production, 2005

Sub-District	Total product (kg)			
	Beef	Poultry	Milk	Egg
Ampel	1,138,616.77	111,287.77	11,415,424.37	1,285,915.59
Cepogo	1,352,522.69	23,558.11	12,973,590.84	145,709.50
Selo	208,993.06	8,376.51	11,989,225.35	3,503.28
Boyolali	562,926.81	45,764.41	7,533,611.23	334,948.19

Source: Ampel Agropolitan Masterplan Final Report, 2006

Table 6.14 shows the balance between the supply and the demand for edible animal farm products.

Table 6.14.
Balance of Animal Farm Production and Demand in 2005

Sub-District	Population (lives)	Balance (ton/year)		
		Beef	Poultry	Egg
Ampel	68,783	1,014.89	-138.18	962.33
Cepogo	51,553	1,255.79	-162.34	-89.68
Selo	26,580	184.51	-87.43	-117.82
Boyolali	57,684	480.65	-165.64	41.01

Source: Ampel Agropolitan Masterplan Final Report, 2006

With the domination of cattle-rearing activities, Ampel's main edible products are milk and meat. However, the edible products of Ampel's animal farms also include processed food. The abundance of beef in Ampel has encouraged the growth of cattle-products processing activities including the production of floss and dried meat, as well as the collection of milk. However, there is no milk processing facility currently available in Ampel. The large supply of milk shows the feasibility of developing a milk processing facility, which can process milk into pasteurized milk, milk chips, milk candy and fermented milk.

The floss and dried meat agro-industry is well established in Ampel. This is due to the abundance of beef. The product is graded into different quality grades, whereby the highest quality purely contains meat while the lower quality is a mixture of meat and other ingredients such as onion or peanuts. The industry is located in Candi, Tanduk and Kaligentong villages.

As we have mentioned earlier, animal farms also produce non-edible products. The production of non edible commodities from animal farming in Ampel can be estimated as follows(Table 6.15):

Table 6.15.
Estimated Non-Edible Animal Farm Products, 2005

Sub-District	Total products (kg, kg, kg, lt,sheet)				
	Dung	Bones	Fats	Biogas	Skin
Ampel	117,166.46	327.37	42,787.80	4,890,536,450.00	19,693.00
Cepogo	129,847.66	376.68	50,944.98	5,355,732,600.00	19,122.00
Selo	63,862.59	57.67	7,947.68	2,575,228,300.00	2,705.00
Boyolali	66,307.36	162.96	21,553.04	2,757,950,950.00	9,941.00

Source: Ampel Agropolitan Masterplan Final Report, 2006

Unfortunately, many potential non-edible products have not yet been optimally utilized. This is ironic, considering the abundance of the raw materials and the strong economic prospects. For example, cow dung can be processed to produce fertilizer, biogas and bio-charcoal. The bones can be processed into handcrafts, button, bone flour, gelatine and glue. The animal fats can be processed into oil and butter. The skins can be processed into leather products, handicrafts and chips. There is also enormous potential for biogas from the processing of dung using biogas digester units, which can be used as the source of power for cooking and lighting. Blood is also abundant and can be processed into blood flour that is useful as animal feed.

It is important to note the density of livestock and the land carrying capacity, especially in looking at the growth potential of this sector. Currently, the livestock density in Ampel is 2.52 animals per hectare. With the current livestock density, the government is still optimistic of setting a target for livestock growth. For Ampel, the actual growth rate of livestock exceeds the target rate of growth (Table 6.16).

Table 6.16.
Livestock Production

Sub-District	Livestock		
	Target	Actual Production	Production as a percentage of the target (%)
Ampel	21,785	22,763	104.5
Cepogo	21,475	21,035	97.9
Selo	11,132	10,760	96.7
Boyolali	13,216	12,535	94.8

Source: Ampel Agropolitan Masterplan Final Report, 2006

The strategies in achieving a higher livestock population growth include breeding, the use of high yielding animal breeds and intensification of artificial insemination. In terms of meat production, the targeted meat production and the actual production are outlined in table 6.17.

Table 6.17.
Meat Production, 2004

Sub-District	Meat Products		
	Target (kg)	Actual Production (kg)	Production as a percentage of the target (%)
Ampel	1,127,568	1,138,617	101.0
Cepogo	1,381,922	1,352,523	97.9
Selo	209,776	208,993	99.6
Boyolali	639,920	562,927	88.0

Source: Ampel Agropolitan Masterplan Final Report, 2006

Consistent with the achievement in livestock, Ampel manages to exceed the target for meat production of 1,127 tons by 1 percent. The government also targeted growth in milk production, in which the balance between the targeted and actual milk production is as shown in table 6.18.

Table 6.18.
Milk Production, 2004

Sub-District	Milk Product		
	Target (kg)	Actual (kg)	Achievement (%)
Ampel	10,832,076.44	11,415,424.37	105.4
Cepogo	12,312,357.03	12,973,590.84	105.4
Selo	11,346,906.80	11,989,225.35	105.7
Boyolali	7,131,948.29	7,533,611.23	105.6

Source: Ampel Agropolitan Masterplan Final Report, 2006

Consistent with the growth of livestock, Ampel manages to produce abundant milk and achieves its target of milk production successfully.

Forage is one of the most important inputs in cattle rearing. Spending on forage may constitute 60-70 percent of the total costs. The availability of forage at a low price is a key factor in cattle rearing. The availability of forage is crucial in ensuring productivity. The main forages for cattle are grass and concentrates made from corn. Grass is obtained either from growing it in the backyard or by purchasing from the forage market. Ampel has the highest production of forage compared to its neighboring sub-districts. Corn is the main contributor, followed by grass. There are indeed business opportunities in the cultivation of grasses including natural and king grasses by creating pastures. The forage market is functioning effectively to channel the surplus to the deficit areas.

Overall, the strengths of Ampel's cattle-related industries include the strategic location, large-scale cattle production, the established upstream and downstream industries, the available commercial infrastructure, the willingness of the residents to pursue developments and the organizational arrangements for both public and private sectors. However, the low capacity to utilize technology remains a challenge. In addition, the residents still face problems related to weeds and animal diseases that still require support from the government. There are some villages with low accessibility, due to the mountainous terrain, which may affect the supply of farm inputs and the distribution of farm outputs.

6.6 Ampel as an Agropolitan Region

The analysis of land carrying capacity shows the relationship between population, land use and environment. This analysis is used to find the carrying capacity to support agricultural activities. Table 6.19 shows the detail of the analysis, where A is the total area that can be used for farming and r is the frequency of harvests per hectare per year.

Table 6.19. Analysis of Carrying Capacity for Ampel

A		r
Wet Rice	704,0	2
Dry Rice	184,0	1
Corn	3.511,0	1
Cassava	840,0	1
Sweet Cassava	14,0	1
Nuts	364,0	1
Plantations	1.569,2	2
Horticulture	551,0	3

Source: Ampel Agropolitan Masterplan Final Report, 2006

The carrying capacity is calculated as follows:

$$CCR = \frac{A \times r}{H \times h \times F} \quad [6.1]$$

Source: Ampel Agropolitan Masterplan Final Report, 2006

Where F is the land size, h is the percentage of population residing, H is the total farmer households and CCR is the carrying capacity. For Ampel with 68,783 people, assuming the average household comprises of five members, the result of this analysis shows that the average households in Ampel has 0.80 hectare of land. This is smaller than the ideal threshold of 1 hectare, as determined by the carrying capacity. However, the development of an Agropolitan can solve this problem by increasing efficiency through pooling of resources.

In defining the economic activities that support the functioning of an Agropolitan region, the agricultural economic activities can be grouped into upstream, cultivation, downstream and supporting activities. The agricultural system has a cycle that starts with pre-harvest followed by harvest post-harvest and finally the marketing of products. A participative meeting was held during 28-29 September and 1 October 2005. It discussed the preparation for the Ampel Agropolitan Masterplan. According to this meeting, the facilities that should be available in an Agropolitan region are as follows:

1. Upstream: production facility shops, farming tools, unloading location, fertilizer supply and pesticides.
2. Cultivation: irrigation, clean water, collection centers, livestock containers and farm roads, wells, centers for disease management, skill improvement programs, roads and bridges to neighboring areas, improvement of roads to access the markets, tertiary water distribution systems, small dams and sprayers for medicines.
3. Downstream: drying locations, warehouses for produces, cold storages, packing houses, slaughter houses, factory, preservation of produce, cutting machines and small industry centers.
4. Marketing: traditional market and supporting facilities, agro-business sub-terminals, animal markets, rural-urban infrastructure, agro-business sub-terminals, subsidized fertilizer retailers, vegetable marketing posts, shops for sale of produce, west ring road construction, village market development, shops for production facilities, showrooms for leading commodities and rural transport.

In the Ampel Agropolitan region, the Ampel city acts as a market center. The target hinterland population is between 100,000 and 500,000 and the center population is between 5,000 and 10,000. The size of the center has been achieved, but the next target is to increase the total hinterland population to the threshold. Table 6.20 shows the types of growth centers and the ideal population size.

Table 6.20.
Types of Growth Centers

Types	Population in Core	Population in Hinterland
1. Market Centre	5.000 – 10.000	100.000 – 500.000
2. Growth Centre	10.000 – 30.000	500.000 – 600.000
3. Growth Pole	30.000 – 100.000	2 – 3 million
4. Growth Cluster	> 100.000	12 – 15 million

Source: Ampel Agropolitan Masterplan Final Report, 2006

The facilities needed in the market center include the collection center and the market, primary cooperative, farm tutors and farmers' associations. The infrastructure needed include road, electricity, telephone, clean water and solid waste system.

Table 6.21.
Selection of the Growth Center for Agropolitan

No	District	Size Area (ha)	Total Population	Growth Center Types			
				Market Centre	*Growth Centre*	*Growth Pole*	*Growth Cluster*
1	Ampel	90,391	68.783	2	1	1	1
2	Selo	56,078	26.580	6	2	1	0
3	Cepogo	46,358	51.553	5	2	1	0
4	Boyolali	26,251	57.684	5	2	1	1
	Total	219,078	204.600	18	7	4	2

Source: Ampel Agropolitan Masterplan Final Report, 2006

The growth centers in Boyolali have a radius of 2.5 kms that is accessible by bicycle. The hinterland is within the radius of 5 kms from the outer radius of the core. This gives a total of 7.5 kms ideal radius for the hinterland (Christaller, 1933 and Friedman and Weber, 1979). As shown in Table 6.21, Ampel has been selected as one of the agro-cities in Boyolali, besides from Selo and Cepogo. However, Ampel has the potential to become the main agro-city in the district. The ideal capacity of an Agropolitan Region is between 50-400 hectare with a population size between 50,000-

100,000. The capacity for the agro-city is 10,000-25,000. As the main agro-city, Ampel must have groceries, large industries, microfinancing, information centers, warehouses, research centers and cooperatives. The infrastructure includes terminal, bus and rural transport, electricity, clean water, solid waste final disposal site and road access.

Thus, Ampel qualifies as a research area for an Agropolitan Region. The criteria described in Chapter 4 are fully met by Ampel. Ampel acts as a marketing center, sales center, information center, animal market, outlet for small-middle scale industries, slaughter house and vegetable market. The larger industries are in the capital of the district, which is Boyolali city. The data from Ampel can thus be used to conduct empirical analysis on the characteristics of an Agropolitan region.

CHAPTER 7
ANALYSIS

7.1. Introduction

This chapter discusses the results of the empirical tests based on the methodologies described in chapter 5. The findings from the empirical tests will be used as inputs to construct a working model for Agropolitan development. The hypotheses discussed in Chapter 5 are tested and the results will determine the characteristics of the research area. Since the research area fulfills the criteria listed in Chapter 4, the findings from the empirical tests will show the actual pre-requisites that should be met by Agropolitan areas.

7.2. Investigating the Role of Accessibility in Urban Growth

This research analyzes the pattern of urban growth for an agriculture-based city. The Agropolitan concept was proposed by Friedmann and Douglass (1975) based on the creation of agriculture-based cities as an engine of growth for the rural population. The city serves as the growth center and should be accessible from its hinterland villages. Therefore, this research uses the Agropolitan concept as the criterion for selecting the research object observation. The criteria for being considered as an Agropolitan region are mainly the economic base of the area and the level of rural-urban interaction. In Indonesia, despite the fact that agriculture is one of the nation's main sources of living, it is rare to find an urban area that relies on agriculture-related activities. Ampel sub-district of Boyolali district in Central Java is one rare example. Ampel sub-district fulfills the criteria of an Agropolitan region since its urban area development relies on value added activities within the agricultural-industry linkages. Ampel's main commodity is cattle, and the villagers mainly raise cattle for milking or meat. Activities such as pooling of milk, meat, food processing, take place in the urban part, making Ampel suitable to be an example of an Agropolitan region.

Ampel comprises of 20 villages, five of which are grouped as the urban center or capital city of the sub-district. These five villages have highest level of services and industrial activities based on the data obtained from the Statistical Yearbook of Ampel Sub-district in 2003. Table 7.1 shows some data obtained from the annual statistics publication for the Ampel sub-district (2003). In Table 7.1, the highest occupation in services can be found in the bottom five villages in the list, which are the five villages that constitute the urban area of the Ampel sub-district.

Table 7.1. Statistics of Ampel Sub-District

	Agriculture				Population		Occupation				
	Milk Cow (Owners)	Milk Cow	Meat Cow (Owners)	Meat Cow	Working Age (Male)	Working Age (Female)	Manufacturing	Trade	Services	Service, Trade & Manufacturing	% Secondary
08. Ngendem	105	221	169	347	549	540	4	13	116	421	0.35113
17. Ngargoloko	119	304	253	331	406	453	10	14	116	338	0.35208
10. Gondang Slamet	14	28	119	360	453	493	2	7	373	558	0.52198
07. Selodoko	168	227	138	474	738	800	2	19	141	770	0.45888
20. Jlaren	112	344	175	393	687	742	6	10	121	1055	0.62648
09. Ngampon	44	98	278	360	408	406	18	15	132	356	0.35388
02. Seboto	231	801	197	394	1300	1353	3	13	174	1794	0.63821
19. Ngadirejo	126	437	170	586	1077	1162	3	15	119	1448	0.60459
18. Sampetan	143	368	171	531	1545	1600	5	27	108	2220	0.67766
06. Ngargosari	259	611	114	369	1090	1213	4	51	108	1834	0.6691
01. Ngagrong	232	805	212	663	816	898	6	17	199	1043	0.56257
16. Candisari	115	400	142	391	609	682	13	35	240	2802	0.79108
15. Kembang	290	937	184	535	1404	1541	11	16	190	376	0.25337
05. Sidomulnya	224	851	97	298	1106	1166	2	31	215	1468	0.61141
04. Banyuanyar	212	736	46	112	687	770	5	21	240	968	0.61538
14. Gladagsari	132	377	235	338	784	848	15	97	298	2159	0.71967
13. Kaligentong	187	578	207	352	1301	1278	19	94	224	1919	0.67547
11. Candi	114	309	152	313	1422	1482	15	97	315	1713	0.54416
12. Urut Sewu	104	362	127	557	1306	1340	23	136	273	2204	0.69243
03. Tanduk	168	653	206	603	1525	1571	7	10	224	2105	0.63538

Source: Ampel Sub-District Statistical Yearbook 2003

The five villages also have more amenities such as small shops and restaurants, which indicate the level of economic development. However, it is noticeable that other villages have a fair share of citizens employed in the services sector.

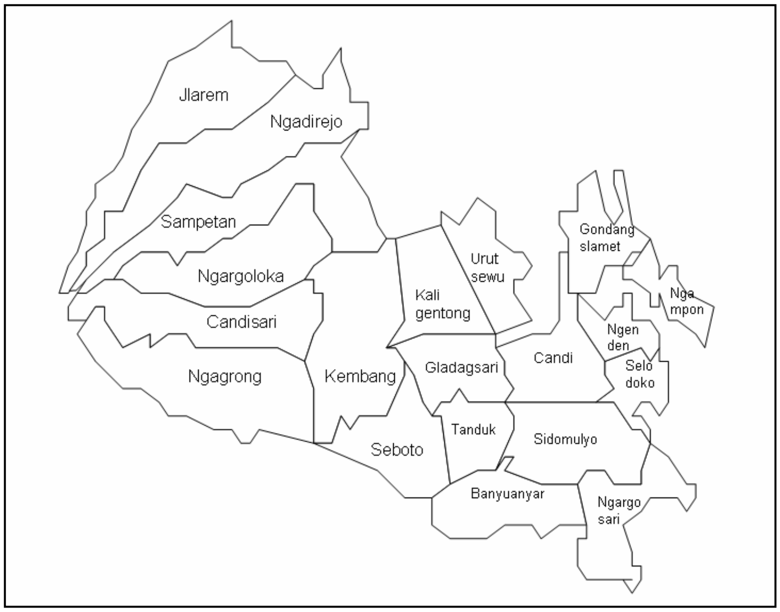
Assuming that service activities are concentrated only in these five urban villages, these service-sector occupants are most likely to travel to the urban area to work and thus constitute people who commute from the hinterland villages to the urban area of Ampel sub-district.

There are 15 villages outside the urban area of Ampel and within the Ampel sub-district. Eight of them are located in the west of Ampel city. Four villages are located in the east of Ampel city and four villages are located in the south of the city. There are no villages located in the north of Ampel city within the same sub-district, thus indicating that a potential hinterland extends beyond the Ampel sub-district administrative line. Figure 7.1 shows the map of Ampel and the points representing each village outside the Ampel city and the nodal point of Ampel city where five villages are merged into one point.

7.2.1. Geographic and Potential Accessibility Measures

The location of Ampel city is rather central, but from Figure 7.1, we can see that Seboto and Kembang villages are also located in the central area and should be included in the Ampel city. Nevertheless, a geographic accessibility matrix must be constructed to justify whether the current five villages in the Ampel city are the most accessible villages within the Ampel sub-district. In constructing the geographic accessibility matrix, the distance is not represented by just geographic distance. Table 7.2 shows the valued graph matrix[13] that contains the distance between villages that is measured by the shortest route. The measure has taken into consideration the available road network.

Figure 7.1. Ampel Sub-district Map and Nodal Points



Source: Boyolali Agropolitan project, map album (2006)

To construct the geographic accessibility matrix, the valued graph matrix is transformed into Table 7.3 to allow for horizontal summation of distance in measuring the geographic accessibility. The total distances from each village are summed up to find the total distance. The higher the distance, the less accessible the village, and vice versa. The results show that the five villages that are the most accessible villages from the highest to the lowest are as follows: Gladagsari (107 kms), Candi (121 kms), Tanduk (130 kms), Urutsewu (135 kms) and Kaligentong (135 kms). This measure is based on the road distance, and the two villages appearing to be accessible based on the quick map

[13] A valued graph matrix is a matrix of distance (shortest route) between the nodes in the network (Rodrigue, 2004)

view are Kembang and Seboto. These have accessibility of 141km and 196km respectively. This justifies why they are not included in the Ampel city.

Table 7.2. Distance between Villages in Ampel Sub-District

Ngagrong																			
13	Seboto																		
9	4	Tanduk																	
11	4	5	Banyuanyar																
11	5	5	1	Sidomulnya															
13	7	6	2	3	Ngargosari														
12	8	5	4	11	13	Selodoko													
13	8	6	4	8	11	8	Ngendem												
14	9	7	5	10	13	10	2	Ngampon											
13	12	7	7	10	13	11	5	3	Gondang										
7	8	3	6	6	9	6	4	4	6	Candi									
7	9	4	7	7	10	8	5	6	4	2	Urut Sewu								
7	9	4	7	7	10	8	5	6	4	2	1	Kaligentong							
6	7	2	5	5	8	5	3	5	5	1	2	2	Gladagsari						
4	11	6	9	9	12	9	7	9	8	5	6	6	4	Kembang					
1	12	7	10	10	13	10	8	10	9	6	7	7	5	1	Candisari				
12	14	9	12	12	15	12	10	12	11	8	9	9	7	3	2	Ngargoloko			
13	16	11	14	14	17	14	12	14	13	10	11	11	9	5	4	2	Sampetan		
15	16	11	14	14	17	14	12	14	13	10	11	11	9	5	4	4	1	Ngadirejo	
16	24	19	22	22	25	21	20	22	21	18	19	19	17	22	22	24	26	2 6	Jlaren

Source: Statistical Yearbook of Ampel Sub-district (2003)

Table 7.3. Geographic Accessibility Matrix

	NGA	SEB	BAN	SID	NGS	SEL	NGD	NGP	GSL	KEM	CDS	NGL	SAM	NGR	JLA	TAN	CAN	URS	KLG	GLS	
NGA	0	13	11	11	13	12	13	14	13	4	1	12	13	15	16	9	7	7	7	6	197
SEB	13	0	4	5	7	8	8	9	12	11	12	14	16	16	24	4	8	9	9	7	196
BAN	11	4	0	1	2	4	4	5	7	9	10	12	14	14	22	5	6	7	7	5	149
SID	11	5	1	0	3	11	8	10	10	9	10	12	14	14	22	5	6	7	7	5	170
NGS	13	7	2	3	0	13	11	13	13	12	13	15	17	17	25	6	9	10	10	8	217
SEL	12	8	4	11	13	0	8	10	11	9	10	12	14	14	21	5	6	8	8	5	189
NGD	13	8	4	8	11	8	0	2	5	7	8	10	12	12	20	6	4	5	5	3	151
NGP	14	9	5	10	13	10	2	0	3	9	10	12	14	14	22	7	4	6	6	5	175
GSL	13	12	7	10	13	11	5	3	0	8	9	11	13	13	13	21	6	4	4	5	181
KEM	4	11	9	9	12	9	7	9	8	0	1	3	5	5	22	6	5	6	6	4	141
CDS	1	12	10	10	13	10	8	10	9	1	0	2	4	4	22	7	6	7	7	5	148
NGL	12	14	12	12	15	12	10	12	11	3	2	0	2	4	24	9	8	9	9	7	187
SAM	13	16	14	14	17	14	12	14	13	5	4	2	0	1	26	11	10	11	11	9	217
NGR	15	16	14	14	17	14	12	14	13	5	4	4	1	0	26	11	10	11	11	9	221
JLA	16	24	22	22	25	21	20	22	21	22	22	24	26	26	0	19	18	19	19	17	405
TAN	9	4	5	5	6	5	6	7	7	6	7	9	11	11	19	0	3	4	4	2	130
CAN	7	8	6	6	9	6	4	4	6	5	6	8	10	10	18	3	0	2	2	1	121
URS	7	9	7	7	10	8	5	6	4	6	7	9	11	11	19	4	2	0	1	2	135
KLG	7	9	7	7	10	8	5	6	4	6	7	9	11	11	19	4	2	1	0	2	135
GLS	6	7	5	5	8	5	3	5	5	4	5	7	9	9	17	2	1	2	2	0	107

Source: Author's calculation

The village with the least accessibility is Jlarem, which is located in the northwest of Ampel city. Jlarem has accessibility of 405 kms, which is followed by Ngagrong with accessibility of 221 kms, followed by Sampetan and Ngargosari, both with accessibility of 217 kms. Other villages have accessibility between 140 kms to 197 kms. Thus, by looking at the geographic accessibility, the five villages constituting Ampel city are the most accessible villages within the Ampel sub-district area.

However, it is necessary that other aspects, apart from mere distance, be considered in measuring the accessibility. This is particularly important as one village may be more important than another one in terms of economic potential. Therefore, potential accessibility needs to be measured. In the case of Ampel, the potential accessibility is measured by two indicators. The first indicator is the working age population in each village and the second indicator is the number of meat and milk cattle in each village.

The use of working age population as the indicator of potential accessibility is justified because working age population can serve as a measure of the potential labor force and the potential consumers of Ampel's products and services. Under the assumption that only working age populations are earning, the purchasing power of the village will be determined by the number of working age population. This assumption would ignore the fact that more population means more demand for goods and services. However, potential purchasing power is more important, because in the absence of purchasing power, residents are most likely to satisfy their needs through local resources not traded in the market.

In Table 7.1, the sum of the female and male working age population is the total working age population for each village within the Ampel sub-district. A good example of a village with low accessibility but large population is Sampetan with 1,545 working age males and 1,600 working age females. Sampetan village has the highest number of working age people. A contrasting example is Banyuanyar, a village with relatively high accessibility but small population. Banyuanyar village has 687 working age male and 770 working age female. Figure 7.4 shows the potential accessibility matrix that is constructed with working age population as the indicator. Unlike the geographic accessibility that is measured in a way that the lower the total distance the more accessible the node, the potential accessibility measure shows higher accessibility along with higher total value. The vertical summation in the Table 7.4 shows the potential accessibility measure.

From table 7.4, we can see that Kembang village has the highest potential accessibility with respect to the working age population. The village with the second highest potential accessibility is Gladagsari, followed by Candi, Candisari, Sampetan, Kaligentong and Urutsewu. Despite the high potential accessibility, the inclusion of Kembang village into Ampel city still depends on whether it is located adjacent to other accessible villages.

Table 7.4. Potential Accessibility Matrix based on Working Age Population

	NGA	SEB	BAN	SID	NGS	SEL	NGD	NGP	GSL	KEM	CDS	NGL	SAM	NGR	JLA	TAN	CAN	URS	KLG	GLS
NGA	0.000	0.336	0.288	0.362	0.309	0.271	0.216	0.181	0.205	1.165	3.005	0.214	0.374	0.264	0.196	0.349	0.449	0.449	0.449	0.524
SEB	0.336	0.000	1.028	0.985	0.708	0.524	0.468	0.385	0.300	0.509	0.329	0.251	0.362	0.306	0.170	1.021	0.510	0.454	0.454	0.583
BAN	0.288	1.028	0.000	3.729	1.880	0.749	0.637	0.454	0.343	0.489	0.275	0.193	0.329	0.264	0.131	0.577	0.481	0.412	0.412	0.577
SID	0.362	0.985	3.729	0.000	1.525	0.346	0.420	0.309	0.322	0.580	0.356	0.261	0.387	0.322	0.168	0.740	0.617	0.529	0.529	0.740
NGS	0.309	0.708	1.880	1.525	0.000	0.295	0.308	0.240	0.250	0.437	0.276	0.211	0.320	0.267	0.149	0.622	0.415	0.373	0.373	0.467
SEL	0.271	0.524	0.749	0.346	0.295	0.000	0.328	0.235	0.226	0.498	0.283	0.200	0.335	0.270	0.141	0.593	0.495	0.371	0.371	0.593
NGD	0.216	0.468	0.637	0.420	0.308	0.328	0.000	0.952	0.407	0.576	0.298	0.195	0.353	0.277	0.126	0.420	0.630	0.504	0.504	0.839
NGP	0.181	0.385	0.454	0.309	0.240	0.235	0.952	0.000	0.587	0.418	0.211	0.139	0.283	0.218	0.102	0.320	0.561	0.374	0.374	0.449
GSL	0.205	0.300	0.343	0.322	0.250	0.226	0.407	0.587	0.000	0.486	0.249	0.164	0.315	0.245	0.183	0.113	0.396	0.594	0.594	0.475
KEM	1.165	0.509	0.489	0.580	0.437	0.498	0.576	0.418	0.486	0.000	4.236	1.268	1.218	1.037	0.199	0.729	0.875	0.729	0.729	1.094
CDS	3.005	0.329	0.275	0.356	0.276	0.283	0.298	0.211	0.249	4.236	0.000	1.075	1.109	0.883	0.124	0.389	0.453	0.389	0.389	0.544
NGL	0.214	0.251	0.193	0.261	0.211	0.200	0.195	0.139	0.164	1.268	1.075	0.000	2.002	0.775	0.095	0.254	0.286	0.254	0.254	0.327
SAM	0.374	0.362	0.329	0.387	0.320	0.335	0.353	0.283	0.315	1.218	1.109	2.002	0.000	5.384	0.176	0.416	0.457	0.416	0.416	0.508
NGR	0.264	0.306	0.264	0.322	0.267	0.270	0.277	0.218	0.245	1.037	0.883	0.775	5.384	0.000	0.141	0.333	0.367	0.333	0.333	0.408
JLA	0.196	0.170	0.131	0.168	0.149	0.141	0.126	0.102	0.113	0.199	0.124	0.095	0.176	0.141	0.000	0.150	0.159	0.150	0.150	0.168
TAN	0.372	1.071	0.618	0.781	0.656	0.634	0.454	0.349	0.368	0.763	0.418	0.277	0.434	0.352	0.161	0.000	1.020	0.765	0.765	1.531
CAN	0.613	0.654	0.673	0.809	0.542	0.686	0.917	0.848	0.588	1.105	0.645	0.430	0.572	0.482	0.223	1.336	0.000	2.004	2.004	4.008
URS	0.660	0.617	0.623	0.739	0.521	0.555	0.799	0.620	0.963	0.975	0.599	0.418	0.550	0.468	0.228	1.083	2.167	0.000	4.333	2.167
KLG	0.623	0.589	0.586	0.703	0.495	0.523	0.747	0.577	0.898	0.932	0.562	0.389	0.526	0.444	0.214	1.019	2.038	4.075	0.000	2.038
GLS	0.802	0.821	0.911	1.074	0.675	0.927	1.395	0.782	0.808	1.510	0.877	0.565	0.693	0.593	0.266	2.263	4.525	2.263	2.263	0.000
	10.455	10.413	14.199	14.177	10.066	8.026	9.871	7.888	7.836	18.400	15.809	9.122	15.722	12.990	3.194	12.728	16.899	15.437	15.695	18.038

Source: Author's calculation

From Figure 7.1, we can see that Kembang is located adjacent to the villages in Ampel city. Thus, it can be included in Ampel city based on its potential accessibility. In contrast, Tanduk village, which is located at the southern-most part of Ampel city and has very low potential accessibility, may be excluded from Ampel city.

This shows the possibility of altering the structure of Ampel city, if potential accessibility with respect to working age population is taken into consideration. However, it is important to look at other factors in measuring the potential accessibility. The most important one is the number of livestock, which is the main produce of Ampel sub-district.

Table 7.1 shows the livestock of each village. The number of meat and milk cattle are summed up for each village to arrive at the total livestock. The total livestock is used to calculate the potential accessibility matrix. Table 7.5 shows the potential accessibility matrix based on the livestock in each village. From Table 7.5 we can see that Kembang, Sidomulnya and Seboto are the villages with the highest livestock, in particular meat cattle. The least livestock is found in Gondang Slamet and Ngampon villages.

Thus, the need to be accessible to Gondang Slamet and Ngampon villages is less important compared to being accessible to Kembang, Sidomulnya and Seboto.

Table 7.5. Potential Accessibility Matrix based on Livestock

	NGA	SEB	BAN	SID	NGS	SEL	NGD	NGP	GSL	KEM	CDS	NGL	SAM	NGR	JLA	TAN	CAN	URS	KLG	GLS
NGA	0.000	0.925	0.869	1.154	1.004	0.855	1.356	1.136	1.128	3.870	20.360	1.133	1.569	1.145	0.885	1.573	2.023	2.023	2.023	2.360
SEB	0.925	0.000	2.558	2.672	1.960	1.366	2.288	1.842	1.278	1.468	1.753	1.019	1.317	1.115	0.618	3.708	1.854	1.648	1.648	2.119
BAN	0.869	2.558	0.000	10.890	5.625	2.115	3.958	2.822	1.839	1.520	1.856	0.983	1.329	1.098	0.562	2.472	2.060	1.766	1.766	2.472
SID	1.154	2.672	10.890	0.000	4.793	1.054	2.370	1.724	1.600	1.868	2.169	1.243	1.552	1.321	0.704	3.098	2.582	2.213	2.213	3.098
NGS	1.004	1.960	5.625	4.793	0.000	0.919	1.756	1.354	1.258	1.431	1.696	1.019	1.299	1.109	0.634	2.642	1.761	1.585	1.585	1.981
SEL	0.855	1.366	2.115	1.054	0.919	0.000	2.066	1.481	1.234	1.598	1.926	1.041	1.379	1.148	0.622	2.612	2.177	1.633	1.633	2.612
NGD	1.356	2.288	3.958	2.370	1.756	2.066	0.000	11.090	4.188	3.107	3.329	1.986	2.223	1.953	1.022	3.405	5.108	4.086	4.086	6.810
NGP	1.136	1.842	2.822	1.724	1.354	1.481	11.090	0.000	6.407	2.226	2.491	1.512	1.782	1.551	0.850	2.673	4.678	3.118	3.118	3.742
GSL	1.128	1.278	1.839	1.600	1.258	1.234	4.188	6.407	0.000	2.349	2.630	1.536	1.824	1.575	1.344	0.832	2.912	4.368	4.368	3.494
KEM	3.870	1.468	1.520	1.868	1.431	1.598	3.107	2.226	2.349	0.000	24.480	5.903	4.904	4.258	0.831	3.047	3.656	3.047	3.047	4.570
CDS	20.360	1.753	1.856	2.169	1.696	1.926	3.329	2.491	2.630	24.480	0.000	11.295	7.350	6.543	1.053	3.309	3.860	3.309	3.309	4.632
NGL	1.133	1.019	0.983	1.243	1.019	1.041	1.986	1.512	1.536	5.903	11.295	0.000	11.315	4.850	0.683	1.821	2.049	1.821	1.821	2.341
SAM	1.569	1.317	1.329	1.552	1.299	1.379	2.223	1.782	1.824	4.904	7.350	11.315	0.000	26.210	0.892	2.109	2.320	2.109	2.109	2.578
NGR	1.145	1.115	1.098	1.321	1.109	1.148	1.953	1.551	1.575	4.258	6.543	4.850	26.210	0.000	0.768	1.815	1.997	1.815	1.815	2.219
JLA	0.885	0.618	0.562	0.704	0.634	0.622	1.022	0.850	0.832	0.831	1.053	0.683	0.892	0.768	0.000	0.893	0.942	0.893	0.893	0.998
TAN	1.426	3.375	2.206	2.832	2.420	2.346	3.183	2.483	2.306	2.825	3.119	1.673	1.988	1.695	0.823	0.000	5.210	3.908	3.908	7.815
CAN	2.140	1.956	2.197	2.718	1.852	2.313	5.313	4.883	3.048	3.820	3.997	2.151	2.402	2.079	0.988	5.927	0.000	8.890	8.890	17.780
URS	1.700	1.397	1.443	1.890	1.359	1.350	3.634	2.742	3.803	2.670	2.986	1.570	1.904	1.610	0.774	3.675	7.350	0.000	14.700	7.350
KLG	2.124	1.727	1.867	2.314	1.656	1.721	4.228	3.237	4.545	3.165	3.410	1.900	2.174	1.880	0.930	4.418	8.835	17.670	0.000	8.835
GLS	3.040	2.701	3.288	3.914	2.491	3.428	8.170	4.558	4.310	5.590	5.448	2.924	3.031	2.672	1.238	10.520	21.040	10.520	10.520	0.000
	47.819	33.334	49.022	48.783	35.637	29.962	67.219	56.170	47.690	77.882	107.889	55.736	76.443	64.581	16.219	60.547	82.412	76.420	73.450	87.806

Source: Author’s calculation

From Table 7.5, we see that Candisari has the highest potential accessibility, followed by Gladagsari, Candi, Kembang, Sampetan, Urutsewu and Kaligentong. It is important to note that Kembang, the top scorer for working age population based potential accessibility, is only ranked fourth, and Candisari, ranked fourth for working age population based potential accessibility, is ranked first. Gladagsari and Candi have second and third ranks, respectively, for both working age population based potential accessibility as well as livestock-based potential accessibility. Kembang, Sampetan and Candisari are consistently in the top five in the working age and livestock-based potential accessibilities but are not included in the current Ampel city. This is most likely due to the fact that these villages are not in the top five villages in terms of geographic accessibility. However, Tanduk village is out of the top five for both categories of potential accessibilities. Thus, its inclusion in the Ampel city is not justifiable when these two categories are taken into consideration.

All the five villages within Ampel city are also ranked the highest five in terms of geographic accessibility. However, only Candi and Gladagsari villages are also among the top five villages in the rankings of potential accessibility for both the working-age population-based score as well as livestock-based score. Candisari tops the score for potential accessibility based on livestock by a significant margin. Gladagsari is the second highest scorer. Kembang village, with a score of 18.4, is the top scorer for potential accessibility based on working age population. Unlike Candisari, which leads by a significant margin, Kembang village is closely followed by Gladagsari, with a score of 18.038.

In terms of consistency, Candisari as the top scorer for livestock based potential accessibility is only ranked fourth in working age based potential accessibility score and seventh in the geographical accessibility score. Kembang is only ranked fourth in the livestock-based potential accessibility score and sixth in terms of geographical accessibility. Sampetan, a village included in the top five for both measures of potential accessibility, is ranked in the bottom five for geographical accessibility. In contrast, both Gladagsari and Candi villages have displayed consistency by being ranked first and second respectively for geographical accessibility, second and third respectively for both measures of potential accessibility. These two villages are also among the five villages constituting the Ampel city.

The remaining three villages in the Ampel city, which are Tanduk, Urutsewu and Kaligentong villages, are not among the top five scorers for both measures of potential accessibility. However, both Urutsewu and Kaligentong are ranked among the top seven for both measures of potential accessibility, which may indicate a relatively high level of potential accessibility for both categories. On the contrary, Tanduk village is ranked low for both measures of potential accessibility, despite being ranked third in terms of geographical accessibility.

This leads us to the question of why Tanduk village is included in Ampel city instead of Kembang or Candisari village. Sampetan may be excluded from consideration since it has a very low score for geographic accessibility. In answering this question, it is important to go back to the basic nature of this research, which is to study the relationship between accessibility and urban growth. Although villages in Ampel city show a significant level of economic development, the current level of economic activities among these villages varies. There is also a possibility that such variations can be explained by the differences in accessibility.

7.2.2. Investigating the Indicators of Economic Activities for the Most Accessible Villages

In analyzing the relationship between accessibility and the villages' level of economic development, in particular, the factors that have contributed to the growth of Ampel city's villages, this paper breaks down Ampel city's villages into the original five villages and looks at these villages on an individual basis to measure their respective level of development. In addition, a comparison is made with three other Ampel villages outside Ampel city that have scores among the highest five in terms of potential accessibility. These include Kembang, Candisari and Sampetan villages. However, all villages will be included in this analysis.

Based on the Ampel Sub-District Statistical Yearbook (2003), the available information that can be used as indicators of the level of economic activities and development in each village are as follows: telecommunication infrastructure, educational institutions (secondary school, senior school, and higher education institution), access to basic infrastructure (electricity and clean water), commercial activities (shops, market, small shop, restaurant, financial institutions) and tax revenue. These data are available for the fiscal year 2003 in the Statistical Yearbook of Ampel Sub-District (2003). Table 7.6 shows the data for access to telecommunication infrastructure and educational institutions.

Table 7.6. Data on Access to Telecommunication and Educational Institutions

	Phone	Primary Teachers	Secondary Schools	Secondary Students	Secondary Teachers	Senior Schools	Senior Students	Senior Teachers	Islamic Primary Schools	Islamic Primary Students	Islamic Primary Teachers	Islamic Junior High Schools	Islamic Junior High Students	Islamic Junior High Teachers	Higher Education Institution	Higher Education Students	Lecturers
08. Ngendem	-	19	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
17. Ngargoloko	-	8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10. Gondang Slamet	-	16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
07. Selodoko	-	16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
20. Jlaren	-	17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
09. Ngampon	-	8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
02. Seboto	-	16	-	-	-	-	-	-	1	103	3	-	-	-	-	-	-
19. Ngadirejo	-	17	-	-	-	-	-	-	1	97	2	-	-	-	-	-	-
18. Sampetan	-	20	-	-	-	-	-	-	1	108	2	1	80	-	-	-	-
06. Ngargosari	-	23	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
01. Ngagrong	-	21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
16. Candisari	-	19	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
15. Kembang	-	16	1	367	37	-	-	-	2	169	7	1	94	1	-	-	-
05. Sidomulnya	-	25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
04. Banyuanyar	-	16	-	-	-	-	-	-	1	49	2	-	-	-	-	-	-
14. Gladagsari	-	24	-	-	-	1	403	41	-	-	-	-	-	-	-	-	-
13. Kaligentong	83	29	2	512	39	2	223	32	1	83	3	-	-	-	1	116	15
11. Candi	92	19	4	1585	119	2	474	46	1	100	4	-	-	-	-	-	-
12. Urut Sewu	60	29	-	-	-	1	51	14	-	-	-	-	-	-	-	-	-
03. Tanduk	94	17	-	-	-	-	-	-	1	161	4	-	-	-	-	-	-

Source: Ampel Sub-District Statistical Yearbook (2003)

For telecommunication infrastructure, only Kaligentong, Candi, Urut Sewu and Tanduk villages currently have telephone services. Surprisingly, Gladagsari, which is among Ampel City's villages, does not have access to telephone services. However, the remaining four connected villages are constituents of Ampel city.

For the education sector, it is important to look at three important and inseparable aspects, which are the number of students, number of teachers and the number of schools. This is particularly important considering the case of Gladagsari and Kaligentong villages. In Gladagsari, there is only one senior school while in Kaligentong, there are two senior schools. However, there are 403 students and 41 teachers in Gladagsari's senior schools, which is more than Kaligentong with only 223 students and 32 teachers for both of its senior schools. Primary schools are present in every village and thus, they are not included in the comparison.

There are seven secondary schools in Ampel. These are one in Kembang village, two in Kaligentong village and four in Candi village. In the sub-district, there are a total of 2,464 students who are enrolled in the secondary schools. The highest number of students and teachers are in Candi village and the least number are by Kembang village. In addition, the same level of secondary study is also provided through two Islamic junior high schools or *Madrasah Tsanawiyah*, one located in Sampetan village with 80 students and another one in Kembang village with 94 students. At senior secondary level, there are six schools, which include one in Gladagsari village, two in Kaligentong village, two in Candi village and another one in Urutsewu village. At the senior school level, the highest number of students and teachers are in Gladagsari and Candi villages. Urutsewu village has the least number. There is only one higher educational institution that is located in Kaligentong village with 116 students and 15 lecturers.

Table 7.7 shows the data for access to basic infrastructure and level of commercial activities including tax revenue. For access to basic infrastructure, there are two important measures, which are access to electricity and access to clean water. However, since all villages have their sub-villages or *dusun* connected to electricity, the comparison can only be made with respect to clean water access coverage. In comparing the access to clean water, we look at the percentage of coverage that is obtained by calculating the ratio of sub-villages with access to clean water to the total number of sub-villages in each respective village.

Out of the 20 villages, 11 villages have absolutely no access to clean water. There are seven villages with 100 percent coverage. These are Seboto, Ngargosari, Sidomulnya, Banyuanyar, Gladagsari, Kaligentong and Tanduk villages. Two other villages, Candi and Urut Sewu have 50 percent and 40 percent coverages, respectively.

Table 7.7. Data on Access to Basic Infrastructure & Level of Commercial Activities

	Villages	Villages with Clean Water	Shops	Market	Small Shop	Restaurants	Land & Building Tax Target	Land & Building Tax Actual	Government Bank	Local Credit Bank	Private Commercial Bank	Cooperatives
08. Ngendem	2	0	None	None	4	0	11,563,834	11,563,834	-	-	-	-
17. Ngargoloko	2	0	None	None	6	0	11,152,470	11,152,470	-	-	-	-
10. Gondang Slamet	2	0	None	None	7	0	10,954,178	9,045,364	-	-	-	-
07. Selodoko	3	0	None	None	7	0	13,705,759	7,664,155	-	-	-	-
20. Jlaren	4	0	None	None	8	0	16,972,273	14,396,466	-	-	-	-
09. Ngampon	2	0	None	None	6	0	26,280,032	24,470,925	-	-	-	-
02. Seboto	2	2	None	None	3	4	20,007,626	16,740,927	-	-	-	-
19. Ngadirejo	5	0	None	None	9	0	21,338,569	18,683,900	-	-	-	-
18. Sampetan	6	0	None	None	7	0	18,288,531	13,308,360	-	-	-	-
06. Ngargosari	3	3	None	None	6	3	23,728,812	23,728,812	-	-	-	-
01. Ngagrong	4	0	None	None	12	0	19,451,264	14,759,549	-	-	-	-
16. Candisari	4	0	None	None	8	0	13,055,095	10,860,059	-	-	-	-
15. Kembang	5	0	None	None	16	0	35,674,098	26,632,713	-	-	-	-
05. Sidomulnya	3	3	None	None	11	6	13,606,658	13,606,658	-	-	-	-
04. Banyuanyar	2	2	None	None	14	6	11,019,081	11,019,081	-	-	-	-
14. Gladagsari	3	3	None	None	24	9	11,281,450	8,445,941	-	1	1	-
13. Kaligentong	6	6	Present	None	19	11	20,069,805	18,625,012	-	1	-	1
11. Candi	6	3	Present	None	28	16	29,100,777	27,415,737	1	1	-	2
12. Urut Sewu	5	2	Present	Present	41	22	17,962,526	15,006,876	-	-	-	1
03. Tanduk	2	2	None	None	114	3	25,623,745	25,623,745	-	-	-	1

Source: Ampel Sub-District Statistical Yearbook (2003)

For the commercial activities, there are various indicators that are available in the statistical yearbook. These include shops, markets, small shops, restaurants as well as banks and registered cooperatives. The difference between shops and small shops is only the size. Shops are relatively larger in size with wider assortment of goods and occupy larger space. An example is the supermarket. Shops are only present in three villages, which are Kaligentong, Candi and Urutsewu villages. Small shops can be found almost everywhere, although the number of small shops in each village varies a lot. The most number of small shops is found in Tanduk village, which has 114 small shops and the least in Seboto village with only three shops. There is only one market in Ampel, which is located in Urutsewu village. A market is different from a shop, as a market may have many small and medium-size shops and it occupies a very large space.

The number of restaurants shows the level of economic activities at the tertiary sector. Restaurants can be found in nine villages. There are 80 restaurants in Ampel. Most restaurants can be found in the Ampel city's villages. Gladagsari has nine restaurants. Kaligentong village has 11 restaurants. Candi village has 16 restaurants and Urutsewu has 22 restaurants. Ngargosari and Tanduk villages with 3 restaurants each, have the lowest number.

Financial institutions also show the degree of economic activities. They can only operate if there is sufficient economic base. There are various types of banks, which include the government bank, the private local credit banks and a commercial bank. In addition, registered cooperatives also serve as both depository and lending financial institutions in Ampel.

The government bank, BRI or Indonesian People's Bank, is located in Candi village. There are three private local credit banks, one each in Gladagsari, Kaligentong and Candi villages. A commercial bank also operates in Gladagsari village. Registered cooperative is a popular form of financial institutions in Ampel, where there are five cooperatives. There are one cooperative each in Kaligentong village, Urutsewu village and Tanduk village and there are two cooperatives in Candi village. Candi village seems to be the center for financial institutions in Ampel with the presence of a government bank, a private local credit bank and two registered cooperatives.

Another important measure are taxes on lands and buildings. This shows development in terms of the level of physical facilities. The tax collection varies among villages from the lowest Rp7.664 millions to the highest Rp27.415 millions. Villages with the highest tax revenue are Candi, Kembang, Tanduk, Ngampon and Ngargosari villages. Gladagsari and Candisari villages are both ranked low in terms of tax collection.

There is a large variation among villages in terms of economic and development indicators. For telecommunication infrastructure, the Ampel city's villages perform well except Gladagsari. Both Kembang and Candisari have no access to telecommunication infrastructure. For the education sector, Kembang, Candi, Gladagsari, Urutsewu and Kaligentong have relatively more teachers and students for post-primary education. Candisari and Tanduk are relatively behind these leading villages in terms of post-primary education. For access to basic infrastructure, the leading villages are Seboto, Ngargosari, Sidomulnya, Banyuanyar, Gladagsari, Kaligentong and Tanduk. Both Candi and Urutsewu also have decent coverage while Kembang and Candisari do not have any coverage. For commercial activities, Urutsewu, Kaligentong, Candi and Tanduk are the most active villages. Gladagsari village has two financial institutions, but both Kembang and Candisari do not have any significant commercial activities apart from small shops. For tax revenue, out of the seven villages with high accessibility, only Candi, Kembang and Tanduk are among the top, while both Candisari and Gladagsari are ranked relatively low. Both Urutsewu and Kaligentong are ranked in the middle for tax collection.

Table 7.8 shows a summary of this analysis. Seven villages with the highest accessibility are Candi, Candisari, Kembang, Gladagsari, Urutsewu, Tanduk and Kaligentong. Some of these villages show a low level of development in some aspects.

Gladagsari, Candisari and Kembang have no access to telecommunication infrastructure. Both Candisari and Gladagsari are ranked low in tax collection. Both Candisari and Kembang villages have no financial institutions and no access to clean water. Both Tanduk and Candisari are lacking in the number of schools and human resources for post-primary education.

Table 7.8. Summary of Economic Development Analysis

	Telecomm	Education	Basic Infrastructure	Commerce	Tax
Non Ampel City Villages					
Kembang	Low	High	Low	Low	High
Candisari	Low	Low	Low	Low	Low
Ampel City Villages					
Candi	High	High	Mid	High	High
Tanduk	High	Low	High	High	High
Urutsewu	High	High	Mid	High	Mid
Gladagsari	Low	High	High	High	Low
Kaligentong	High	High	High	High	Mid

Source: author's summary based on Ampel Sub-District Statistical Yearbook 2003

Candi, Urutsewu and Kaligentong villages perform well in terms of all indicators. On the other hand, no villages outside the seven most accessible villages score high in terms of all the indicators. Only in terms of tax revenue some less accessible villages perform better than the others. This can be explained by the fact that the residents might earn their income from working in Ampel city and use their earnings to build houses as well as purchase vehicles, which are subject to taxes in their respective villages. Therefore, Candi, Urutsewu and Kaligentong are the more accessible villages, and are among the villages inside the Ampel city, which generally are also among the most developed villages in Ampel. In summary, Ampel city's villages are both developed and accessible.

7.2.3 Analysis of Geographical Conditions and Road Network

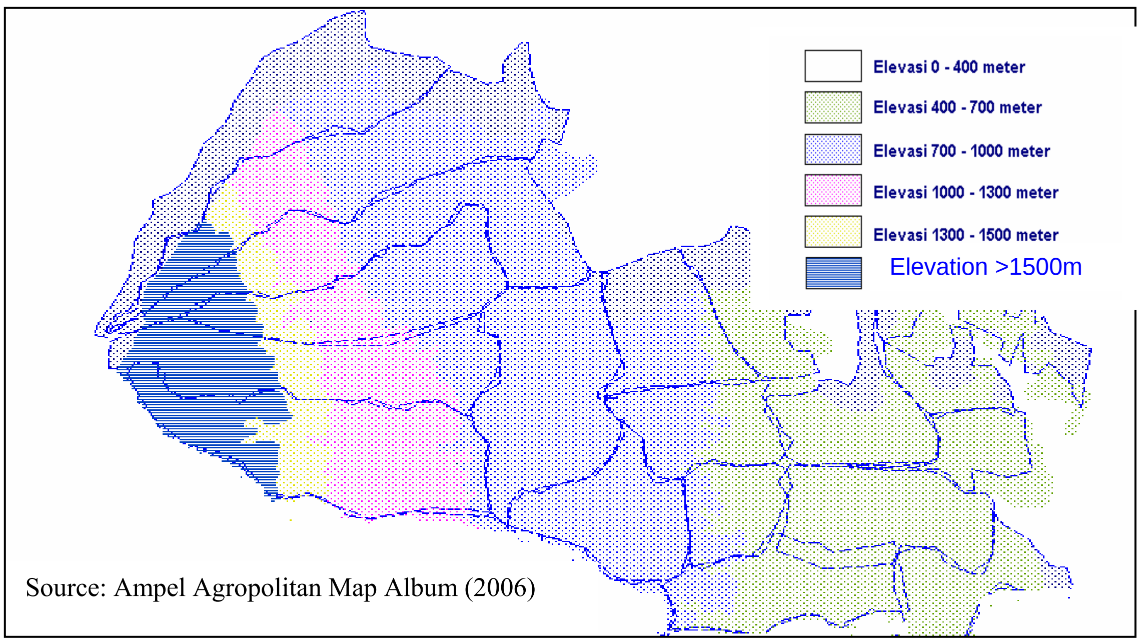
As the most accessible village in almost all the types of accessibility measures, why does Gladagsari lag behind other accessible villages in terms of tax revenue and telephone service. Another interesting case is Tanduk, which displays low accessibility apart from geographical accessibility, but has the highest number of small shops in Ampel. The cases of Kembang and Candisari are also interesting because both villages demonstrate high accessibility but are relatively less developed and not included in Ampel city.

Figure 7.2 shows the map of Ampel with information on the elevation measured from above sea level. It shows that Kembang and Candisari are adjacent to each other and Kembang is adjacent to Kaligentong and Gladagsari. However, we can see that the most developed villages, Candi, Urutsewu and Kaligentong are located to the east while Candisari and Kembang are to the west of Ampel. As we mentioned earlier, the location of Ampel city is rather central to the other villages in Ampel. The central location shows their relatively higher geographical accessibility. The reason why Candisari is not preferred for development activities is most likely due to the nature of its location being at the western-most part of Ampel. In addition, other considerations are important in deciding the location for economic activities and administrative functions.

Figure 7.2 has more information on the actual geographical condition in Ampel. It is clearly shown that towards the west, the elevation is higher where steep elevation is found in Ngagrong, Candisari, Sampetan, Ngargoloko and Ngadirejo villages. These villages have elevation from 700-1,000 meters to more than 1,500 meters. This may create difficulties in transport and explain why Candisari is excluded from administrative and economic activities. Even though the map shows that Kembang village has an even slope of 700-1,000 meters, our field trip shows that the slope is uneven. This make transport difficult and explains why Kembang is not included in the Ampel city.

In contrast, the five villages within the Ampel city are located in a relatively plain land with elevation of 400-700 meter (see figure 7.2 and figure 7.1). The economic activities take place at the meeting point between Kaligentong, Urutsewu and Candi villages, which have the largest plain land with low elevation. The reason why Gladagsari is relatively less developed still remains unclear as it also has a significant portion of low and plain land. The reason for Tanduk lagging behind in some aspects of development may be due to its location being at the southern most part of Ampel city.

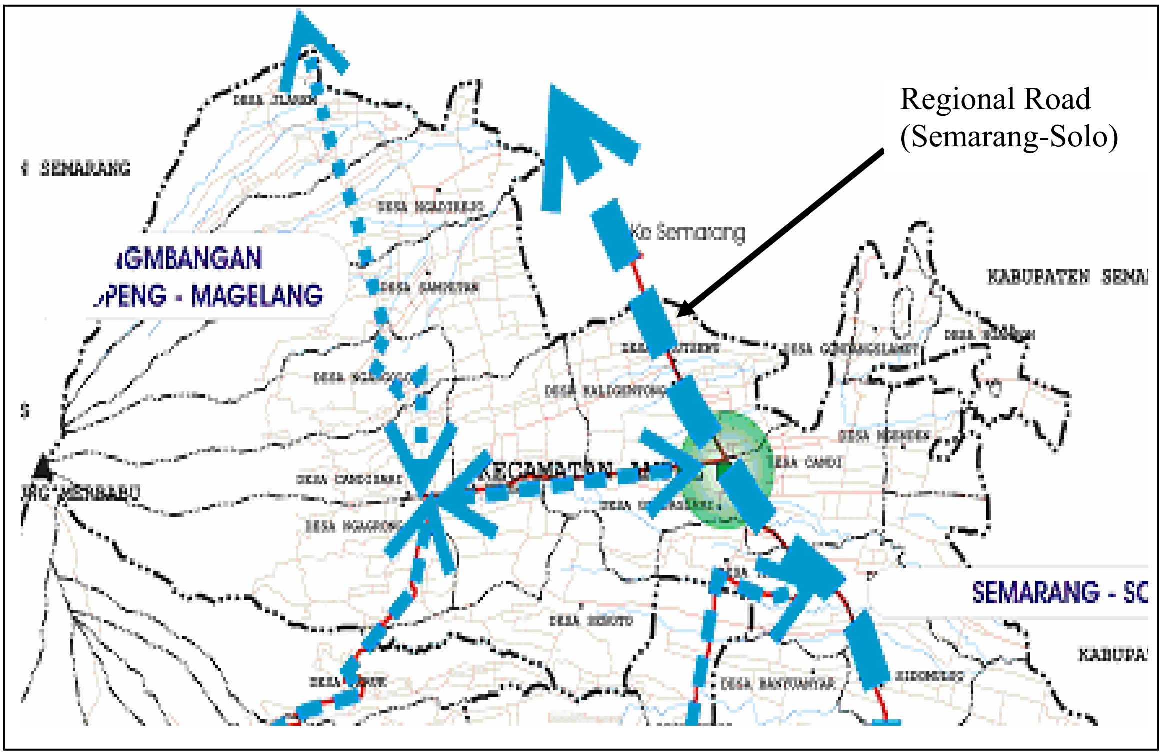
Figure 7.2. Map of Ampel with Elevation Information



Source: Ampel Agropolitan Map Album (2006)

Figure 7.3 shows the map of road network in Ampel. We can see that a regional road going across Ampel actually passes through Ngargosari, Sidomulyo, Candi, Urutsewu and Kaligentong villages. This may explain why Gladagsari village relatively lags behind. It is due to its distance from the regional road. It is important to note that accessibility is defined both in terms of accessibility to the hinterland and to the economic center. However, the fact also counters the argument that the growth in Ampel city takes place only because of the regional road route that goes across it. If the regional road is the sole factor, Ngargosari and Sidomulnyo should be the most developed villages since the regional road passes through both villages. But these villages are not among the leading villages in terms of development indicators.

Figure 7.3. Map of Ampel with Road Network Information



Source: Ampel Agropolitan Map Album (2006)

This shows that the most developed villages in Ampel also have the highest accessibility both in terms of accessibility with the hinterland villages as well as accessibility with the growth center, which in this case is represented by the regional road. The three villages with the highest development are also connected by the regional road.

These are Candi, Urutsewu and Kaligentong. They are also those with the best accessibility within Ampel.

7.2.4 Analyzing the Relationship between Distance from Growth Center and Village Level Growth

The analysis of accessibility has shown that three of the most accessible villages in four aspects, which are geographical accessibility, working-age population-based accessibility, cattle-population based accessibility and accessibility to regional growth center, are the most developed villages within Ampel. Candi village is the center-point of Ampel city, and can be considered as the growth center of Ampel.

Next, we examine whether the current development in other Ampel's villages are determined by the distance from Ampel's growth center. To perform this analysis, a non-parametric Spearman rank correlation is used to investigate the relationship between the distance from Candi village as the growth center, and the village's respective development. Although, in theory, distance from the growth center has a significant impact on the level of development, the very concept of Agropolitan development is to promote equitable growth in the hinterland by locating the most accessible node as the growth center. Thus, from any point within the Agropolitan region, the transport cost is lower compared with outside.

The analysis is done using various indices and measured separately and not using any composite index. The indices include: transport facility ownership (bicycle, motorcycle, and motorcycle ownership per household), communication facility ownership (radio, television), cattle ownership (milk cattle, milk cattle per household, meat cattle, meat cattle per household), education record (senior high graduates, junior high graduates, post-primary education graduates per household), employment (manufacturing, trade, services, secondary/tertiary sector, percentage of population working in the secondary/tertiary sector) and commercial activities (small shops ownership, tax – actual and target collection). Table 7.9 shows the rankings in terms of these indices.

The above mentioned indices are analyzed against the distance of each village to Candi village as the growth center. Table 7.10 shows the Spearman rank correlation test results. Results show that out of the 20 indices measured for correlation, only post-primary education graduates per household index has a rank correlation more than 0.5 at 0.5571. This is followed by employment in services sector (0.393), percentage of population working in secondary/tertiary sector (-0.346), meat cattle per no of household (0.336), meat cattle (0.336) and radio ownership (-0.336).

Table 7.9. Development Indices and Distance from the Growth Center Village

Villages	Distance	Motor/HH	Radio	TV	Milk Cow	milk/ hh	Meat Cow	meat/ hh	Senior High	Junior High	Post-pri/H H	Manufacturing	Trade	Services	Service, Trade & Manufacturing	% Secondary	Small Shop	Land & Building Tax Actual	Land & Building Tax Target
08. Ngendem	1	10	11	15	13	10	12	6	14	14	11	10	12	13	8	13	14	10	12
09. Ngampon	2	6	7	12	14	14	10	2	13	9	4	1	9	9	15	15	13	2	2
15. Kembang	3	13	1	1	1	5	3	10	6	5	3	3	8	6	12	12	1	1	1
10. Gondang Slamet	4	8	12	13	15	15	11	1	8	11	2	15	15	1	2	2	8	14	15
07. Selodoko	5	14	14	8	12	13	5	9	7	7	6	14	6	8	1	3	9	15	9
16. Candisari	6	4	13	9	8	4	8	5	9	8	13	2	2	2	14	14	7	13	11
05. Sidomulnya	7	2	4	2	2	3	14	14	1	1	7	13	3	4	11	8	4	8	10
04. Banyuanyar	8	1	10	4	5	1	15	15	5	4	1	7	5	3	13	9	2	12	14
01. Ngagrong	9	5	15	3	3	2	1	3	4	6	5	5	7	5	3	1	3	6	6
17. Ngargoloko	10	12	6	14	11	7	13	4	15	10	8	4	11	12	4	7	12	11	13
02. Seboto	11	11	8	6	4	6	6	13	3	3	10	11	13	7	7	6	15	5	5
06. Ngargosari	12	3	2	5	6	8	9	12	2	2	9	9	1	14	6	5	11	3	3
19. Ngadirejo	13	9	5	9	7	11	2	8	11	13	14	12	10	11	9	10	5	4	4
18. Sampetan	14	15	9	10	9	12	4	11	10	12	15	8	4	15	10	11	10	9	7
20. Jlaren	15	7	3	7	10	9	7	7	12	15	12	6	14	10	5	4	6	7	8

Source: Author’s Calculation

Table 7.10. Spearman Rank Correlation Result

Villages	Dis/ Bicy	Dis/ Mot	Dis/M otHH	Dis/ Rad	Dis/ TV	Dis/ Milk	Dis/Mi lkHH	Dis/ Meat	Dis/M eatHH	Dis/S enior	Dis/J unior	Dis/Pos tpriHH	Dis/M anu	Dis/T rade	Dis/Se rvices	Dis/Sec ondary	Dis/Per centsec	Dis/Sma llshops	Dis/Ta xActual	Dis/Tax Target
08. Ngendem	36	144	81	100	196	144	81	121	25	169	169	100	81	121	144	49	144	169	81	121
09. Ngampon	16	100	16	25	100	144	144	64	0	121	49	4	1	49	49	169	169	121	0	0
15. Kembang	100	9	100	4	4	4	4	0	49	9	4	0	0	25	9	81	81	4	4	4
10. Gondang Slamet	1	100	16	64	81	121	121	49	9	16	49	4	121	121	9	4	4	16	100	121
07. Selodoko	1	36	81	81	9	49	64	0	16	4	4	1	81	1	9	16	4	16	100	16
16. Candisari	9	9	4	49	9	4	4	4	1	9	4	49	16	16	16	64	64	1	49	25
05. Sidomulnya	25	36	25	9	25	25	16	49	49	36	36	0	36	16	9	16	1	9	1	9
04. Banyuanyar	25	36	49	4	16	9	49	49	49	9	16	49	1	9	25	25	1	36	16	36
01. Ngagrong	25	25	16	36	36	36	49	64	36	25	9	16	16	4	16	36	64	36	9	9
17. Ngargoloko	25	25	4	16	16	1	9	9	36	25	0	4	36	1	4	36	9	4	1	9
02. Seboto	1	36	0	9	25	49	25	25	4	64	64	1	0	4	16	16	25	16	36	36
06. Ngargosari	121	81	81	100	49	36	16	9	0	100	100	9	9	121	4	36	49	1	81	81
19. Ngadirejo	25	36	16	64	16	36	4	121	25	4	0	1	1	9	4	16	9	64	81	81
18. Sampetan	16	16	1	25	16	25	4	100	9	16	4	1	36	100	1	16	9	16	25	49
20. Jlaren	16	49	64	144	64	25	36	64	64	9	0	9	81	1	25	100	121	81	64	49
	442	738	554	730	662	708	626	728	372	616	508	248	516	598	340	680	754	590	648	646
Speaman Coef	**0.2**	**-0**	**0.01**	**-0.3**	**-0**	**-0**	**-0.12**	**-0.3**	**0.336**	**-0.1**	**0.09**	**0.5571**	**0.08**	**-0.1**	**0.393**	**-0.214**	**-0.346**	**-0.0536**	**-0.157**	**-0.154**

Source: Author's Calculation based on data from Ampel Sub-District Statistical Yearbook 2003

The remaining indices have rank correlations of less than 0.3 or -0.3. With a sample size of 15, even at 10% significance level, the remaining nineteen indices do not exceed the critical value of around 0.4 or -0.4. Thus, only one index is statistically significant. The low rank correlation results show a relatively even distribution of development benefits among the villages within the Ampel sub-district, which is in compliance with the concept of Agropolitan development. This is because the differences in transport cost are not substantial and all villages within the sphere of influence of the growth center can benefit from the growth center's development. In addition, despite the lack of significance for correlations, it is worth noting that some of the indices are negative. This indicates that distance does not correlate positively with development. However, this does not necessarily imply that the hypothesis of longer distance correlating negatively with development is rejected. Instead, we find that there is a condition where within a certain sphere of influence of the growth center, any points are equally accessible.

7.2.5 Summary

This analysis focuses on the role of accessibility in the growth of Ampel's villages, particularly in explaining the growth of Ampel city. As an ideal example of Agropolitan, Ampel sub-district of Boyolali shows strong conformance to the concept of Agropolitan. Based on the analysis of geographical accessibility, the five villages within Ampel city are the most accessible. We find that there is no village, that has the best accessibility in terms of all the indicators. However, the growth center does not need to be at the top in terms of all indicators of accessibility. In the case of Ampel, Candi village is the point of intersection, and the villages possessing similar traits are Kaligentong and Urutsewu.

The possible reason for the inclusion of Gladagsari and Tanduk villages can be the centrality of their location and the high geographical accessibility. Although Kembang and Candisari seem to qualify in terms of potential accessibility, both villages have relatively low level of development and are disadvantaged with respect to the topography. Thus, the topographical conditions, road network and weighted potential accessibility measures determine the accessibility of a location in this case.

The rank correlation also conforms to the concept that every point within the Agropolitan should be as accessible as the others. There appears to be no relationship between a village's development and its distance from Candi. This reaffirms the importance of accessibility in locating a growth center and in ensuring that a functional region developed on the basis of a planned program can function effectively.

7.3. Analysis of the Spatial Pattern of Industrial Linkages

7.3.1. Classification of Cattle-Related Economic Sectors

There are four indices to measure the spatial patterns of industrial linkages. Each of these four indices measures different aspects of the spatial patterns. The complexity of the linkage is measured using the β index. The magnitude or density of flows relative to the total linkage is measured using ι index. The degree of concentration or dispersion is measured using the π index. The length of flow is measured by the η index.

In addition to these four basic indices, two modified indices will are used in analyzing the pattern of industrial linkages. The reciprocal ι index ($1/\iota$), is used to provide information on the average purchases or sales per distance unit of the links. The modified η index (η_{ω}) is used to provide a composite measure of the geographical market size and volume of sales. Thus, there are a total of six indices that will be calculated to study the spatial industrial linkages in Ampel sub-district's cattle industry.

The objective of this analysis is to investigate whether the Ampel sub-district demonstrates the industrial linkages characteristics of an Agropolitan region. This analysis also tests the hypothesis that there is a concentration of secondary or tertiary economic activities in Ampel City.

The theoretical working model of Agropolitan development is used as the benchmark for this analysis. It is important to note that this analysis focuses only on the forward linkages of each economic unit. Therefore, what is analyzed is only the flow of goods leaving the particular economic unit instead of the source of inputs for the economic unit. An economic unit represents the total activities of a particular sector in a particular village. For example, the milk cattle raising activities in Candisari village are grouped as one economic unit, which is the Candisari milk cattle economic unit. Similar milk cattle raising activities in another village, for example, Seboto, is grouped as another economic unit named Seboto milk cattle economic unit. Since Candisari has more than one type of economic activities, each type of economic activities in Candisari will count as one economic unit.

The initial step in identifying the economic units is to classify the cattle-related economic sectors. Proper identification of economic units is crucial. The classification of cattle-related economic sectors is done by referring to the findings from field trips and previous reports published by government and research agencies and consultants. The Agropolitan Masterplan Preliminary Report (2005) by the Local Development Planning Agency (BAPPEDA) of Boyolali has identified six main cattle-related economic sectors in Ampel. These are:

1. The cultivation of forage grasses for cattle feed

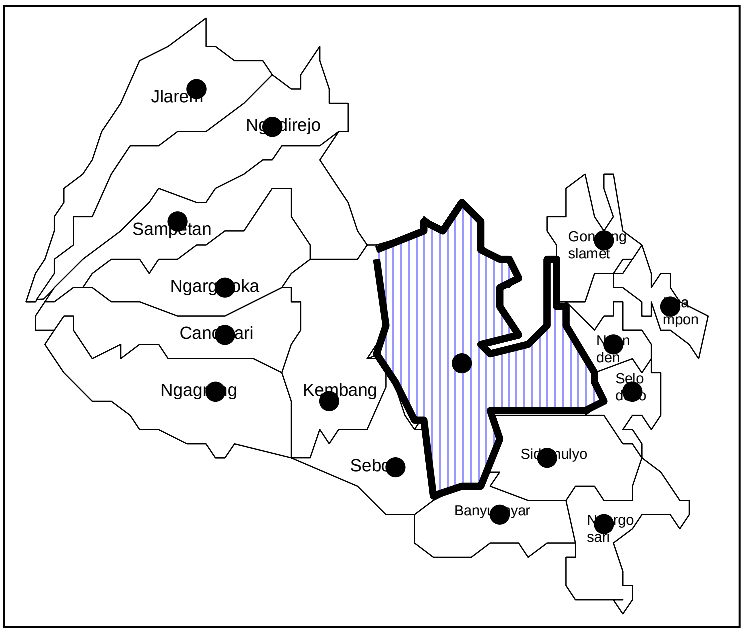
2. The cattle growing sectors (including milk and meat cattle)
3. The slaughter house (for meat cattle and old milk cattle/non-lactating)
4. The Ganesha cooperative as a center to pool the milk
5. The production of dried meat (*dendeng*) and floss
6. The marketing of dried meat and floss

Schmidt (1975) observed the spatial pattern of industrial linkages in USA's steel industry by analyzing the participating firms. This thesis observed the spatial pattern of industrial linkages in Ampel's cattle industry by analyzing the participating villages. The information on whether the economic sector is present or not in the villages of Ampel is obtained from field trips and the Ampel Sub-district Statistical Yearbook 2003. If an economic sector is not present in a village, say, for example, a slaughter house is not present in Kembang, there will be no Kembang slaughter house economic unit.

The five villages constituting Ampel city, which are Candi, Tanduk, Urutsewu, Gladagsari and Kaligentong, are grouped as one urban area of Ampel city. Therefore, if there is a milk cooperative in Tanduk, there is no Tanduk milk cooperative unit. Instead, it is considered the Ampel city milk cooperative unit. This means that if there are milk cattle raising activities both in Candi and Urutsewu, these activities are identified only as one economic unit, which is the Ampel city milk cattle raising economic unit. Figure 7.4 shows the network nodes in Ampel sub-district.

Both meat and milk cattle raising activities can be found in every villages of Ampel sub-district, including the five villages that are part of the Ampel city. We separate meat and milk cattle raising activities into two sectors, which are the milk cattle and meat cow raising sectors. The reason for this separation is that milk cattle raising activities have their own industrial linkages and so do the meat cow raising activities. Thus, each village has two cattle raising economic units, which are the meat cattle economic unit and milk cattle economic unit.

Figure 7.4. The Industrial Linkage Network in Ampel Sub-District



Source: Author's Calculation

For Ampel city, despite the fact that all the five villages have both meat and milk cattle raising activities, these will be grouped into only two economic units. They are the Ampel city meat cattle raising economic unit and the milk cattle raising economic unit.

In total, Ampel sub-district has 15 milk cattle raising economic units outside Ampel city and one milk cattle raising economic unit in Ampel city. According to the Agropolitan Masterplan Preliminary Report (2005), the leading villages in terms of milk production are Seboto, Tanduk, Banyuanyar, Sidomulnyo, Ngargosari, Ngendem, Kaligentong, Gladagsari, Kembang, Candisari, Ngadirejo and Jlarem. Most of the milk cattle are raised by households in the villages and not by farm companies. The cattle are raised in the large backyards of the villagers' houses.

Ampel sub-district also has 15 meat cattle growing economic units outside Ampel city and one meat cattle growing economic unit in Ampel. According to the Agropolitan Masterplan Preliminary Report (2005), the leading villages in terms of meat production are Tanduk, Ngargosari, Selodoko, Ngendem, Ngampon and Gondangslamet.

The locations for raising meat cattle and milk cattle are the same, since most of the meat cattle are raised by villagers who put their cattle in their large backyards. The main feed for both meat and milk cattle are forage grasses and concentrates. The forage grasses can be divided into two kinds, which are the special grass (i.e. king grass) and the natural grass. Concentrates are mixtures of various foods containing high nutrients. According to Syukur (2006), the ideal composition of daily food intake for one cattle is 45% of cattle dry mass for natural grass, 15% of cattle dry mass for special grass and 40% of cattle dry mass for corn or other types of concentrates. Therefore, with cattle commonly weighing 450 kgs, the ideal daily consumption includes 21 kgs of natural grass, 7.5 kgs of king grass and 6 kgs of corn or other concentrates.

These forages are usually grown in areas around the villagers' houses, which explain why this activity is included among the cattle-related economic sectors. However, precisely identifying the physical flow of forages is not easy since many cattle-growers plant forages as a side-income activity. Based on field observations, forage growing activities can be found in all villages. In addition, field observations show that some of these forages are actually sold to the forage market located in the Ampel city. It appears that most of these forages sold to the forage market are surpluses that have not been used up for cattle feed. The buyers are mainly cattle growers who have insufficient supply of forages from their own areas. As it is difficult to identify the exact flow of forages and the sellers and buyers, the information from the Ampel Sub-District Statistical Yearbook 2003 is used as the benchmark.

Since forage grasses are grown on dry land, the total area of dry land in the village serves as a reliable indicator for the potential grass yield in the respective villages. However, the land use for dry land also includes corn cultivation and housing. Natural grasses are not specially cultivated and can be collected freely from the idle dry lands. The average yield per square meter is 266.6 grams for every 45 days of harvesting.

The king grasses are specially cultivated and are usually planted in the backyard of the cattle growers. The size of the area dedicated for the cultivation range from 250-1,000 square meters of land. However, at the average size of land per household of 1,000 square meters, the ideal usage of land for cultivating special grass or king grass is around 250 square meters (Ampel Sub-District Statistical Yearbook 2003). The average yield per square meter is 4,297.64 grams for every 45 days of harvesting (Paat et al, 2003).

The total land with the potential to grow natural grass is obtained by subtracting the area dedicated solely for corn cultivation and area for housing, from the total dry land in the village. There are two kinds of economic units related to forage grass growing, which are natural grass and king grass growing. Since all villages have grass growing activities, there are a total of 16 natural grass growing economic units and 16 king grass growing economic units. There is also a forage grass market economic unit in Ampel city.

Corn is not directly used for cattle feed. Some villagers also consume corn since corn is one of the staple foods in Java. When it is used to feed cattle, corn is processed and mixed with other ingredients to become concentrates. Therefore, corn is sent to Ampel city for further processing into concentrates. Corn contributes around 45% of the concentrates' ingredients (Hanafi, 2004). Thus, many villagers cultivate corn for this purpose. Concentrates also contain other ingredients such as coconuts, beans and by-products of rice. The unconsumed corn is sold in the Ampel city for further processing. This corn is then bought by the cattle growers in the form of concentrates. The corn processing activities in the Ampel city are identified as an economic unit. There are a total of 16 corn growing economic units in Ampel sub-district, including 15 units outside Ampel city.

There are two alternatives for meat cattle after these cattle have been raised. The first is to slaughter them for meat. The villagers do not usually slaughter the cattle for their own consumption. Instead, if they decide to consume meat, they would do so by buying small amounts of meat from the market or by eating out in the restaurants. The common practice is to send the cattle to the slaughter house. The advantage of using the slaughter house is the certification of disease-free issued by the agencies for farming and the veterinarians. The female non-lactating milk cows are also usually slaughtered at the slaughter house. It is quite rare to find female meat cows as farmers usually prefer to buy male meat cows and only farmers focusing on breeding meat cattle would have female cows and these female cows cannot be slaughtered unless they are no longer productive.

There is only one slaughter house in Ampel, which is located in the Gladagsari village. Since Gladagsari is a part of Ampel city, there is only one economic unit for slaughter house in the Ampel sub-district. Most of the meat slaughtered is exported to other areas as shown from the balance in meat consumption and production. The balance shows a surplus of 1,014.89 tons in 2005 (Agropolitan Masterplan Final Report, 2006).

The second alternative is to sell the cattle to the animal market. The animal market is located in Candi village of Ampel city. This market serves as the outlet for people to buy livestock. The consumers usually come from other areas outside Ampel. The market has developed so much that its capacity can no longer accommodate the level of activities. This market has become a provincial center for trading of livestock. However, it is unlikely that meat cattle growers will sell their livestock to the animal market. Instead they usually buy livestock from the animal market. Cattle growers prefer to buy young breeds weighing around 250 kgs, and focus on feeding the cattle to reach the ideal weight for slaughtering.

Since there is only one breeding center in Central Java, which is the village breeding center in Kebumen district, villages in Ampel instead buy young breeds from the animal market. However, milk cattle growers will also have calves from artifical or natural insemination. If the calf is a male, these cattle growers usually sell it to the market. If the calf is a female, they would raise the calf and inseminate it through artificial or natural means so that it can be ready for milking.

The slaughtered cattle are sold to the Ampel market. The Ampel market is located at Gladagsari, which is a part of Ampel city. Villagers purchase food including meats from this market. However, meat processing industries usually purchase meat directly from the slaughter house since they buy in bulk as they look for lower price. There is one economic unit to represent Ampel market, the Ampel City market economic unit.

The meat processing industries process local meats into dried meats or *dendeng* and floss. According to the Agropolitan Masterplan Final Report (2006), the production facilities for *dendeng* and floss in Ampel can only be found in Candi, Urutsewu, Tanduk and Kaligentong villages. Both *dendeng* and floss are the leading commodities in Ampel sub-district. Candi, Urutsewu, Tanduk and Kaligentong villages are part of the Ampel city. Therefore, there is only one economic unit for *dendeng* and floss production, which is the Ampel city *dendeng* and floss production economic unit. The marketing outlets for *dendeng* and floss can be found along the regional road linking Semarang and Solo in Candi, Urutsewu and Kaligentong villages. Since Candi, Urutsewu and Kaligentong are part of the Ampel city, the marketing outlets are also grouped as one economic unit named Ampel city *dendeng* and floss marketing outlet economic unit. Consumers from other areas usually buy Ampel city's *dendeng* and floss in these marketing outlets. The export of *dendeng* and floss is also done through these marketing outlets.

For milk cattle, the daily milk produce is pooled by traveling milk collectors who work for the local milk cooperative. The cooperative is named Ganesha milk village unit cooperative. The cooperative is located in Tanduk, which is a village inside the Ampel city. All milk produce is pooled to this cooperative, processed at the milk processing center outside Ampel and then exported to consumers outside Ampel or sold in the Ampel market in the form of powdered milk or fresh pasteurized milk.

Table 7.11 gives a summary of all the economic units to be included in this analysis. Since the main focus of this analysis is the internal industrial linkage, any export of commodities that originate from Ampel city will not be discussed in detail. However, if there are exports of commodities originating directly from the villages and not through Ampel city, these exports will be discussed.

So far, there is no information showing that direct exports take place from the villages. There are many important reasons for this. First, the level of development in Ampel city and the commercial infrastructure encourages the export activities to utilize Ampel city as the hub. Second, the location of Ampel city as the gateway for Ampel's villages to other areas makes it inevitable for all activities in relation to other cities to make their transit at Ampel city.

Table 7.11. Summary of All Economic Units For Analysis

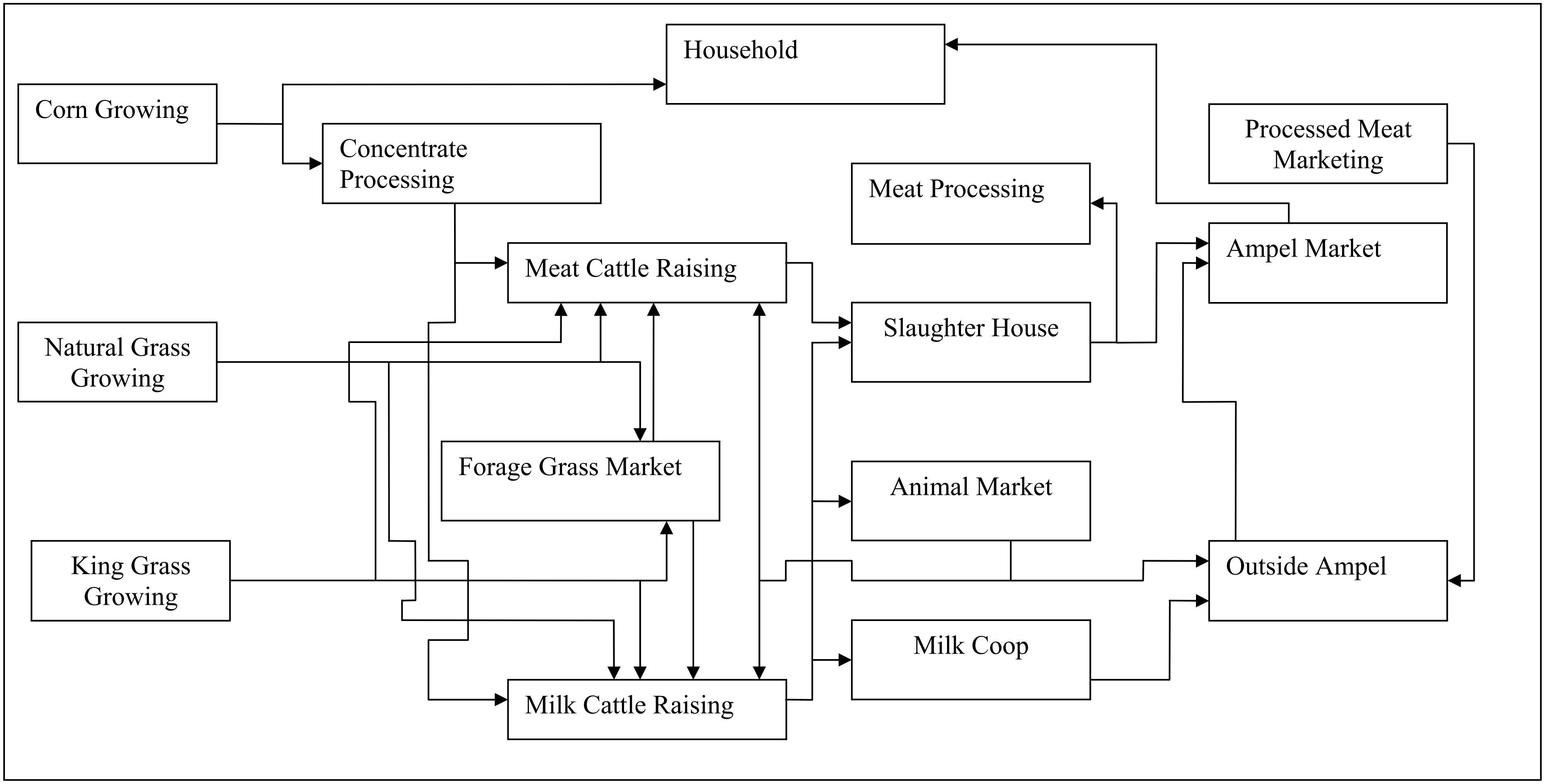
No	Economic Sector	No of Economic Units	Location
1	Milk Cattle Raising	16	All Villages
2	Meat Cattle Raising	16	All Villages
3	Natural Grass Growing	16	All Villages
4	King Grass Growing	16	All Villages
5	Forage Grass Market	1	Ampel City
6	Corn Growing	16	All Villages
7	Corn Processing into Concentrates	1	Ampel City
8	Slaughter House	1	Ampel City
9	Animal Market	1	Ampel City
10	Ampel Market	1	Ampel City
11	*Dendeng* & Abon	1	Ampel City
12	Marketing outlet for Dendeng & Abon	1	Ampel City
13	Ganesha Milk Coop	1	Ampel City
14	Household	16	All Villages

Source: Author's Calculation based on Various Sources

Figure 7.5 shows the industrial linkages for cattle-related sectors in the Ampel sub-district. It is important to note that sectors outside Ampel are not included in the index calculation, but is included in the figure to provide reference for the outward flows.

With the exception of meat cattle, most of the economic sectors have more than one forward linkage. The sectors that deal directly with areas or consumers from outside Ampel in terms of forward linkage are the processed meat marketing and the milk cooperative. The main supply from outside Ampel within this linkage is the processed milk sold to the market.

Figure 7.5. Diagram for Industrial Linkages in Ampel Sub-District



Source: Author's Analysis

7.3.2. The Forage Grass Growing Industry and the Forage Grass Market

As mentioned earlier, there are two types of forage grass growing activities, which are the natural grass growing and king grass growing. Natural grass is much easier to grow and usually involves leaving the dry land idle. King grass requires some treatments, including planting of seeds. Therefore, usually only cattle growers plant king grass in their private lands. The size of land planted for king grass is, on average, around 250 square meters (Ampel Sub-District Statistical Yearbook 2003). The information on land size is discussed in the previous section. By multiplying the total number of cattle owners with the land size for king grass cultivation, we find the total area size used for king grass cultivation. The previous section has also explained the calculation of dry land area for natural grass growing.

By comparing the total potential yield for both types of grasses with the total number cattle in the respective villages, we find some villages have surpluses and some villages have deficits. These surpluses are sold to the forage grass market, and some of the consumers are cattle growers from the deficit villages. The surplus villages for natural grass are Ngagrong, Ngargosari, Candisari, Ngargoloko, Sampetan, Ngadirejo, Candi and Jlaren. The remaining villages are the deficit villages. The surplus villages for king grass are Seboto, Ngargosari, Selodoko, Ngendem, Ngampon, Gondang Slamet, Candi, Kaligentong, Gladagsari, Kembang, Candisari, Ngargoloko, Sampetan and Jlaren. This calculation is done by initially finding the total need for grass obtained by multiplying the total number of cattle with the daily intake for natural grass and king grass. This total intake is then compared with the daily yield for both types of grasses and the number of cattle this yield can sustain.

The price of king grass is Rp100/kg and the price of natural grass is Rp3,500 per 45kg or Rp.77.78/kg. There are costs of transporting the grasses, but the transport cost is not included in the analysis since the focus is on the gross value of the goods transported. Table 7.12 shows the total deficit and surplus in terms of cattle numbers and monetary value. After subtracting the deficit from the surplus, Ampel sub-district is found to be a major surplus king grass producer with 2,906 cattle that can be fed from the surplus. In the case of natural grass, the surplus can feed another 295 cattle. This explains why the forage grass market in Ampel city is well developed.

Table 7.12. Deficit and Surplus for Grass Intake

	Land for King Grass (in sqm)	Dry Land for Natural Grass (sqm)	Natural Grass Yield	King Grass Yield	Surplus/(Deficit) for King Grass	Surplus/(Deficit) for Natural Grass
01. Ngagrong	111,000	7,251,950	42963.7749	10,600.85	(54.55)	577.89
02. Seboto	107,000	3,776,785	22375.3529	10,218.83	167.51	(129.51)
03. Tanduk	93,500	2,090,650	12385.9398	8,929.54	(65.39)	(666.19)
04. Banyuanyar	64,500	1,949,385	11549.0231	6,159.95	(26.67)	(298.05)
05. Sidomulnya	80,250	3,068,455	18178.8912	7,664.12	(127.12)	(283.34)
06. Ngargosari	93,250	3,785,465	22426.7741	8,905.67	207.42	87.94
07. Selodoko	76,500	1,028,680	6094.35751	7,305.99	273.13	(410.79)
08. Ngendem	68,500	236,917	1403.6016	6,541.96	304.26	(501.16)
09. Ngampon	80,500	196,745	1165.60186	7,688.00	567.07	(402.50)
10. Gondang Slamet	33,250	292,608	1733.53688	3,175.48	35.40	(305.45)
11. Candi	66,500	2,659,016	15753.1896	6,350.96	224.79	128.15
12. Urut Sewu	57,750	1,190,440	7052.69564	5,515.30	(183.63)	(583.16)
13. Kaligentong	98,500	2,315,200	13716.2738	9,407.06	324.27	(276.84)
14. Gladagsari	91,750	1,793,394	10624.8631	8,762.41	453.32	(209.05)
15. Kembang	118,500	4,541,130	26903.6724	11,317.12	36.95	(190.87)
16. Candisari	64,250	3,684,555	21828.9414	6,136.07	27.14	248.47
17. Ngargoloko	93,000	2,885,750	17096.4656	8,881.79	549.24	179.12
18. Sampetan	78,500	8,928,978	52899.2341	7,496.99	100.60	1,620.01
19. Ngadirejo	74,000	7,409,931	43899.7216	7,067.23	(80.70)	1,067.46
20. Jlaren	71,750	4,891,263	28978.0159	6,852.35	176.65	642.91

Source:Author's calculation

In calculating the indices, the information required are the flow of grasses from each village to the forage market and the flow of grasses from the forage market to each village, which are expressed in the monetary value of the flow.

Since only surplus villages can sell grasses to the forage market and only deficit villages buy the grasses from the forage market, we can clearly identify the flow based on table 7.12. Table 7.13 shows the value of flow for each village.

Table 7.13. Value of Flow of Forage Grasses for Each Village to the Forage Market

	Value of Flow for King Grass (to forage market)	Value of Flow for Natural Grass (to forage market)	Value of Flow for King Grass (from forage market)	Value of Flow for Natural Grass (from forage market)
01. Ngagrong		43,688,790	14,729,568	
02. Seboto	8,480,247			9,790,730
04. Banyuanyar			7,201,776	22,532,317
05. Sidomulnya			34,321,512	21,420,392
06. Ngargosari	14,000,986	6,648,387		
07. Selodoko	18,436,392			31,055,913
08. Ngendem	20,537,668			37,887,834
09. Ngampon	38,277,004			30,428,633
10. Gondang Slamet	2,389,306			23,092,067
15. Kembang	2,494,068			14,429,979
16. Candisari	1,832,174	18,784,589		
17. Ngargoloko	37,073,604	13,541,276		
18. Sampetan	6,790,448	122,472,843		
19. Ngadirejo		80,700,198	21,789,712	
20. Jlaren	11,923,634	48,603,657		
Ampel City	67,661,314	9,688,283	67,235,560	131,184,820

Source: Author's Calculation

There are a total of 33 economic units in the forward linkages for both natural grass and forage grass. For natural grass, the other economic units as possible links for natural grass economic units are the other 15 natural grass growing units from other villages, 16 household economic units in Ampel and one forage grass market economic unit. All villages will have at least one linkage for local household consumption. However, since the distance is 0, the ι, η and η_ω indices cannot be calculated. Villages trading in the forage grass market in the forward linkage can have the ι, η and η_ω indices calculated. Table 7.14 shows the indices for the natural grass growing economic units and table 7.15 shows the indices for the king grass growing economic units.

From Table 7.14, we can see that for natural grass, with a β index of 0.0625, there is a high concentration of forward linkages, because out of the 32 possible links, only 2 links are used. For villages with positive ι indices, the 1/ ι shows that Sampetan, Ngadirejo, Candisari and Ngagrong villages have average value per distance flow of more than Rp100 million/km. The other villages have around Rp50 million/km. Villages with higher 1/ ι index have greater magnitude of flows. The π index shows that there is an absolute domination of flow by one link that is longest in length, which is due to the fact that the other link out of the two links is just transporting the product within the same village, thus having a zero length. In terms of η index, most villages have around 4km/link with only one village scoring 9. This shows that on an average, the villages have around 4km length of links except for Jlaren which has a much longer length. The η_ω varies widely among villages, with some above 5,000 and some less than 3,000. Higher η_ω index shows a higher average volume and length of flow. So for villages with higher η_ω index, the geographical market size in terms of length and value are large.

Table 7.14. Indices for Natural Grass

NATURAL GRASS	Land for Natural Grass (sqm)	Natural Grass Yield (kg/day)	Total Cattle	Surplus/ (Deficit)	Local Consume (mill Rp)	To Forage Market (million Rp)	Total Dist	Distance	Total Links	No Links	Longest Edge	β	ι	π	η	$1/\iota$	η_w
01. Ngagrong	7,251,950	42,973	1,468	578	863	340	7	7	32	2	7	0.0625	0.01	1	4	171.894	4,211
02. Seboto	3,776,785	22,380	1,195	(129)	627	-	0	0	32	2	8	0.0625	-	0	0	n/a	-
04. Banyuanyar	1,949,385	11,552	848	(298)	323	-	0	0	32	2	6	0.0625	-	0	0	n/a	-
05. Sidomulnya	3,068,455	18,183	1,149	(283)	509	-	0	0	32	2	6	0.0625	-	0	0	n/a	-
06. Ngargosari	3,785,465	22,432	980	88	576	52	9	9	32	2	9	0.0625	0.01	1	5	69.788	2,826
07. Selodoko	1,028,680	6,096	701	(411)	171	-	0	0	32	2	6	0.0625	-	0	0	n/a	-
08. Ngendem	236,917	1,404	568	(501)	39	-	0	0	32	2	4	0.0625	-	0	0	n/a	-
09. Ngampon	196,745	1,166	458	(402)	33	-	0	0	32	2	4	0.0625	-	0	0	n/a	-
10. Gondang Slamet	292,608	1,734	388	(305)	49	-	0	0	32	2	6	0.0625	-	0	0	n/a	-
15. Kembang	4,541,130	26,910	1,472	(191)	753	-	0	0	32	2	5	0.0625	-	0	0	n/a	-
16. Candisari	3,684,555	21,834	791	249	465	146	6	6	32	2	6	0.0625	0.01	1	3	101.891	1,834
17. Ngargoloko	2,885,750	17,100	635	179	373	105	8	8	32	2	8	0.0625	0.02	1	4	59.851	1,915
18. Sampetan	8,928,978	52,911	896	1,624	527	955	10	10	32	2	10	0.0625	0.01	1	5	148.151	7,408
19. Ngadirejo	7,409,931	43,910	1,023	1,068	602	628	10	10	32	2	10	0.0625	0.01	1	5	122.947	6,147
20. Jlaren	4,891,263	28,985	737	643	433	378	18	18	32	2	18	0.0625	0.02	1	9	45.087	7,304
City Milk Cow	10,048,700	59,546	3,206	(370)	1,667	-	0	0	32	2	0	0.0625	-	-	0	n/a	-

Source: Author’s Calculation

Table 7.15. Indices for King Grass

KING GRASS	Land for King Grass (sqm)	King Grass Yield (kg/day)	Total Cattle	Surplus/ (Deficit)	Local Consume (mill Rp)	To Forage Market (million Rp)	Total Dist	Distance	Total Links	No Links	Longest Edge	β	ι	π	η	$1/\iota$	η_w
01. Ngagrong	111,000	10,601	1,468	(55)	831	-	0	0	32	2	0	0.0625	-	n/a	0	n/a	-
02. Seboto	107,000	10,219	1,195	168	703	45	8	8	32	2	8	0.0625	0.011	1	4	93.486	2,992
04. Banyuanyar	64,500	6,160	848	(27)	483	-	0	0	32	2	0	0.0625	-	n/a	0	n/a	-
05. Sidomulnya	80,250	7,664	1,149	(127)	601	-	0	0	32	2	0	0.0625	-	n/a	0	n/a	-
06. Ngargosari	93,250	8,906	980	207	576	56	9	9	32	2	9	0.0625	0.014	1	4.5	70.249	2,845
07. Selodoko	76,500	7,306	701	273	412	74	6	6	32	2	6	0.0625	0.012	1	3	80.989	1,458
08. Ngendem	68,500	6,542	568	304	334	82	4	4	32	2	4	0.0625	0.010	1	2	104.03	832
09. Ngampon	80,500	7,688	458	567	269	153	4	4	32	2	4	0.0625	0.009	1	2	105.6	845
10. Gondang Slamet	33,250	3,175	388	35	228	10	6	6	32	2	6	0.0625	0.025	1	3	39.617	713
15. Kembang	118,500	11,317	1,472	37	866	10	5	5	32	2	5	0.0625	0.006	1	2.5	175.1	2,189
16. Candisari	64,250	6,136	791	27	465	7	6	6	32	2	6	0.0625	0.013	1	3	78.739	1,417
17. Ngargoloko	93,000	8,882	635	549	373	148	8	8	32	2	8	0.0625	0.015	1	4	65.209	2,087
18. Sampetan	78,500	7,497	896	104	527	28	10	10	32	2	10	0.0625	0.018	1	5	55.482	2,774
19. Ngadirejo	74,000	7,067	1,023	(81)	554	-	0	0	32	2	0	0.0625	-	n/a	0	n/a	-
20. Jlaren	71,750	6,852	737	177	433	48	18	18	32	2	18	0.0625	0.037	1	9	26.725	4,329
City Milk Cow	408,000	38,965	3,206	1,989	1,885	537	0	0	32	2	0	0.0625	-	-	0	-	-

Source: Author’s Calculation

For king grass, the β index for all villages is 0.0625. This shows a high degree of spatial concentration. The ι indices vary, but most of them are around 0.01. The 1/ ι indices are mostly lower than Rp100 million. This shows that the flows for king grass have less value per km than they are for natural grass. The π indices are the same as that of natural grass. The η indices for the villages vary but are mostly below 4. There is one village scoring 9. This shows that most villages have shorter length of link compared to the natural grass. The η_{ω} indices show a rather uniform low score of less than 3,000. This shows that the geographical market sizes for king grass economic units in most villages are smaller than those for natural grass.

Table 7.16 shows the indices for the forage market. The forage market has 32 possible links, consisting of 16 meat cattle growing units and 16 milk cattle growing units. The forage market supplies both natural grass and king grass to the cattle growers. Not all cattle growing units need supplies from the forage market, because surplus villages can fully rely on the local availability of the grasses. Thus, only villages with deficits in king grass will buy king grass from the forage market and the same applies for the case of natural grass.

Table 7.16. Indices for the Forage Market

FORAGE MARKET UNIT	Forage Purchase (million Rp)	Total Dist	Distance	Total Links	No Links	Longest Edge	β	ι	π	η	1/ ι	η_{ω}
Forage Market	1,778	226	226	32	22	18	0.6875	0.127	12.556	10.273	7.8675	384

Source: Author's Calculation

Table 7.16 shows that the total forage purchase has reached Rp1.778 billion. The β index of 0.6875 shows a concentrated pattern of forward linkages since the forage market supplies to 22 out of the 32 possible links. Therefore, there are a total of 22 economic units requiring supply of forage grass, which come from meat and milk cattle growers.

The ι index of 0.127 means that to transport Rp1 million worth of goods, it takes 0.127 kms. The 1/ ι index shows a low value of Rp7 million per km. This can be explained by the fact that Ampel is a surplus producer of grasses due to the large availability of dry land. Hence, the forage grass market can be used by cattle growers from other areas who want to buy Ampel's grasses. The π index of 12.556 shows that there is no single linkage which dominates the total length. The η index of 10.723 indicates that the average length per link is considerably long. The η_{ω} index of 384 shows a small geographical market size. The forage market has a smaller market size compared to the grass growers probably due to the fact that only deficit villages are purchasing grasses. In addition, the amount of deficit is not significant as compared to the total surplus of grasses in the region.

7.3.2 The Corn Growing and Concentrate Processing Linkages

The previous section discusses the intake for corn, which is consumed in the form of concentrates. Since one cattle beast consumes 6 kgs of concentrate, about 2.7 kgs of corn is needed for each one on a daily basis (Syukur, 2006). From field observations, the price of concentrate is around Rp650/kg. With 45% of its content coming from corn we can estimate that the price the cattle growers are paying for the corn per beast is Rp1,755 per day.

All these villages purchase corn in the form of concentrates. In total, Ampel has enough supply of corn for concentrates. It has a surplus that can feed another 2,036 cattle. Thus, concentrate production is also one of the main commodities for Ampel to develop. The price of corn used for concentrate production ranges from Rp600-1,000 per kg. Thus, the average of Rp800 is used as a benchmark. However, since corn is also consumed locally as staple food, there are also flows to the households. According to the Ampel Agropolitan Masterplan Final Report (2006), the total consumption of corn in the sub-district is 145.27 tons per annum. Thus, to obtain the local consumption of corn, the number of households in the village must be used, assuming that each household will have the same level of corn consumption.

Tables 7.17 and 7.18 show the summary information and the calculation of indices for the corn growing sectors in all villages and the concentrate processing sector located in the Ampel sub-district. There are a total of 32 possible linkages for each corn growing unit, which consists of 15 other corn growing units, 16 households and one concentrate processing. For concentrate processing, there are a total of 32 possible forward linkages consisting of 16 meat cattle raising units and 16 milk cattle raising units.

Table 7.17. Indices for Corn Units

CORN UNIT	Corn (ton)	Local Consume (ton)	Local Consume (mill Rp)	To Concentrate Processor (mill (Rp)	Total Dist	Distance	Total Links	No Links	Longest Edge	β	ι	π	η	$1/\iota$	η_w
01. Ngagrong	613	6	5	485	7	7	32	2	7	0.0625	0.014	1	3.5	70.057	1,716
02. Seboto	988	8	7	784	8	8	32	2	8	0.0625	0.010	1	4	98.8	3,162
04. Banyuanyar	1055	5	4	840	6	6	32	2	6	0.0625	0.007	1	3	140.67	2,532
05. Sidomulnya	865	8	7	685	6	6	32	2	6	0.0625	0.009	1	3	115.33	2,076
06. Ngargosari	1363	7	6	1,084	9	9	32	2	9	0.0625	0.008	1	4.5	121.16	4,907
07. Selodoko	905	7	5	719	6	6	32	2	6	0.0625	0.008	1	3	120.67	2,172
08. Ngendem	627	4	3	498	4	4	32	2	4	0.0625	0.008	1	2	125.4	1,003
09. Ngampon	565	3	3	449	4	4	32	2	4	0.0625	0.009	1	2	113	904
10. Gondang Slamet	547	3	2	435	6	6	32	2	6	0.0625	0.014	1	3	72.933	1,313
15. Kembang	1385	10	8	1,100	5	5	32	2	5	0.0625	0.005	1	2.5	221.6	2,770
16. Candisari	1266	4	3	1,010	6	6	32	2	6	0.0625	0.006	1	3	168.8	3,038
17. Ngargoloko	1120	3	3	893	8	8	32	2	8	0.0625	0.009	1	4	112	3,584
18. Sampetan	1424	10	8	1,131	10	10	32	2	10	0.0625	0.009	1	5	113.92	5,696
19. Ngadirejo	1490	8	6	1,186	10	10	32	2	10	0.0625	0.008	1	5	119.2	5,960
20. Jlaren	1474	5	4	1,175	18	18	32	2	18	0.0625	0.015	1	9	65.511	10,613
City Corn	3549	53	43	2,797	0	0	32	2	0	0.0625	-	-	0	-	-

Source: Author's Calculation

Table 7.18. Concentrate Processing Indices

ECONOMIC UNITS	Total Sale of Concentrate (million Rp)	Total Dist	Distance	Total Links	No Links	Longest Edge	β	ι	π	η	$1/\iota$	η_w
Concentrates	23,187	226	226	32	32	18	1	0.005	12.556	7.0625	205.2	4,428

Source: Author's Calculation

Table 7.17 shows that the corn growing units have a β value of 0.0625, indicating strong concentration of activities. This can be explained by the fact that these units supply their produce mainly to the concentrate producers in Ampel and to the local households in the respective villages. There is enough surplus of corn to feed the population. Thus, there is no need for inter-village trade of corn for households. All ι indices are more than 0.005 with the majority having more than 0.008. This shows that the distance traveled to transport Rp1 million worth of goods is 0.008km. The 1/ ι indices are mostly above Rp100 million, which shows that for most villages, there is a high magnitude of flow at more than Rp100 million/km. Only Seboto and Jlaren villages have lower magnitudes of flow at less than Rp100 million/km, which may be due to Jlaren's distance from the concentrate processing. In Ampel city and in the case of Seboto, due to the relatively low value of flow of goods. The π indices show a domination of one link in the total length, which is also due to the fact that the supply to Ampel city is the only link apart from the supply to the local households which involves no traveling. The η_{ω} indices vary widely with the majority of villages scoring less than 3,000 and only Ngargosari, Sampetan and Ngadirejo scoring around 5,000. However, Jlaren has a very high modified η index of more than 10,000. This shows that most villages have small geographical market size. The exceptions are Ngargosari, Sampetan and Ngadirejo.

The total sale of concentrate for processing to the whole of Ampel is Rp23 billion. The β index is one, showing a highly dispersed linkage. This is especially because the concentrate processing supplies to all the possible linkages available. The ι index is 0.005 and the 1/ ι index is 205.2, showing a large magnitude of Rp205.2 million per km of flow.

The π index is 12.556, which shows that there is no link that dominates the total linkage length for concentrate processing.

The η index is 7.0625, which shows that the average length of the link is around 7.0625km. The η_ω index is 4,428, which is considerably large, but is still lower than that of Jlaren. Some corn growing villages also score around 5,000. This is due to the fact that Ampel is a large corn producer and there is a large surplus of corn.

7.3.3. Milk Cattle and Milk Cooperative Forward Linkages

There are 18 possible links for a milk cattle economic unit. These include 15 other milk cattle economic units, the animal market, the slaughter house and the Ganesha milk cooperative. Milk cattle units sell male milk calves to the market at the price between Rp2 and 3 million (Werdiono and Setyahadi, 2006). Milk cattle units also supply milk to the Ganesha milk cooperative everyday. According to the Ampel Agropolitan Masterplan Preliminary Report (2005), on an average, each cattle can produce 10 liters of milk per day. The price is obtained by field observation.The price of milk is currently around Rp1,300 per liter, which is still quite low. Milk cattle units also send their cattle for slaughtering if the female milk cattle no longer lactate.

Since sales of male milk calves and non-lactating milk cattle only contribute 3% to the total revenue of milk cattle growers, the estimated value for the sale of male calves and non-lactating milk cattle can be obtained (Bantul Information and Technology Center, 2006). The rate of birth for milk cattle in Ampel is 20% (*Suara Merdeka*, 2001). Assuming that only 25 percent of the calves are sold to the animal market, the revenue obtained from sale of male milk calves to the animal market can be estimated.

Table 7.19. Indices for Milk Cattle Unit

MILK COW UNIT	To Animal Market (million Rp)	To Coop (million Rp)	To Slaughter (million Rp)	Total Dist	Distance	Total Links	No Links	Longest Edge	β	ι	π	η	$1/\iota$	η_w
01. Ngagrong	80.50	3,767	161	21	7	17	3	7	0.17647	0.005	3	7	190.899	9,354
02. Seboto	80.10	3,749	160	24	8	17	3	8	0.17647	0.006	3	8	166.207	10,637
04. Banyuanyar	73.60	3,444	147	18	6	17	3	6	0.17647	0.005	3	6	203.626	7,331
05. Sidomulnya	85.10	3,983	170	18	6	17	3	6	0.17647	0.004	3	6	235.442	8,476
06. Ngargosari	61.10	2,859	122	27	9	17	3	9	0.17647	0.009	3	9	112.695	9,128
07. Selodoko	22.70	1,062	45	18	6	17	3	6	0.17647	0.016	3	6	62.803	2,261
08. Ngendem	22.10	1,034	44	12	4	17	3	4	0.17647	0.011	3	4	91.715	1,467
09. Ngampon	9.80	459	20	12	4	17	3	4	0.17647	0.025	3	4	40.670	651
10. Gondang Slamet	2.80	131	6	18	6	17	3	6	0.17647	0.129	3	6	7.747	279
15. Kembang	93.70	4,385	187	15	5	17	3	5	0.17647	0.003	3	5	311.083	7,777
16. Candisari	40.00	1,872	80	18	6	17	3	6	0.17647	0.009	3	6	110.666	3,984
17. Ngargoloko	30.40	1,423	61	24	8	17	3	8	0.17647	0.016	3	8	63.080	4,037
18. Sampetan	36.50	1,708	73	30	10	17	3	10	0.17647	0.017	3	10	60.590	6,059
19. Ngadirejo	43.70	2,045	87	30	10	17	3	10	0.17647	0.014	3	10	72.542	7,254
20. Jlaren	34.40	1,610	69	54	18	17	3	18	0.17647	0.032	3	18	31.724	10,279
City Milk Cow	227.90	10,666	456	0	0	17	3	0	0.17647	-	-	0	-	-

Source: Author's calculation

Table 7.19 shows the information on milk cattle forward linkages and the calculation of industrial linkage pattern indices. The milk male calves sold to the animal market are usually already 1 year of age. At that age, they are usually already independent from the parents. The largest supplier of male milk calves is the Ampel city, since it consists of five villages. The β index is 0.17647 for all villages, which indicates the highly concentrated pattern of forward linkages, since all villages supply to three centers in Ampel city, which are the slaughter house, the milk cooperative and the animal market.

The ι indices vary with one village, Gondang Slamet, scoring very high at 0.129. Selodoko, Ngendem, Ngampon, Ngargoloko, Sampetan, Ngadirejo and Jlaren villages have a ι index above 0.01. Thus, these villages have longer distance traveled per million Rp worth of goods transported. The 1/ ι indices show that these villages have lower magnitudes since the indices are less than Rp100 million per km. The other villages score high in this index with more than Rp100 million per km, indicating greater magnitude of flow.

The π indices are uniform at 3, which indicate a possible domination of one link in the total linkage length. The η indices vary with the majority having 8 kms and below, and the others between 9 and 10. This shows that the average length of links is quite short. The η_{ω} indices are high with the exception of Selodoko, Ngendem, Ngampon and Gondang Slamet with less than 3,000. The other villages mostly have η_{ω} above 5,000. Thus, these villages have large geographical market sizes.

The milk cooperative index is not calculated since the milk cooperative supplies to the milk processing facilities located outside the Ampel sub-district. However, some of the processed milk are then supplied to Ampel market and retailed to the consumers. Therefore, the Ampel market analysis section will include a discussion of flow of processed milk to the households in Ampel.

7.3.4. Meat Cattle and Slaughter House Forward Linkages

There are 16 possible linkages for meat cattle economic units. This includes 15 other meat cattle economic units and the slaughter house. Since Ampel produced 1,054.51 tons of meat in 2005 (Ampel Agropolitan Masterplan Final Report, 2006), the number of cattle sent from each village to the slaughter house was estimated based on the proportion of meat cattle population in each village to the total cattle population. It is important to note that the cattle slaughtered will not produce edible meat at the same weight as the livestock. Since only 46.5 percent of the dry mass will be edible, the total amount of meat produced, must be divided by 0.465 to arrive at the actual weight of cattle slaughtered (Bantul Information and Technology Center, 2006b). This assumes a common weight of 450kg for every meat cattle that is slaughtered.

Most villages send more than 70 percent of their livestock to the slaughter house every year. The slaughtered meat cattle can go either to the Ampel market or to the meat processors.The price is Rp28,000 per kg, which is around Rp10,000 less compared to the retail price at the Ampel market. Table 7.20 shows the calculation of indices for the meat cattle economic units. The price of meat cattle is Rp11,000 per kg. Thus, the price of a livestock at the slaughter house is Rp4,950,000, assuming a common weight of 450kg.

Since the slaughter house only supplies to Ampel market and meat processors, both of which are located in Ampel city, most indices such as π, η and η_{ω} cannot be calculated. The ι index will be zero since the distance traveled is zero and the only index that can be calculated is the β index. This is because the β index does not include distance in the formula.

Table 7.20. Indices for Meat Cows

MEAT COW UNIT	To Slaughter (million Rp)	Total Dist	Distance	Total Links	No Links	Longest Edge	β	ι	π	η	1/ ι	η_{ω}
01. Ngagrong	2,339	7	7	16	1	7	0.0625	0.003	1	7	334.14	16,373
02. Seboto	1,390	8	8	16	1	8	0.0625	0.006	1	8	173.75	11,120
04. Banyuanyar	395	6	6	16	1	6	0.0625	0.015	1	6	65.853	2,371
05. Sidomulnya	1,051	6	6	16	1	6	0.0625	0.006	1	6	175.22	6,308
06. Ngargosari	1,302	9	9	16	1	9	0.0625	0.007	1	9	144.64	11,716
07. Selodoko	1,672	6	6	16	1	6	0.0625	0.004	1	6	278.7	10,033
08. Ngendem	1,224	4	4	16	1	4	0.0625	0.003	1	4	306.04	4,897
09. Ngampon	1,270	4	4	16	1	4	0.0625	0.003	1	4	317.51	5,080
10. Gondang Slamet	1,270	6	6	16	1	6	0.0625	0.005	1	6	211.67	7,620
15. Kembang	1,887	5	5	16	1	5	0.0625	0.003	1	5	377.48	9,437
16. Candisari	1,379	6	6	16	1	6	0.0625	0.004	1	6	229.9	8,276
17. Ngargoloko	1,168	8	8	16	1	8	0.0625	0.007	1	8	145.96	9,342
18. Sampetan	1,873	10	10	16	1	10	0.0625	0.005	1	10	187.33	18,733
19. Ngadirejo	2,067	10	10	16	1	10	0.0625	0.005	1	10	206.73	20,673
20. Jlaren	1,386	18	18	16	1	18	0.0625	0.013	1	18	77.025	24,956
City Milk Cow	3,270	0	0	16	1	0	0.0625	-	-	0	-	-

Source: Author's Calculation

Table 7.20 shows that the β index is 0.0625 for all villages and the city. This indicates a high degree of concentration, since all meat growers send their cattle to the slaughter house. The ι indices are mostly less than 0.07, which indicates less distance traveled per million rupiah value of goods transported. Thus, the 1/ ι indices for these villages with less than 0.07 ι index will be high, indicating greater magnitudes of flow that are around Rp200 million. Only Banyuanyar village has a lower magnitude of flow at Rp65.853 million per km.

The π index of 1 shows the strong domination of one link, since there is only one link for each village. There is no local consumption since all cattle are sent to the slaughter house and household consumption is met by purchasing small amounts of meat from the Ampel market. The η indices vary, but are mostly within the 4-6km, thus showing relatively short length of links. The η_{ω} indices are all high, mostly above 7,000, which show the large magnitude of geographical market size for most of the meat cattle growing economic units.

The biggest meat cattle units are in Jlaren and Ngadirejo villages with scores above 20,000. The smallest is Banyuanyar village with a score of less than 3,000. This is still low compared to the other economic sectors.

The slaughter house has a β index of 1 since out of the two possible links, it supplies to both the links, which are the Ampel market and the meat processing industries. The value of fresh bulk meat supplied to the meat processors is Rp8.925 billion and that to Ampel market is Rp9.369 billion. This is obtained by estimating the amount of purchase by the meat processors and assuming the remaining available meats are sold to the Ampel market.

7.3.5 The Animal Market

The animal market has 32 possible links, which include 16 meat cattle growing units and 16 milk cattle growing units. The supply of milk cattle to milk cattle growing units is estimated based on the need to replace the number of non-lactating milk cows sent to the slaughter house. From field observations, the price of milk cattle ready to be inseminated is Rp6 million. The meat cattle growers also purchase on the basis of the need for replacement for the number of meat cattle slaughtered. The price is Rp8,000 per kg and the usual weight is around 250kg.

Table 7.21. Indices for the Animal Market

ECONOMIC UNITS	Total Sales (million Rp)	Total Dist	Dista nce	Total Links	No Links	Longest Edge	β	ι	π	η	$1/\iota$	η_ω
Animal Market	10,541	226	226	32	32	18	1	0.011	12.556	7.0625	93.287	2,190

Source: Author's Calculation

Table 7.21 shows the calculation of indices for the animal market. With a β index of 1, the animal market is highly dispersed. This is because, out of the 32 possible links, the animal market supplies to all of them. The ι index of 0.0011 is rather low. The π index of 12.556 shows that there is no single link that dominates the total length in the linkage. The η index of 7.0625 shows an average length of link that is not short. The η_ω index of 2,190 shows a small geographical market size.

7.3.6 Meat Processing and *Dendeng* and Floss Marketing Forward Linkages

The total value of *dendeng* and floss production was Rp20 billion in 2003(Trinugroho, 2003). According to the Ministry of Agriculture (2006), the value added from fresh meat to *dendeng* is Rp4000/kg. In the case of fresh meat to *dendeng*, the value added is Rp13,000/kg. It is assumed that producers of *dendeng* and floss purchase meat in bulk at the price for fresh slaughtered meat. Since the field observations show the price of fresh meat to be Rp28,000/kg, the same 1kg of meat can produce floss of Rp42,000/kg of meat and *dendeng* of Rp32,000/kg of meat. The ingredients for floss come from any parts of the meat while the ingredient for *dendeng* is usually the round meat that constitutes 20% of the total fresh meat from a slaughtered cattle.

The price of *dendeng* is Rp55,000/kg and floss is Rp58,000/kg. If we look at the total amount of *dendeng* and floss, the total weight of *dendeng* and floss based on the total value of production in Ampel is 354 tons. Assuming that meat processing industries purchase meat from the slaughter house, the proportion of meat available for *dendeng* is 20% and the remainder can be used for floss production (Bantul Information and Technology Center, 2006b). Thus, the total amount of meat for *dendeng* is 80 tons and the total amount of meat for floss is 275 tons.

The total amount of meat required for *dendeng* production is 87.5% of 80 tons, which is 70 tons. The total amount of meat required for floss production is 65% of 275 tons, which is 248.75 tons. This figure is used as the basis to estimate the purchase of bulk meat from the slaughter house, which is Rp8.925 billion.

The processing industries usually also own the marketing outlets, mostly located along the regional road. Since the supply takes place only within the Ampel city, most of the indices cannot be calculated. This analysis assumes that the processing industries supply all the produce to the marketing outlets, and the marketing outlets sell the products to consumers from other areas. Hence, the only index that can be calculated is the β index which is 1, because the meat processors supply to the only possible link. The total value of forward linkage is Rp20 billion for both *dendeng* and floss products.

7.3.7. Ampel Market Forward Linkages

This analysis focuses on the distribution of meat and milk to the households in Ampel through the Ampel market. The Ampel market has 16 possible linkages, which are all household economic units. The households purchase meat and milk for daily consumption. The meat is supplied by the slaughter house and the milk is supplied by the milk processors outside Ampel, in the form of powdered milk and fresh milk. Since most of the people consume powdered milk due to storage and expiration considerations, this analysis assumes that all milk consumptions are in the form of powdered milk.

The consumption of milk in Indonesia is very low at the national rate of 7 liter per capita per annum (*Gatra*, 2006). The price of a 400 gram powdered milk package is Rp18,000. Since 100 grams of milk can be used to make 1 liter of milk (Eddleman, 1998), the value of consumption can be estimated. The consumption of milk is estimated by considering the number of households and the per capita consumption of milk per annum. The cost per liter of milk is Rp4,500 and thus, on an average, a household would spend Rp31,500 per annum on powdered milk.

In estimating the meat consumption, reference is made to the Ampel Agropolitan Masterplan Final Report (2006), which states that the consumption of meat in Ampel is 39.62 tons per annum. Thus, the estimation is made based on the proportion of the number of households in the village to the total number of households in the Ampel sub-district, with reference to the total consumption of 39.62 tons per annum.

Table 7.22 shows the calculation of indices for the Ampel market. The β index of 1 indicates a high degree of dispersal. This is because the market supplies to all the possible links. The ι index of 0.054 and the 1/ ι of 18.5 show a low magnitude of flow of Rp18.5 million per km. The π index of 6.2778 shows a low degree of domination by a single link. The η index of 6.6471 indicates a medium average length of link. The η_{ω} index of 603 shows a small geographical market size.

Table 7.22. Ampel Market Links for Milk and Meat Consumption

MARKET UNIT	Total	Total Dist	Distance	Total Links	No Links	Longest Edge	β	ι	π	η	$1/\iota$	η_{ω}
Ampel Market	2,091	113	113	17	17	18	1	0.054	6.2778	6.6471	18.501	603

Source: Author's Calculation

7.3.8. Comparison with Rural Urban Linkages in West Java

We obtain the linkages between the economic sectors by analyzing West Java's socio-economic input-output matrix in 1999[14]. Since some economic sectors are predominantly located in rural areas and some others are predominantly in urban areas, the analysis can be extended to investigate the rural-urban linkage pattern. In West Java, 91% of the labor income from agriculture is received by the rural households. The labor income from manufacturing that goes to the rural households is only 3.39%. The labor income from other sectors such as services and trade is rather balanced with 42.02% going to the rural households. Rural households receive 34.96% of capital income.

The expenditure pattern for rural households and urban households can be analyzed by looking at the matrix. Out of the total expenditure of agricultural households, 36.18% is spent on domestic manufactured products, 20.14% on imported manufactured goods, 20.14% on agricultural goods and 10.63% on services. From this data, it can be seen that rural households mostly spend on urban products. The households in the urban areas spend 35.58% on domestic manufactured products, 18.07% on imported manufactured goods, 8.73% on agricultural commodity and 8.61% on services. These data show that urban households mostly spend their income on urban products as well.

[14] Central Bureau of Statistics, 1999

The input-output matrix can be used to calculate the backward and forward linkages. The backward linkage index of more than one shows a strong backward linkage and the same applies to the forward linkage index. The predominantly rural agricultural sector has low backward and forward linkage indexes as both are less than one with the value of 0.7709 and 0.9134, respectively. However, we can see that agriculture is more of a forward-linked sector rather than a backward-linked.

The manufacturing sector has high backward and forward linkages with the indexes of 1.3173 and 2.4890, respectively. Other sectors with strong backward linkages are utilities, construction, transport and communication.

Kasikoen (2005) calculates the multiplier effect of injecting expenditures in the economic sectors that are included in the input-output matrix. The multiplier effect is measured by using the model

$$Dt = (I-A)^{-1}\, dX$$

$$= Ma\, dX \qquad [7.1]$$

Where $Ma = (I-A)^{-1}$ = accounting multiplier. This model explains how the changes to the exogenous account *(X)* on the matrix will cause changes to the endogenous account *(Dt)* in the matrix by $(I-A)^{-1}$.The exogenous accounts are the capital account, government account, indirect net tax account and external trade account. From this analysis, Kasikoen finds that injecting the agricultural production sector will multiply the agricultural domestic commodities by 1.0378. Manufacturing production sector has a much larger multiplier effect of 1.7943 to the manufacturing domestic commodities.

Kasikoen (2005) also conducts an analysis of rural-urban linkages by looking at the origin and destination data for the transport of goods[15] (refer to Appendix 6 for the data on origin and destination of transport). These data can be used to perform similar analysis to Schmidt's industrial linkage indices, with the only difference being the fact that the data in Kasikoen's analysis are aggregated data of all economic sectors.

Nevertheless, the data still serve as useful benchmarks to the calculated indices in Boyolali. In Indonesia, an area is usually split into a regency and a municipality when the urban portion of the area has grown to a certain extent, and this is done at the discretion of the government.

Kasikoen assumes based on the domination of farm activities in the regencies, that the regencies are the rural areas. The regencies are characterized by sparse population with less than 10 percent of the land allocated for housing and a large percentage of land allocated for farms and forests. In contrast, the municipalities' land use is dominated by housing and a very small allocation is made for farms and forests. Although the actual condition in the regency does not necessarily show exact similarities to the rural area of Ampel, the data are still useful for comparison.

In general, not all the cities in West Java are originators of large tonnages of goods. Only Bandung city is a large originator of goods with 303 million tons. The other cities are relatively small ranging from 7 million to 14 million tons. However, it is important to note that the regencies with the same name as the cities, which can be considered as the suburbs of their respective cities, are large originators of goods. On average, the regencies in West Java originate about 5 to 10 million tons of goods. However, Bogor, Tangerang, Bandung and Cirebon regencies originate 42, 46, 12 and 19

[15] Ministry of Transportation, 1996

million tons respectively. We can see that the regencies which are the immediate suburbs of the cities in West Java are very active in originating transport of goods, and thus there seems to be a significant level of economic activities. The regencies which are not the immediate suburb of the cities, are less active in originating transport of goods, and thus, there seems to be a small level of economic activities.

The less economically active regencies generally have a surplus in trade with larger originators of goods. This trend may indicate that these regencies do not have high purchasing power. The more active regencies despite having surplus in their trade are also relatively larger in terms of being the destination for goods. This may be due to the larger population size, as well as their higher purchasing power.

The cities, on the contrary, are much smaller in being the destination of goods. This is most likely due to the smaller population size and the larger availability of urban-produced goods rather than the lack of purchasing power. It is important to note that the cities are small in size geographically and with regard to population.

Therefore, we can reclassify the regions by including the immediate suburbs of the cities as the urban areas and the other regencies as the rural areas. There is indeed a strong rural-urban linkage, which is characterized by massive flow of manufactured goods from within the urban areas and larger flow of primary goods from the rural areas to the urban areas compared to the flow of goods from the urban areas to the rural areas. West Java is well recognized for its unhealthy rural-urban linkage patterns. Kasikoen found the strong domination of urban areas and the poor industrial linkages between the rural areas and the urban areas.

The large regencies and the cities are considered here as the urban areas, and the smaller regencies as the rural areas. The districts under Jakarta are not included in the analysis.The analysis shows that the urban areas including Bandung, Cirebon, Bekasi, Sukabumi, Tangerang as well as the Bandung regency, are among the bottom ten in terms of beta value. Most of them have less than 0.5 β value, which indicates low spatial complexity and their ineffective role as centers of distribution. The same case applies to the π indices, as the urban areas are again among the bottom ten with most of them scoring less than 7. This again shows the ineffective role of urban areas as centers of distribution in Indonesia and the strong domination of certain links.

However, the urban areas, including Bandung regency and Bandung municipality, as well as Cirebon municipality, Bekasi regency and Tangerang regency are among the top ten in terms of η_{ω} value. In terms of 1/ ι, these urban areas are again among the top ten. Therefore, we can see that the urban areas have larger geographical markets and linkage magnitudes compared to the smaller regencies.

Overall, these indices conform to the hypothesis that West Java has an unhealthy rural-urban linkage pattern. The urban areas dominate the economy but have less spread effect as shown from the high 1/ ι and η_{ω} as well as the low β and π indices. This confirms the validity of the indices and provides a comparison to the indices calculated for the Ampel sub-district. In fact, Ampel sub-district possesses a healthier rural-urban linkage pattern compared to West Java.

Kasikoen (2005) also conducted research for smaller areas, by surveying villages and their interactions with their respective small urban centers. The six villages studied were Cibuntu village in the Simpenan sub-district, Girijaya and Hegarmanah villages in the Warungkiara sub-district, Karanganyar and Tambelan villages in the Karangsembung sub-district and Bungko village in the Kapetakan sub-district.

For Cibuntu village, the interaction with the small urban center was very low. The villagers purchase their main daily needs from the vendors in the village and for secondary and tertiary needs, they directly travel to the larger cities such as Pelabuhan Ratu and Sukabumi. Only 3 percent of the heads of household work in the small urban center and only 9% of the family members do so. The percentage of heads of household working in Cibuntu village is 90 percent. The small urban center is not the source for raw materials. The villagers source their raw materials from the larger cities, other neighboring villages and Cibuntu village itself. The marketing outlet for farm produce is the neighboring village, Cibuntu. The strong interaction with the larger cities such as Pelabuhan Ratu, is due to the improvement in roads linking the village and the Pelabuhan Ratu city. In addition, the wider availability of goods and services attract the villagers. Nevertheless, 48% of the residents go to the school in the small urban center.

In the case of Girijaya village in the Warungkiara sub-district, 96 percent of the heads of household work in the village and 54 percent of the family members work in the small urban center. There is a strong interaction between the village and the small urban center. The main location to source raw materials for industry is also the small urban center. However, the small urban center does not function as a provider of services because the residents purchase their basic needs mostly from their own village or from the nearest neighboring village. In marketing the farm produce, the villagers rely fully on the middlemen.

Another village in the Warungkiara sub-district, Hegarmanah village, the same trend applies. All the heads of household work in the village and 47 percent of the family members work in the small urban center. For Hegarmanah, the small urban center is also not the provider of goods and services as the villagers purchase their basic needs mostly from their own village and the neighboring villages. The village also has a direct link with Jakarta and Bogor to create handicrafts with raw materials sourced from these cities and these handicrafts are also sold to these cities.

In the case of Karanganyar village in the Karangsembung sub-district, a similar pattern to the villages in Warungkiara sub-district exists. The heads of households mostly work in the village and a major proportion of the family members work in the small urban center. However, the small urban center in this sub-district performs effectively as the provider of secondary goods with 68% of the villagers buying the secondary goods from the small urban center. The small urban center is also a significant supplier of farming tools and inputs. However, the marketing of farm produce is still done through the middlemen. The villagers go to another neighboring town for schooling instead of the small urban center.

For another village in Karangsembung sub-district, Tambelang, a similar pattern is observed as that of Karanganyar village with regard to location of work. The function of the small urban center as provider of goods and services is also similar to that of Karanganyar. However, the small urban center does not perform its role as supplier of the farm inputs, because the villagers can obtain all the necessary inputs from Tambelang. A neighboring village, Ciledug, has strong linkages, particularly for animal farming. It appears that Tambelang village is relatively self-sufficient with most activities conducted in the village.

In the case of Bungko village in the Kapetakan sub-district, most of the heads of household and the family members work in the village. However, the small urban center functions effectively as the provider of goods and services as well as the supplier of farm inputs. The educational facilities in the small urban center also attract the villagers to study in the small urban center.

From the above cases, the small urban centers can be allocated to three main groups. In the first group, the small urban center does not function effectively as the provider of goods and services and the supplier of farm inputs and the work location. The village and small urban center that fall under this category is the Cibuntu village and the Simpenan sub-district's small urban center. In the second group, the small urban center functions effectively as the work location, but functions less effectively as the provider of goods and services and supplier of farm inputs. The Hegarmanah and Girijaya villages with the Warungkiara sub-district's small urban center belong in this category. In the third group, the small urban center functions effectively as the provider of goods and services and the supplier of farm input.

However, two villages within the same sub-district may have different characteristics. In the case of Hegarmanah and Girijaya villages, both part of the Warungkiara sub-district, Hegarmanah's industries have links with Jakarta and Bogor while Girijaya's industries have links directly with Warungkiara. Thus, there is less concentration of activities in the small urban center compared to the case of Ampel sub-district. In the case of Karanganyar and Tambelang villages, both part of the

Karangsembung sub-district, Tambelang village is rather self-sufficient and has strong linkages with Ciledug village for animal farming, while Karanganyar does not. Again, this is a sign of less concentration of activities in the small urban center compared to the case of Ampel sub-district. It is not possible to infer the degree of concentration from the cases of single villages such as Bungko and Cibuntu.

Using the LOGIT model, Kasikoen (2005) also analyzes the relationship between the socio-economic variables and the work pattern as well as shopping pattern in terms of shopping in the village or outside the village. The results show that heads of household are most likely to work within the village. The ideal distance to work is between 100-500 meters, and the younger generation tends to work outside the village. For the shopping pattern, the results show that animal farmers or fishermen are most likely to shop in the village while those working in other sectors have equal probability of shopping inside or outside the village. The results also show that for villages having mainly craftsmen and dry farmers, the probability to shop outside the village is higher while for villages having mainly featuring fish and farmers, the probability to shop inside the village is higher.

Kasikoen also finds that the improvement of regional roads has a great impact on land conversion where agricultural lands are converted for non-agricultural land, while improvements of local village roads have no impact on land conversion. It is important to note that Kasikoen suggests the implementation of Agropolitan development as a way of improving the rural-urban linkages by promoting processing of farm produce in the small urban centers.

7.3.9. Summary

From the calculated indices, we find that the economic units located in the villages outside Ampel city, which include milk cattle growing units, meat cattle growing units, natural grass growing units, king grass growing units and the corn growing units, have highly concentrated forward linkages to the Ampel city's economic units. The secondary and tertiary activities take place in the Ampel city. Ampel city has highly dispersed forward linkages as it supplies to almost all the villages in Ampel sub-district. However, the market size as indicated by the η_{ω} index shows that the economic units in the villages have a greater market size than the Ampel city's economic units. This shows a balanced rural-urban linkages pattern. Therefore, the hypothesis that the economic units in the villages outside Ampel city have a concentrated pattern of forward linkages is accepted. The hypothesis that the secondary and tertiary activities are concentrated in Ampel city is also accepted.

From the comparison with West Java, it can be seen that Ampel has stronger conformance to the concept of an Agropolitan region. The spatial complexity and degree of concentration of forward linkages for the rural sectors are higher in Ampel compared to West Java. Similarly, the size of the geographical market for the rural sectors relative to the urban sectors is higher for Ampel than to West Java. This also shows the applicability of the indices to measure the spatial pattern of rural-urban linkages, since the results conform to the existing literature that considers the rural-urban linkages in West Java as unhealthy. With regard to the comparison to village-town linkages in West Java, Ampel may indeed be a rare case where there is a healthy rural-urban linkage and a concentration of activities in the town.

7.4. The Relationship between the Socio-Economic Factors and the Residents' Level of Use of the Rural Town

7.4.1 Introduction

The chosen research area is the Ampel sub-district located in Boyolali district, Central Java province, Indonesia. The sub-district has 20 villages, five of which are grouped together as the Ampel city or small urban center. Most of the people work as farmers and cattle growers. The area is chosen because it has a rural-urban linkage pattern that is characterized by the strong role of Ampel small urban center as the center for rural produce collection and distribution of urban services.

The main commodity in Ampel is cattle, which includes both meat and milk cattle. There are value-added activities taking place in the small urban center. These are meat processing, farm produce collection and supply of production inputs such as the cattle feed market and animal market.

7.4.2 Analysis and Results

The questionnaires were distributed to the residents who live outside Ampel city. The distribution of questionnaire was conducted in cooperation with the team from the National Spatial Planning Directorate of the Indonesian Ministry of Public Works. 200 questionnaires were distributed and 175 questionnaires were returned. Out of the 175 questionnaires, 150 questionnaires were considered usable based on the completed answers and included for the analysis.

Table 7.23 shows the distribution of respondents in terms of age groups. Table 7.24 shows the distribution of respondents in terms of occupation, which is divided into two main groups. 41 percent of the respondents are working in the service or trading sector and the remaining majority are working in the farming sector.

Table 7.23. Distribution of Respondents by Age Group

Age Group	<25	25-35	35-45	45-55	>55	Total
Numbers	9	17	63	33	28	150

Source: Author's Calculation

Table 7.24. Distribution of Respondents by Occupation

Occupation	Service/Trading	Farming
Numbers	62	88
Percentage	41%	59%

Source: Author's Calculation

The recapitulation for responses is shown in table 7.25.

Table 7.25. Recapitulation of Responses

Question	1	2	3	4	5	Total
Q1 Accessibility	2	20	24	89	15	150
Q2 Accessibility	2	20	24	88	16	150
Q1 Willingness to Travel	4	14	42	55	35	150
Q2 Willingness to Travel	3	14	43	55	35	150
Q1 Rural Village Amenities	6	82	46	14	3	150
Q2 Rural Village Amenities	1	25	96	26	4	150
Q1 Modernity	19	31	73	22	5	150
Q2 Modernity	23	97	7	21	2	150
LUA	18	38	40	34	14	150

Source: Author's Calculation

These data are used as the inputs for LISREL to generate a polychoric correlation matrix (refer to appendix 7 for syntax and outputs). The first stage of the moderated structural equation modeling does not involve the interacting variables. So the polychoric correlation matrix does not include the interacting variables. The first stage consists of two equations. The first equation involves the independent variables of accessibility and willingness to travel. The second equation involves the independent variables of rural village amenities and modernity. Prior to generating the polychoric matrix, the data are transformed into mean-centered values because of the possible multicollinearity caused by the interaction model. The polychoric correlation matrices are shown in tables 7.26 and 7.27.

Table 7.26. Polychoric Correlation Matrix Stage 1 for Equation 1

	ACC1	ACC2	WTT1	WTT2	LUA
ACC1	1.000	0.996	0.252	0.263	0.122
ACC2	0.996	1.000	0.259	0.271	0.126
WTT1	0.252	0.259	1.000	0.987	0.056
WTT2	0.263	0.271	0.987	1.000	0.039
LUA	0.122	0.126	0.056	0.039	1.000

Source: Author's Calculation

Table 7.27. Polychoric Correlation Matrix Stage 1 for Equation 2

	RVA1	RVA2	MOD1	MOD2	LUA
RVA1	1.000	0.324	-0.045	-0.049	0.273
RVA2	0.324	1.000	0.062	0.264	0.119
MOD1	-0.045	0.062	1.000	0.364	-0.023
MOD2	-0.049	0.264	0.364	1.000	-0.104
LUA	0.273	0.119	-0.023	-0.104	1.000

Source: Author's Calculation

The first stage analysis generated results for the measurement model of the latent variables and the structural model. The resultant measurement models for latent variables are as follows:

<u>Equation 1</u>

Accessibility

- ACC1 = 0.98*ACC, Errorvar.= 0.041 , t-values: 16.46 [7.2]

- ACC2 = 1.02*ACC, Errorvar.= 0.22 , t-values: 17.85 [7.3]

Willingness to Travel

- WTT1 = 1.00*WTT, Errorvar.= 0.00100 , t-values: 17.21 [7.4]

- WTT2 = 1.00*WTT, Errorvar.= 0.00100 , t-values: 17.21 [7.5]

<u>Equation 2</u>

Rural Village Amenities

- RVA1 = 0.44*RVA, Errorvar.= 1.56 , t-values: 1.56 [7.6]

- RVA2 = 0.98*RVA, Errorvar.= 1.61 , t-values: 1.61 [7.7]

Desire for Urban Services / Modernity

- MOD1 = 0.63*MOD, Errorvar.= 0.61 , t-values: 5.68 [7.8]

- MOD2 = 0.61*MOD, Errorvar.= 0.62 , t-values: 5.61 [7.9]

The loadings and error variance from the measurement models in the first stage analysis are used to calculate the loading and error variance for the interacting variables. There are two interacting variables. The first interacting variable is for the moderating effect of the willingness to travel on the relationship between accessibility and the level of small urban center usage. The second interacting variable is for the moderating effect of the modernity on the relationship between rural village amenities and the level of usage. The indicator for interacting variable 1, VARINT1, is obtained as follows:

$$VARINT1 = (RACC1 + RACC2) \cdot (WTT1 + WTT2) \qquad [7.10]$$

The indicator for interacting variable 2, VARINT2, is obtained as follows:

$$VARINT2 =(RVA1 + RVA2) \cdot (MOD1 + MOD2) \qquad [7.11]$$

VARINT 1 and VARINT2 are used as indicators to estimate the latent interacting variables for interacting variables 1 and 2 respectively. The loading and error variance for the measurement model of interacting variable 1 (INTER1) with VARINT 1 as the indicator is as follows:

$$\lambda\ VARINT1 = (\lambda_{RACC1} + \lambda_{RACC2}) \cdot (\lambda_{WTT1} + \lambda_{WTT2)} \qquad [7.12]$$

$$\theta\ VARINT1 = (\lambda_{RVA1} + \lambda_{RVA2})^2 \cdot VAR\ (RVA) \cdot (\theta_{MOD1} + \theta_{MOD2}) + (\lambda_{MOD1} + \lambda_{MOD2})^2 \cdot VAR\ (MOD) \cdot (\theta_{RVA1} + \theta_{RVA2}) + (\theta_{RVA1} + \theta_{RVA2}) \cdot (\theta_{MOD1} + \theta_{MOD2)} \qquad [7.13]$$

The loading and error variance for the measurement model of interacting variable 2 (INTER2) with VARINT 2 as the indicator is obtained as follows:

$$\lambda\ VARINT2 = (\lambda_{RVA1} + \lambda_{RVA2}) \cdot (\lambda_{MOD1} + \lambda_{MOD2} \qquad [7.14)$$

$$\theta\ VARINT2 = (\lambda_{RVA1} + \lambda_{RVA2})^2 \cdot VAR\ (RVA) \cdot (\theta_{MOD1} + \theta_{MOD2}) + (\lambda_{MOD1} + \lambda_{MOD2})^2 \cdot VAR\ (MOD) \cdot (\theta_{RVA1} + \theta_{RVA2}) + (\theta_{RVA1} + \theta_{RVA2}) \cdot (\theta_{MOD1} + \theta_{MOD2}\ )$$

[7.15]

After obtaining the loadings and error variances for the interacting variables, the next step is to generate the polychoric correlation matrix that includes the interacting variable. The correlation matrices are in tables 7.28 and 7.29.

Table 7. 28. Polychoric Correlation Matrix Stage 2 for Equation 1

	ACC1	ACC2	WTT1	WTT2	LUA	VARINT1
ACC1	1.000	0.996	0.252	0.263	0.122	-0.124
ACC2	0.996	1.000	0.259	0.271	0.126	-0.123
WTT1	0.252	0.259	1.000	0.987	0.056	0.552
WTT2	0.263	0.271	0.987	1.000	0.039	0.533
LUA	0.122	0.126	0.056	0.039	1.000	-0.033
VARINT1	-0.124	-0.123	0.552	0.533	-0.033	1.000

Source: Author's Calculation

Table 7. 29. Polychoric Correlation Matrix Stage 2 for Equation 2

	MOD1	MOD2	RVA1	RVA2	LUA	VARINT2
MOD1	1.000	0.324	-0.045	-0.049	0.273	-0.21
MOD2	0.324	1.000	0.062	0.264	0.119	-0.14
RVA1	-0.045	0.062	1.000	0.364	-0.023	-0.20
RVA2	-0.049	0.264	0.364	1.000	-0.104	-0.14
LUA	0.273	0.119	-0.023	-0.104	1.000	-0.02
VARINT2	-0.208	-0.145	-0.203	-0.143	-0.02	1.00

Source: Author's Calculation

The second stage analysis involves fixing the loading and error variance. For equation 1, the interacting variable 1 obtained from equations 7.11 and 7.12 are 4 and 0.004, respectively. For equation 2, the loading and error variance for interacting variable 2 obtained from equations 7.13 and 7.14 are 1.7608 and 3.8214, respectively. The correlation between the interacting variables and the related exogenous variables is set at 0.

From the second stage analysis, the measurement model generated is as follows:

<u>Equation 1:</u>

Accessibility

- ACC1 = 0.98*ACC, Errorvar.= 0.04 , t-values: 16.46 (7.15)

- ACC2 = 1.02*ACC, Errorvar.= 0.04 , t-values: 17.85 (7.16)

Willingness to Travel

- WTT1 = 1.00*WTT, Errorvar.= 0.00 , t-values: 17.21 (7.17)

- WTT2 = 1.00*WTT, Errorvar.= 0.00 , t-values: 17.21 (7.18)

<u>Equation 2</u>

Rural Village Amenities

- RVA1 = 0.46*RVA, Errorvar.= 1.00, t-values: 3.36 (7.19)

- RVA2 = 0.47*RVA, Errorvar.= 1.00 , t-values: 3.51 (7.20)

Desire for Urban Services / Modernity

- MOD1 = 0.64*MOD, Errorvar.= 0.59 , t-values: 3.36 (7.21)

- MOD2 = 0.60*MOD, Errorvar.= 0.64 , t-values: 3.51 (7.22)

For rural village amenities, the t-values are higher than 1.645 (critical t-value at 10% significance level). Thus, all the indicators have good fits as the proxies to measure rural village amenities. For accessibility, the t-values are also higher than 1.645. This shows that the accessibility construct variable can be measured using the hypothesized manifest variables. For willingness to travel, the t-values are all higher than 1.645. The same applies to the desire for urban services or modernity with t-values being higher than 1.645. Hence, all the latent variables can be measured using the designated manifest variables. The significance of the loadings shows that in both stages of analysis, the hypothesized manifest variables remain good proxies for the respective construct or latent variables.

The structural models for the second stage analysis are as follows[16]:

Equation 1:

	lua = 0.13*ACC	+ 0.03*WTT	-0.22*INTER1
t-values:	1.94	0.32	-0.53

Equation 2::

	lua = - 0.30*RVA	+ 0.58*MOD	- 0.09*INTER2
t-values:	-1.73	4.40	-1.76

As discussed in chapter 5, four goodness of fit indices we used in assessing this model. For equation 1, the goodness of fit index (GFI) is perfect at 1.00. The adjusted goodness of fit index (AGFI) is very high at 0.99. The model CAIC is 91.96, which is lower than the saturated CAIC at 126.22. The standardized root mean square residual (SRMR) is 0.023, which is lower than the cutoff value of 0.08. Thus, these values indicate a good fit for the model. For equation 2, the GFI score is 0.96 and the AGFI score is 0.85. Although the AGFI score is not as high as GFI but it is within the cutoff

[16] The model was modified according to the suggested modification indices generated in the LISREL output file, which improved the goodness of fit indices by adding error covariances between variables of the same type. This, however, did not violate the theoretical background used in constructing the model. Please refer to appendix 8 for print-outs of the syntax and the path diagrams.

range for acceptable level of fitness. The model CAIC is 107.67, which is lower than the saturated CAIC at 126.22. The SRMR score is 0.076, which is lower than the cutoff value of 0.08. Thus, again, these values indicate a good fit for the model.

From equation 1, accessibility has a significant positive relationship with the level of usage at 10% level of significance. This is shown from the t-value of 1.94 that is higher than the critical t-value of 1.645. This shows that higher accessibility leads to higher level of usage of the small urban center. However, the negative interacting variable means the willingness to travel has a negative moderating effect on the relationship between accessibility and the level of usage. Higher willingness to travel will weaken the relationship between accessibility and the level of usage, and vice versa.

This can probably be explained by the fact that residents with higher willingness to travel will still consider visiting the small urban center to fulfill their needs despite the low level of amenities. For residents with lower willingness to travel, the accessibility is an important factor that influences their decision to visit the small urban center. Nevertheless, the t-value shows a non-significant value at 10% level of significance. The t-value is -0.53, which has an absolute value that is less than the critical t-value of 1.645. Therefore, willingness to travel has a weak moderating effect on the relationship between accessibility and level of usage of the small urban center. Thus, the hypothesis is not supported. This shows that higher willingness to travel is less likely to offset the importance of accessibility as a factor that determines the residents' decision to use the small urban center. This shows that despite the high willingness to travel, the importance of accessibility in influencing the decision to small urban center usage cannot be compromised.

From equation 2, rural village amenities have a t-value with an absolute value greater than the critical t-value of 1.645 at 10% level of significance. The t-value of -1.73 shows that rural village amenities have a significant negative relationship with the level of usage. In other words, the availability of amenities has a strong influence on the decision to use the small urban center. However, the negative interacting variable means the level of modernity has a negative moderating effect on the relationship between rural village amenities and the level of usage. A higher level of modernity will weaken the relationship between rural village amenities and the level of usage, and vice versa. This can probably be explained by the fact that residents a high level of modernity, despite the availability of amenities, will be more inclined to visit the small urban center to gain access to more advanced services and goods. Similarly, residents with a low level of modernity will be more sensitive to the relative availability of amenities in making decisions to use the small urban center. The t-value is significant at the 10% level. The t-value is -1.76, which has an absolute value greater than the critical t-value of 1.645.

Therefore, modernity has a strong moderating effect on the relationship between rural village amenities and level of usage of the small urban center. Thus, the hypothesis is supported. The negative moderating effect means that the more modern residents will not consider their respective villages' level of amenities in making decisions on using the small urban center. In contrast, the less modern residents will be more concerned with their respective villages' level of amenities, and if they find that the provision is adequate, they are less likely to use the small urban center more often.

Overall, the empirical analysis shows that in the Agropolitan Region, the inherent characteristics of the small urban center, which include the accessibility and the rural village amenities, play a very important role in influencing residents' level of usage. However, the personal characteristic of willingness to travel is not an important factor in the residents' decision to use the small urban center. Accessibility is important regardless the residents' willingness to travel. The level of modernity is an important factor that may affect how residents look at their respective villages' level of amenities before deciding on using the small urban center. What is also important to note from the SEM analysis is the fact that the measurement models show a good fit for the indicators in approximating the latent variables. Thus, the measurement of accessibility, rural village amenities, willingness to travel and modernity latent variables can be based on the indicators used in this research.

CHAPTER 8
CONCLUSIONS

8.1 Summary

This chapter begins with a summary of findings of the previous chapters and ends with an overall conclusion. This research explores the theories related to the formation of an urban area, and streamlines these theories to construct a model for an Agropolitan.

8.1.1 Theoretical Discussion

Early theorists, including Von Thunen (1926) and Weber (1908), considered urban areas as growth centers that should have high accessibility. Accessibility was measured by the access to potential markets or dominant industrial inputs which may vary depending on the nature of the process's product weight-volume impact. It is common to have agricultural activities in a more accessible location be replaced by higher value added activities. This occurs under a system where land rent varies according to the level of accessibility.

In addition to accessibility, urban areas grow from the concentration of activities in serving their hinterland. Losch (1940) and Christaller (1933) sought to find the efficient spatial arrangement of an area with multiple cities. The arrangement is considered efficient because of two aspects. First, the hexagonal shape of an urban area's market catchments allows for a clear demarcation of market areas between each urban area without any overlapping market areas. Second, the hierarchy of cities with varying sizes is constructed using a rule of thumb that determines the ideal spacing between cities of equal size.

More modern regional scientists, such as Isard (1956) and Alonso (1964), focused on their works at finding a general equilibrium in a space economy. There are a number of important findings in Isard's study. Isard suggests the important role of transportation infrastructure in altering the spatial structure of an economy that works through altering the friction of distance. This finding was based on the previous studies by Zipf (1949). Zipf found a definite inverse relationship between the tonnage of railway cargo and distance. Similarly, Stewart (1950) found in his gravity model formulation an inverse relationship between the volume of trade and spatial distance. Both Zipf and Stewart suggested that a pair of larger cities have a larger potential attraction compared to a pair of smaller cities.

Isard (1956) explored the possibility of reducing the number of variables in constructing a general equilibrium model under a spatial economy. Isard represented transport costs with labor and land inputs as the proxies. This is underlined by his view that producers are generally faced with the choice of allocating the land and labor inputs for either transport or cultivation. Isard suggested a rational solution to Weber's (1909) triangular problem. Since the elasticity of transport cost to distance shows a much higher value at zero distance, the most efficient location should consequently be at the corner of the polygon rather than the middle. In other words, the ideal location of an industry should either be at the location where the main raw material is sourced, or where the market distribution center is located. Both these locations are where zero transport cost is incurred for one of the industry's logistics activities.

An important term that is useful for describing the mechanisms of agglomeration is the point of critical isodapane. This is the point where savings in labor costs obtained by clustering with other industries are offset by transport costs. Thus, agglomeration takes place when two or more firms with intersecting critical isodapanes can achieve the lowest transport cost by combining their production in serving their combined market area. Nevertheless, Isard warned that firms may be reluctant to move to a new location. In addition, larger firms with greater bargaining power would have some influence in dictating the location of the smaller firms. However, the concept of critical isodapane is still relevant in the case of government-induced localization of economic activities.

Alonso (1956) developed a model of agricultural production under a spatial economy. This model explained how location of agricultural activities is influenced by the market forces where different agricultural commodities have different ability to bid a rent price. The ability to bid a rent price is based on the commodities' respective market price and quantity demanded. Thus, Alonso found that a commodity can be excluded from a system of spatial economy if the market demand is lower compared to other commodities. However, when scarcity occurs, the increase in the market price may alter the structure of bid rent between the commodities, and production is possible for the previously excluded commodity from being produced in the economy. This model is useful in explaining the dynamics of spatial arrangements for an agricultural economy.

Most recently, Henderson (1974) explained how city sizes vary due to the external economies and diseconomies of scale. Cities must specialize in one or a few particular industries that possess external economies of scale. These industries would then serve as the cities' local economic base. Therefore, it is the nature of market catchments and efficient operating scale of the local economic base that would determine the size of cities. Since the local economic base is critical to the effective functioning of a city, the multiplier effect of the local economic base will determine the extent of a city's growth. Tiebout (1963) listed several factors that affect the size of this multiplier. However, the fact is that countries are now trying to end their isolation, focus on products with comparative advantage and refrain from local protectionist policies, contradicting some of the factors listed by Tiebout.

Krugman et al (2000) developed the Dixit-Stiglitz (1977) monopolistic competition model. They found that the balance between the demand of agricultural and manufactured goods will determine the pattern of spatial activities in the region, and this can be used as the basis to analyze the interaction between the core and the periphery of a spatial economy.

The theoretical discussion in Chapter 2 forms an integral foundation in constructing a conceptual framework for an Agropolitan region. In line with Isard's corner solution, locating agro-industries very near to the villages to reduce the transport cost to a virtually negligible amount would provide an efficient logistics arrangement. An Agropolitan's growth center should have high accessibility to the source of agro-industry raw materials and the area should feature higher value added activities. In addition, to ensure economies of scale from the agglomerated output, the growth center should ideally be at the location where the critical isodapanes of two or more firms would meet.

The growth center serves as a center of distribution of urban goods and services as well as a collection center of agricultural produce. The market catchments of the growth center is ideally of a hexagonal market shape, and the distance between the Agropolitan growth centers of the same size should be shorter compared to the distance between larger cities. In line with the gravity model, trade should be higher due to the concentration of activities in the growth center. This increases its market size and the center's accessibility to the region's economic center.

In relation to Alonso's bid rent price model, high value added activities will ideally be at the most accessible point in the area. Nevertheless, under an Agropolitan arrangement, there should be no variations in land use for the hinterland of the growth center. This is because at any point within the hinterland, the transportation costs to the growth center do not vary. Instead, the bid rent price is applied with respect to the accessibility of an Agropolitan area from the region's economic centers. The better infrastructure that links the Agropolitan growth center and the region's economic center would require high value added activities to be present in the growth center. High value added activities can only take place if there is a concentration of activities in the growth center.

The local economic base of an Agropolitan region would determine the extent to which the area can grow. Generally, with basic agricultural industries as the local economic base, the area can grow to a size similar to a small city in Indonesia with population ranging from 50,000-200,000. In ensuring an optimum multiplier of the local economic base, an Agropolitan area should initially have an ideal size of population and natural resource base. In keeping spending to remain within the area, an Agropolitan area should have an effective financial institution arrangement that channels the funds for further investment in other local sectors. The Dixit-Stiglitz monopolistic competition is relevant when looking at an Agropolitan region as a part of a larger regional system. A balance of demand between manufactured goods and agricultural goods would indicate a healthy rural-urban linkage.

8.1.2 Findings from Recent Studies

This research combines the above theoretical framework with the findings from applied research specific to the issue of secondary urban area development. The purpose of this analysis is to draw various real life examples into the conceptualization of an Agropolitan Region. Research on secondary urban area development is in line with the arguments that rural and urban areas should be integrated into one functional region. Rondinelli (1991) highlights the efforts among Asian governments to diffuse urban growths by investing in secondary cities and towns that allows the integration of urban and rural markets. Agropolitan development is an example of such efforts directed towards improving rural urban linkage and strengthening the role of secondary cities.

Parr (1987) provides a conceptual framework to show how rural-urban integration can provide a platform for a multi-sourced growth. This multi-sourced growth is where both rural and urban areas play their roles in creating regional economic growth. To achieve a multi-sourced growth, it is important to have a high degree of leverage. This leverage arises from the concentration of activities originating from the hinterland and spreading to the urban growth center. Thus, to achieve higher degree of leverage, the size of the hinterland accessible from the urban center must be sufficiently large. The size of the hinterland can be measured by the geographical size or natural resource endowments or population. It is better to use isochrones instead of linear distance in identifying the urban area's hinterland. This is useful to take into account variations in terrain and transport infrastructure conditions. In the case of an Agropolitan region, the selection of the growth center is particularly important in ensuring that the hinterland meets the certain size requirement.

The discussion in chapter 3 also covers the benefits, challenges and the important factors in the development of a small small urban center. Various studies including Trager (1988), Gaile (1992), Aeroe (1992) and Rondinelli (1988) look at the case of small towns in Africa. These towns have contributed significantly to regional development. Their contribution is achieved by becoming the center of collection for rural produce, a market place for distribution of urban goods and most importantly, a center for provision of basic services.

Rural town development has also helped to stimulate non-farm employment opportunities. When such a small urban center is developed in an agricultural area, the town stimulates growth of enterprises and jobs related to agricultural marketing, processing and exchange. These towns also provide links or act as a gateway between the villages and the larger cities.

In China, the development of Town and Village Enterprises (TVEs) has made significant contributions. They help avoid the excessive concentration of population in urban centers. Empirical studies also show that rural industrializations is not reducing the share of growth existing larger urban centers. One example is in Ghana, Owusu (2005) finds that the growth rate of larger urban centers did not decline, despite the development of rural industries. Thus, the development of an Agropolitan must be focused on promoting agro-industries in the growth center.

Some studies have suggested that this system of social economy is ineffective. Williams and White (2001) and Amin et al (1999) point out that the social economy still leaves some of the rural households excluded from access to services. They also find the claims that the social economy is being empowering, sustainable and an informal alternative to an urban economy to be not true.

However, many of the endeavors to promote a small urban center have failed due to the challenges faced. Otiso (2005) points out the case of Kenya where the failure was due to insufficient decentralization of power and fiscal responsibility and the dominance of the capital city in attracting investment. In relation to the development of agricultural-based small urban center, the case of USA shows how food manufacturing has low employment creation. The fastest agricultural-related sectors are instead the food retail and marketing. Unfortunately, these activities tend to locate in urban areas to gain access to consumers. Therefore, the development of an Agropolitan region should also encompass the subsequent channeling of investment towards service industries, which include transport, communication, public utilities, wholesale and retail trade, finance, insurance and real estate, personal, business and health services.

It is also important to note the challenges in ensuring equitable development. Southall (1988) cites an example in South America. The case shows that development of small urban centers instead benefits urban capital owners and leaves the rural population impoverished with low earnings from low level jobs. Southall suggested the participation of and initiatives from the rural population in ensuring successful small urban center development. Rural people may sacrifice potential employment in rural areas to pursue an urban life in larger cities. This is particularly true when they perceive urban “city lights” as a superior amenity compared to the rural area’s social amenities. Such an outcome is most likely to take place when the infiltration of the urban mindset is not accompanied by the development of rural economic capacity to accommodate the new aspirations of the rural population. An Agropolitan region may emulate the best practice in the Chinese collective system, where rural industrialization is triggered by the development of skills and entrepreneurship of the rural population.

For a small urban center to function effectively, a number of preconditions must be fulfilled. These preconditions include both exogenous and endogenous factors. The exogenous factors include the national economic policy and its relationship with larger urban centers. The national economic policy mainly relates to the agricultural policies including import substitution, urban-biased development, interventions in food prices and expansionary or contractionary development policies. With regard to the relationship with larger urban centers, the presence of mega-influential urban areas such as Greater Jakarta may have a negative impact. They may stunt the development potential of small towns and cities within close proximity to them. Titus (1991) found from the case of four small towns in Central Java that the town-hinterland relations and the rural development process are more influenced by higher-order centers and the national policies rather than the small towns own functions. There have also been cases of "bypassing" that reduce these towns' potential development. Bypass takes place when the rural people go directly to the larger cities rather than the small urban center in purchasing goods and services or in marketing their rural produce. Thus, it is most likely that an Agropolitan region will not function effectively when it is located near a very large city. For those outside the influence of a very large city, the Agropolitan growth centers should focus on providing the links between the local/rural and the national/global economies.

The endogenous factors include rural-urban linkage patterns, migration factors, services expected and the socio-economic factors. It is best for a small urban center to feature services, distribution, commercial, marketing and agro-processing activities as the economic base. Haggblade et al (1989) point out the case of Asia where agricultural growth through a network of consumption and production linkages can generate significant income and employment multipliers in the rural non-farm economy. The five flows that ideally must be present in a rural-urban linkage include flows of people, production, commodities, capital and information. In relation to the relationship with larger urban centers, small urban centers should no longer be placed in the lower hierarchy of the distribution of services and urban goods. This requires a change in retail strategy of small country towns to have more marketing functions. It is also important to understand the characteristics of the rural population in making decisions about utilizing the small small urban center. One of the factors is the rural urban migration, which depends upon the origin, destination, intervening obstacles and personal factors. Development has reduced the psychological distance between the rural and the urban areas and has encouraged migration. This is especially because there is an increased level of education, aspiration and awareness of urban opportunities. By using the cost-benefit approach, we can identify the motives of migration. Since migrants normally expect an increase in income or reduction in cost of accessing basic services and goods, the Agropolitan growth center should meet the expectations.

Empirical studies show that rural out-migration is positively correlated with higher population density, inequitable land distribution, access to cities, rural-urban integration and commercialization of agriculture, level of formal education and occupational skill levels. Therefore, education development in an Agropolitan should be directed towards skills and knowledge required to maximize the exploitation of local opportunities, such as farm management. This will help ensure that local opportunities are available to cater to the career needs of the rural population.

8.1.3 The Analysis of Accessibility

Accessibility is critical to the effective functioning of a small urban center. The objective of this thesis was to investigate the role of accessibility in the development of Ampel sub-district's small urban center. Rodrigue (2004) classified accessibility into two main types, which are topological accessibility and contiguous accessibility. This study places heavier emphasis on contiguous accessibility. The small urban center is expected to be the most accessible point in the Ampel sub-district.

This study found that five villages that are part of the small urban center have the highest geographical accessibility. However, in terms of potential accessibility based on the working age population, a village outside the small urban center scores the highest. Only two out of the five small urban center villages are among the highest five and only four out of five small urban center villages are among the highest seven. For potential accessibility based on livestock, another village outside the small urban center scores the highest. Again, only two out of the five small urban center villages are among the highest five and only four out of five small urban center villages are among the highest seven. One of the small urban center villages, Tanduk, is consistently out of the highest seven ranks for both measures of potential accessibility. Three villages outside the small urban center, Kembang, Candisari and Sampetan, are consistently among the highest seven for both measures of potential accessibility.

This study also looked at the relationship between accessibility and the level of development. From this analysis, it is shown that the small urban center's villages are the most developed. Kembang, Candisari and Sampetan villages have relatively lower level of economic development.

The adjacent villages to Sampetan have low level of accessibility in terms of geographical conditions. Thus, Sampetan should not be the small urban center. Both Kembang and Candisari have high elevations, which make them unsuitable for hosting economic activities other than farming. In addition, the study found that the most developed villages among the small urban center are located close to the regional road linking the region's economic center. However, other villages which have lower scores for accessibility but are also located close to the regional road have low level of economic development.

Thus, it is possible to conclude that accessibility plays a very important role in the development of a small urban center. The most economically developed villages have high accessibility in terms of geographic accessibility, potential accessibility based on livestock and working age population, topographical condition as well as the link to the regional economic center.

A low correlation between distance and the level of economic development was found for almost all the villages. This shows that under an Agropolitan system, the difference in transportation cost among villages is not substantial, because all points within the growth center's hinterland are equally accessible. Hence, all the points within the hinterland have equal opportunity for benefiting from the development of the growth center. Thus, Agropolitan development requires that the four forms of accessibility be fulfilled by the growth center in effectively serving its hinterland and linking the hinterland with the regional economic center.

8.1.3 The Analysis of Industrial Linkages

Industrial linkages are the key driver of rural-urban linkages for an Agropolitan region. Only with conducive industrial linkages can the rural-urban linkages be considered healthy. Based on the theoretical models and finding of recent studies, we hypothesize that the villages should concentrate on their forward linkage with the small urban center. The linkage should also be balanced between the villages and the small urban center, whereby the village should enjoy comparable income from the supply of their produce with the small urban center.

Schmidt's (1975) graph theoretical analysis that has five main indices for analyzing the spatial pattern of industrial linkages. With slight modification in the application of these indices, it was possible to investigate the pattern of industrial linkages in the Ampel sub-district's cattle-related industry. The four indices used measure the complexity of the spatial structure, the magnitude or density of flows relative to the total mileage within the linkage system, the spatial dispersal or concentration in the linkage pattern, the average length of network linkages and the geographical market size.

In this analysis, linkages were identified between each economic node. Thus, a village can have more than one economic node if it has more than one type of economic activity present. The economic node is a combination of location and the economic sector. For example, the economic sectors in the cattle-related industry are classified into 14 economic sectors. Six sectors are present in all the villages while the remaining eight sectors are urban economic sectors located in the small urban center. In performing this analysis, we gather the data of distance, the quantity and direction of the flow of goods, the number of available nodes for each economic sector and the price were used. In identifying the quantity and direction of the flow of goods, assumptions based on findings from interviews and research were applied.

Based on theoretical and recent research findings, a low spatial complexity and high spatial concentration for the economic sectors in the rural village was hypothesized. The small urban center's economic sectors were hypothesized to have high spatial complexity and high spatial dispersal. In terms of the balance in the rural-urban linkage, it was also hypothesized that a balanced rural-urban linkage is characterized by a high magnitude of flow and the geographical market size of the rural sector.

The finding's show that for the rural economic sectors, which include forage grass growing, cattle growing and corn growing, the level of spatial complexity is low and the degree of spatial concentration is high. The forage grass growing sectors are forward-linked with either the respective village's cattle growing sector or the small urban center's forage market. The meat cattle growing sectors are forward-linked with the slaughter house and the milk cattle growing sectors are forward-linked with the milk cooperative. The corn growing sectors are forward-linked with the household or the concentrate processing industry. Therefore, we can see that apart from local consumption, the rural produce is mostly supplied to the small urban center sectors.

For the small urban center sectors, high levels of spatial complexity and spatial dispersal were found as expected. The forage grass market supplies to many of the villages suffering from a deficit in forage grass production. The Ampel market supplies milk and meat to all the households in Ampel. The animal market supplies livestock and the concentrate processing industry supplies concentrates to all the cattle growing villages.

The milk cooperative supplies the milk to the milk factory outside the region, and it is the milk factory that supplies the Ampel market with powder milk. The slaughter house supplies to the Ampel market and the meat processors. The meat processors produce floss and dried meat that are sold in the outlets located in the small urban center. Nevertheless, all these sectors' linkages have no impact on the spatial structure of the rural sectors.

The analysis also shows that the geographical market size and linkages of the small urban center sectors are not necessarily higher than the rural sectors. For example, the geographical market size of the forage grass market is 384, which is much smaller than the size of the king grass growing sector. Another example is the low linkage index of Ampel market at 18.05 compared to the higher linkage index of the rural milk cattle sector with an average of 70. As hypothesized, there is a balanced rural-urban linkage where the villages enjoy a greater share of income from the economic activities within the cattle-related industry.

Data from West Java were used for comparison with Ampel. However, it is difficult to make a comparison on the magnitude and market size between West Java and Ampel, due to different economic characteristics. Nevertheless, the differences in magnitude and market size between the rural and the urban areas for West Java and Ampel can be compared. Data on the origin-destination of goods transport published by the Ministry of Transport for 1996 were used. There are 31 nodes in the network, all of which are part of the West Java region.

From the analysis, the largest regency and all the cities except Bogor actually have low levels of spatial complexity. They are all among the bottom 10 in terms of the β values. All cities also score low in terms of spatial dispersal. The smaller regencies have high spatial complexity and spatial dispersal. However, the larger regencies and some of the main cities score among the highest in the η_w values. Thus, they have a larger geographical markets size compared to the rural or smaller regencies. These larger regencies and municipalities are also the top scorers for the $1/\iota$ index, which shows a greater magnitude of linkages as compared to the rural or smaller regencies. Thus, in contrast to the Ampel sub-district, the rural-urban linkage of West Java is characterized by the weak role of the urban areas as the centers of distribution and the lack of concentration of rural activities. West Java's urban areas also dominate in terms of geographical market size and linkage magnitudes. Ampel sub-district's rural-urban linkage pattern appear therefore to be healthier than that of West Java. West Java is indeed well recognized to possess the characteristics of an unhealthy rural-urban linkage pattern as described. Schmidt's indices show results that conform to the actual conditions of West Java. This confirms the validity of these indices as measures of spatial industrial linkage pattern.

Kasikoen (2005) was also referred to for the analysis of rural-urban linkages between the village and its respective small urban center for a selected sample of villages in West Java. From this analysis, three main categories of relationship were identified. The first category includes small urban centers that are ineffective in providing goods and services, farm or industry inputs and work opportunities. The second category includes small urban centers that are effective in providing work opportunities but are not effective as providers of goods and services and farm or industry inputs. The third category includes small urban centers that are effective as providers of goods and services, farm inputs and work opportunities. Nevertheless, when the cases where data are available for two villages within the same sub-district, there appears to be less concentration of activities in the small urban center. This is shown from the differences in the rural-urban characteristics of the villages of the same sub-district. Therefore, by comparing Ampel to these sub-districts, Ampel is a better candidate for a model Agropolitan region.

8.1.4 The Analysis of Relationship between the Socio-Economic Factors and the Level of Rural Town Usage

The relationship between the socio-economic factors and the level of use of a small urban center was also analysed. Four independent variables were considered. These four independent variables are grouped into two pairs. The variables in the first pair are the relative accessibility and the willingness to travel. The variables in the second pair are the rural village amenities and the level of modernity. The dependent variable is the level of usage of the small urban center. Some of the questions from Powe (2004) were adopted and the survey was conducted in cooperation with the Directorate of National Spatial Planning, the Ministry of Public Works Indonesia.

Moderated structural equation modeling was used to test the relationship between the inherent locational characteristics and the level of usage of the small urban center. The inherent locational characteristics are the accessibility and the rural village amenities. The personal factors which include the willingness to travel and the level of modernity were tested to see if they affect the relationship between the inherent locational characteristics and the level of usage of the small urban center.

It was hypothesized that the level of accessibility will have a significant positive relationship with the level of usage of the small urban center. The resident's willingness to travel is hypothesized to have a negative moderating effect on the relationship between accessibility and the decision to use the small urban center. It was also hypothesized that the level of rural village amenities relative to the small urban center will have a significant negative relationship with the level of usage of the small urban center. The resident's level of modernity is hypothesized to have a negative moderating effect on the relationship between the rural village amenities and the small urban center usage.

The data were obtained through a survey of 200 households in the Ampel sub-district, in which 150 questionnaires were returned and were usable in the analysis. It was found that the indicators used in the questionnaire are effective as descriptors and as proxies for the latent variables used in the moderated SEM. It was also found, as expected, that there is a significant positive relationship between the accessibility and the level of usage. But, contrary to our hypothesis, only a very weak moderating effect of the willingness to travel on the relationship between accessibility and the level of usage was found. As hypothesized, there is a significant negative relationship between rural village amenities and the level of small urban center usage. The moderating effect of modernity on the relationship between rural village amenities and the level of small urban center usage is also significant.

The results show that the inherent characteristics of the small urban center, which are the accessibility and the level of amenities are important in influencing the residents' decision to use the small urban center. However, the residents' willingness to travel is not an important determinant of the decision to use the small urban center. The personal characteristic of modernity is an important determinant that affects how residents consider the availability in their village before deciding to use the small urban center. Thus, accessibility is of absolute importance and those with high willingness to travel will not automatically be less concerned with accessibility in making decisions to use the small urban center. Rural village amenities are also important, but for residents with higher modernity. They are less concerned with available level of amenities because of their desire to consume urban services from the small urban center.

Agropolitan developers should focus on improving accessibility of the small urban center and ensure that the level of amenities is higher than those of the villages. In addition, education and information can improve modernity and consequently increase the level of usage.

8.2 Recommendation

This thesis has made a significant contribution in combining the literature and research findings into a conceptual framework for an agricultural-based small urban center development. It has also empirically investigated the factors that may determine the effectiveness of a small urban center using the case of the Ampel sub-district. From the theoretical discussion and the research findings, it is found that the development of small urban center relies heavily on its accessibility with regard to the link with the hinterland and with the region's economic center. The industrial linkage promotes agglomeration and value-added activities and socio-economic factors may determine a resident's inclination to use the small urban center, and that accessibility is important.

The moderated SEM model also served as a useful tool. The indicators in the models were useful in describing the latent variables. The fact that willingness to travel does not offset the importance of accessibility in influencing the decision to use the small urban center, has strengthened the view that accessibility must be improved to increase level of usage. As mentioned previously, Agropolitan developers should focus on the inherent characteristics of the small urban center, which include the accessibility and the relative availability of amenities compared to the rural village amenities. These factors will have a strong impact on the residents' decision to use the small urban center and should be incorporated as the main development agenda for Agropolitan regions. In addition, education and access to information should be included. It is important to ensure there is an adequate provision of urban amenities in the small urban center.

Therefore, it is possible to propose policy recommendations for the development of an Agropolitan region. The various accessibility indices, including geographical accessibility and potential accessibility must be considered. The transport infrastructure development should focus on improving the linkage of the most accessible point in the Agropolitan region to the region's economic center. This would enable the hinterland of this most accessible point to benefit from the infrastructure development equally, due to the high accessibility to the newly linked node. Since the accessibility of the growth center from the village is high, the improvement of transport infrastructure linking the villages to the growth center can be done at a lower cost by constructing low grade small roads.

The development program should focus on promoting agglomeration of activities in the small urban center by establishing secondary and tertiary agricultural-related activities such as food processing, cold storage, distribution center and packaging. However, these industries alone will not be sustainable in the long run because they will not create enough employment. Despite the fact that the villagers are still expected to benefit from reduced logistics cost, it is important that the incomes are channeled back to the local economy by improving the local financial institutions. These investments should focus on developing the service sectors, including utilities and marketing activities.

In relation to the socio-economic factors, capacity building and provision of urban amenities are very important. An education program should be directed towards giving the rural residents the necessary knowledge needed for application in the local communities. These include knowledge relevant for agricultural management or food technology. Improved higher education will lead to a higher demand for urban amenities. Thus, the small urban center should improve its role as provider of urban amenities. This is particularly important to prevent excessive migration from the rural areas to the metropolitan areas that may drain the rural human resources.

The national policy must also provide a supportive environment for the development of Agropolitan regions. Since the relationship between the small urban center and its hinterland is largely dictated by the larger economic centers, the central government should pay close attention to the policies related to local government expenditures for rural infrastructure and education, the food price and food import as well as the development of research programs that support the improvement in agricultural technologies.

Finally, Agropolitan development should adopt a participatory planning approach. The local residents should be involved in the planning process, in order to ensure the effectiveness of the program. Unless these residents are able to make good use of the development program, Agropolitan development would become less effective. In addition, the long term sustainability of the small urban center depends on the ability of the people to compete effectively in the market. It is also important for the rural people to have the ability to innovate products and services that will enhance the value addition in the local economy.

There are a number of areas that are closely associated with this research which have not yet been adequately covered in this thesis. They are identified for further research. It would be valuable to extend the industrial linkage analysis to include all the economic sectors in the Ampel sub-district. This will provide a clearer picture on the overall rural-urban linkage pattern in the area. For further research it is also recommended to collect more detailed data in testing the assumptions used in the analysis of industrial linkage.

It is desirable to perform a test of the industrial linkage indices used in this analysis over a larger sample size, to establish an aggregated result or a national average that can be used as a quick benchmark to investigate the rural-urban linkage pattern in new research areas.

The home interview survey has collected a number of valuable data that can be used for various other purposes. This may include the use of LOGIT analysis to investigate the relationship between the socio-economic factors and the pattern of travel. It would also be better to extend the home interview survey to other areas to get a larger sample that is desirable for a more accurate structural equation modeling.

In summary, this thesis has contributed to the understanding of agricultural-based small urban center development in promoting healthier rural-urban linkage patterns, and in being a sustainable alternative for the national economic development. The development of Agropolitan Regions would reduce the heavy burden placed on metropolitan areas to accommodate the ever increasing population in Indonesia. Most importantly, Agropolitan development will also secure the nation's food supply and contribute to the eradication of poverty.

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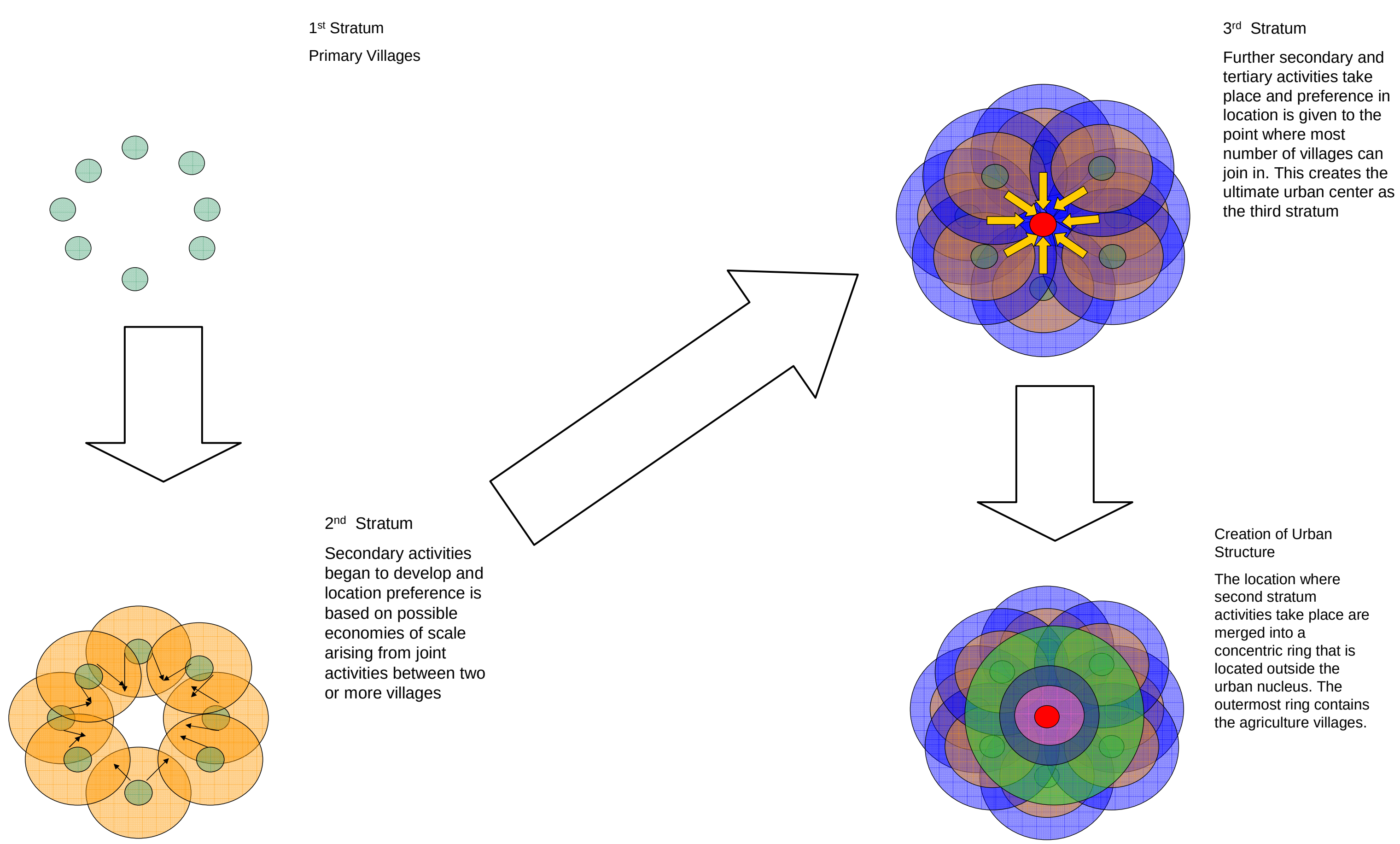
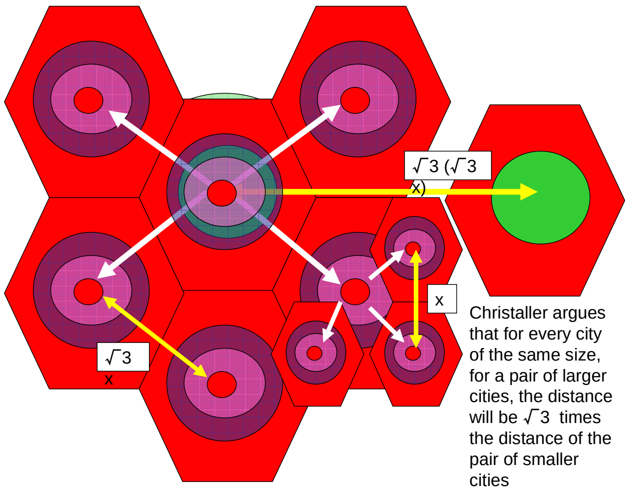
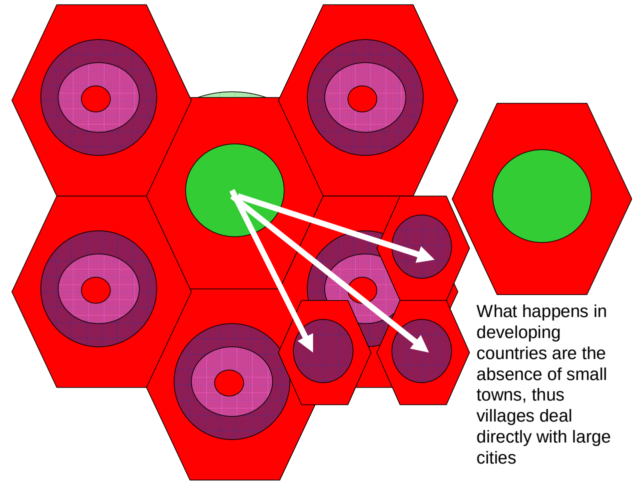
Appendix 1
Urban Area Development Process Illustration (Combination of Spatial Development Theories)



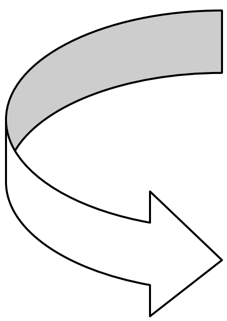
Continue to next page

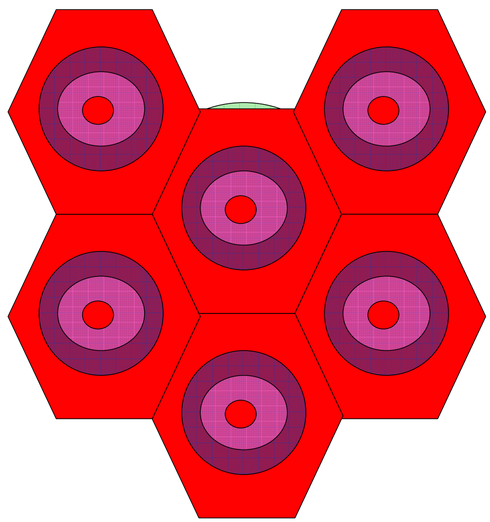


Christaller argues that for every city of the same size, for a pair of larger cities, the distance will be √3 times the distance of the pair of smaller cities

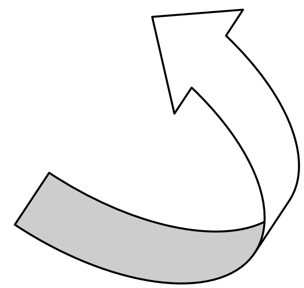


What happens in developing countries are the absence of small towns, thus villages deal directly with large cities

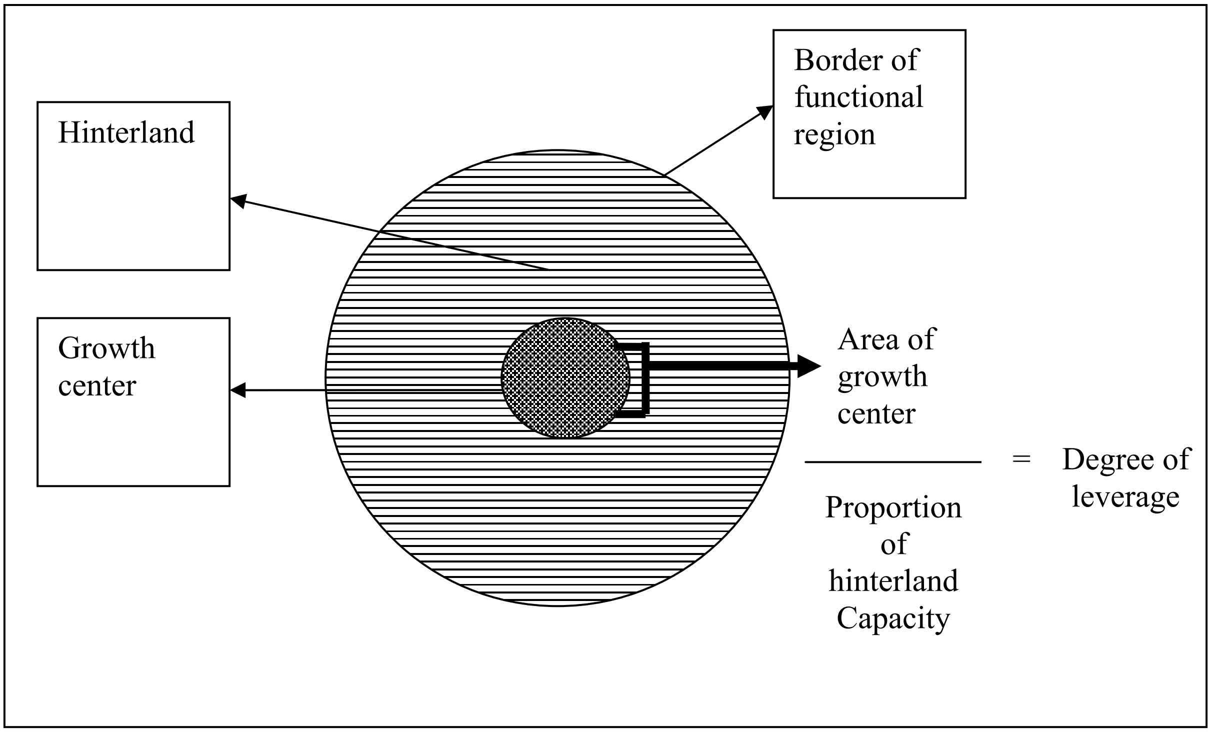




Losch sees hexagonal shape as an effective way to ensure that all areas are within proper coverage by the respective urban areas

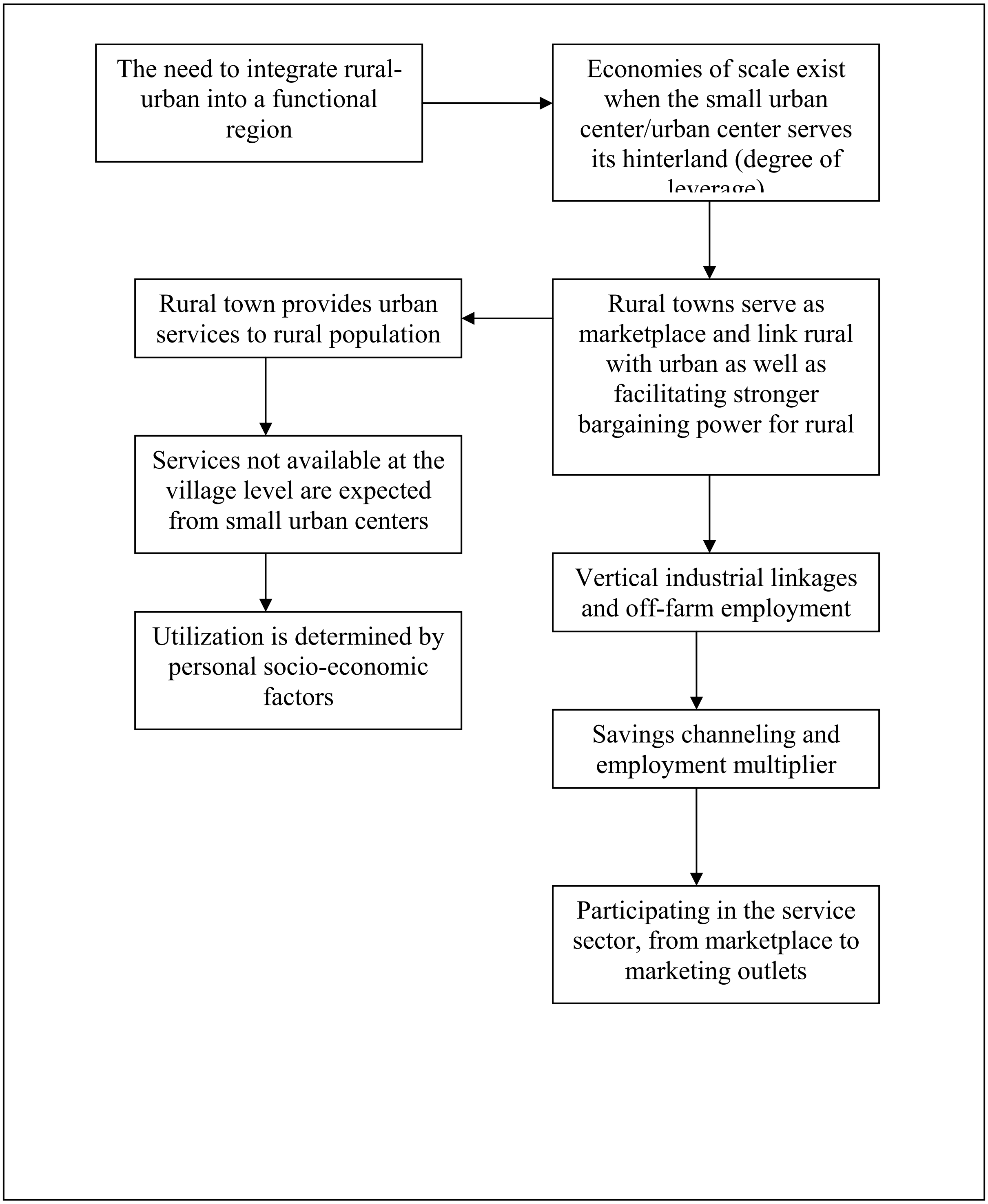


Appendix 2
Degree of Leverage



In calculating the degree of leverage, the growth center area is compared to the proportion of the hinterland area to determine how optimum the leverage is. The border of functional region can be determined using isochrones to take into account variations in sky distance and the actual transport cost and time. The use of area size in calculating degree of leverage can be substituted with population, fertile farm land area size or agricultural produce. Changing these indicators for the degree of leverage provides more suitable information on the economies of scale depending on the cases. However, it is important to note that the accessibility of the growth center in terms of its potential coverage of natural resources or populations plays a more important role in determining the economies of scale.

Appendix 3
Summarized Flowchart of Literature Review of Empirical Studies



Appendix 4

Spatial Linkages Analysis for Iron and Steel Firms in the USA

Table 1.
Changes in the Input and Output of the Steel Firms

		Changes in the Input and Output of the Steel Firms						
	1963-65		1965-67		1967-68		1968-70	
Firm	Input	Output	Input	Output	Input	Output	Input	Output
A	15	10	-30	-15	-5	-5	5	5
B	51	50	69	83	15	18	16	17
C	3	5	3	5	5	5	10	10
D	50	40	35	25	-50	-40	10	10
E	10	6	16	8	-25	-19	12	18
F	43	40	42	30	-30	-15	27	20
G	21	35	27	32	3	16	15	1

Source: Schmidt (1975)

Table 2.
Measures of Linkage Orientation for Steel Firms

			μ_j			ϖ_j	
		1963	**1967**	**1970**	**1963**	**1967**	**1970**
Forward Linked							
Firm	**A**	0.29	0.37	0.28	0.5	0.55	0.4
	B	0.18	0.19	0.19	0.65	0.68	0.67
	C	0.32	0.37	0.36	0.57	0.6	0.65
Backward Linked							
Firm	**D**	0.5	0.49	0.47	0.3	0.35	0.35
	E	0.66	0.64	0.65	0.3	0.2	0.25
Intermediate Linked							
Firm	**F**	0.37	0.37	0.29	0.4	0.44	0.42
	G	0.32	0.31	0.32	0.39	0.37	0.32
Puget Sound Iron							
and Steel		-	0.39	-	-	0.49	-
Washington State							
Iron and Steel		0.2	0.17	-	0.62	0.63	-
Gregon State Iron							
and Steel		0.58	-	-	0.75	-	-
United States Iron							
and Steel		0.57	-	-	0.97	-	-

Source: Schmidt (1975)

Table 3.
Measures of Spatial Linkage Orientation for Steel Firms

Firm	Year	β	$1/\iota$	π	η	η_{ω}	Firm	Year	β	$1/\iota$	π	η	η_{ω}
	1963	0.86	346	1.29	383	0.05		1963	0.9	503	2.84	600	0.147
A	1967	0.86	387	1.28	550	0.062	**A**	1967	0.91	682	2.68	510	0.173
	1970	0.86	93	1.25	1192	0.053		1970	0.91	443	2.81	535	0.088
	1963	0.86	15	2.06	600	0.003		1963	0.8	538	1.57	11	0.007
B	1967	0.87	38	2.06	600	0.007	**B**	1967	0.87	338	1.05	308	0.031
	1970	0.89	55	2.08	456	0.007		1970	0.91	248	1.7	386	0.014
	1963	0.8	65	2.04	919	0.011		1963	0.87	271	1.77	393	0.025
C	1967	0.85	76	2.56	908	0.018	**C**	1967	0.91	139	2.79	723	0.039
	1970	0.85	148	1.92	690	0.02		1970	0.92	345	2.61	337	0.038
	1963	0.85	745	1.39	610	0.094		1963	0.87	6522	2.38	98	0.049
D	1967	0.85	1558	1.39	610	0.375	**D**	1967	0.91	7760	4.17	114	0.067
	1970	0.85	463	0.148	1510	1.29		1970	0.86	18500	2.67	67	0.07
	1963	0.8	5892	1.85	462	0.368		1963	0.91	5690	3.22	290	0.221
E	1967	0.87	3679	2.17	543	0.429	**E**	1967	0.93	1437	7.41	1169	2.56
	1970	0.83	4907	1.57	458	0.532		1970	0.94	1141	7.58	1137	1.81
	1963	0.8	1854	1.28	225	0.029		1963	0.93	508	5.9	632	0.125
F	1967	0.83	2072	2.2	330	0.049	**F**	1967	0.95	544	6.63	939	0.425
	1970	0.83	1242	1.51	540	0.076		1970	0.95	475	9.41	1263	0.668
	1963	0.8	398	2.58	664	0.071		1963	0.91	754	3.67	700	0.412
G	1967	0.83	846	1.87	710	0.124	**G**	1967	0.92	391	4.01	1911	1.1
	1970	0.87	471	2.99	1114	0.124		1970	0.93	283	5.81	2864	2.02

source: Schmidt (1975)

APPENDIX 5

THE FUNDAMENTALS OF STRUCTURAL EQUATION MODELING[17]

Application of SEM

SEM is a second generation multivariate analysis that allows researcher to test relationships between complex variables either recursive or non-recursive to obtain overall picture on the model. Unlike normal multivariate analysis, SEM can test simultaneously:

1. Structural model: relationship between independent and dependent construct variables
2. Measurement model: relationship (loading factor) between indicators (manifest variable) with construct variable (latent variable)

The combination of structural model and measurement model allows researcher to test measurement error and to simultaneously perform factor analysis and hypothesis testing. The basic concept of SEM is the relationship between construct variables with latent variable (variables that cannot be directly measured and requires proxy). The indicators acting as proxy are called manifest variables. In the model there are independent variables and dependent variables, which in SEM are called as exogenous and endogenous variables respectively. Since latent variable measured through many indicators are incorporated in the model, normal regression cannot be used. The SEM concept relies heavily on the error measurement. SEM embarks with the view that every indicator perfectly measures the latent variable and thus there is no measurement error. However, there is always the probability of error in each indicator, particularly when subjective rating scales such as Likert is used. There are two errors measured in SEM, which are the measurement errors that is based on how well the manifest variables act as

[17] Excerpts from Ghozali, I and Fuad (2005), *Structural Equation Modeling*, BP Undip, Semarang

proxies for the latent variables and the structural error that is based on the relationship between the endogenous and exogenous variables.

Measurement of variable can be done in the form of reflective indicators and formative indicators. Formative indicator can only be used with Partial Least Square method. Reflective indicator is affected by latent variable while the formative indicators affect the latent variable. LISREL estimation method assumes that the manifest variables are reflective indicators of the latent variable.

The choice of appropriate indicator is highly important in representing variable latent and since single indicator is usually not sufficient, it is advisable to use many indicators although the more complex the model, the more the minimum sample to be met. In addition, problems may occur when parsimony model (structural model deliberately constructed to produce the best fit) becomes the objective, and thus causing specification error in the structural model due to the erasure of important latent variables according to the theory and the low quality of measurements due to the erasure of important indicators from the latent variable. Thus the listwise method that takes out variables to arrive at the best fit has this disadvantage. SEM also allows the use of single indicator on a construct.

The structural model links the confirmatory models in an overall SEM. The confirmatory factor models show how the latent variables are measured and each indicator is affected by errors. The LISREL notation serves the purpose of explaining the relationships between the elements in the model more efficiently. In the LISREL notation, the exogenous latent variable is named as KSI (ξ), and these exogenous variables are assumed to be inter-correlated that is denoted with PHI (ϕ). The endogenous latent variable is denoted by ETA (η) and the direct relationship between the endogenous latent variable and exogenous latent variable is denoted by GAMMA (γ). The relationship between endogenous variables is denoted by BETA (β). The measurement error due to the relationship between exogenous variable to endogenous variable is denoted by ZETA (ς).

For the measurement model, the indicators of exogenous latent variables are denoted by x while for endogenous, y. The relationship between the latent variables and their indicators is denoted by LAMBDA (λ). The measurement errors for the indicators are denoted by DELTA (δ) for exogenous latent variable and EPSILON (ε) for endogenous latent variable. In terms of the numeric notations accompanying the symbolic notation, for direct path, the rule is for the first number on the subscribe as representing the target variable and the second number as the source. This rule does not apply for non direct relationship including covariance and correlation since the order of the numbering is not important.

The structural model involving relationship between endogenous variables can be denoted as follows:

$\eta 2 = \gamma 21 \xi 1 + \gamma 22 \xi 2 + \beta 21 \eta 1 + \varsigma 2$

The measurement equation for exogenous variable:

$Xi = \lambda i1 \xi 1 + \delta i$

The measurement equation for endogenous variable:

$Yi = \lambda i1 \eta 1 + \varepsilon i$

Structural Equation Modeling serves two main objectives. Firstly, it determines the plausibility or how fit the model is, based on the data obtained. Secondly, it tests the various hypotheses that have been previously constructed. The level of fit is determined by the difference between the sample covariance matrix and the implied covariance matrix. In simple terms, the sample covariance matrix represents the actual data and the implied covariance matrix represents the model or how the data should be if the model is perfectly true.

Variance is measure of deviation of data from a sample's mean and thus provides measurement for metric variables. Mathematically, variance is the average squared difference between every observations and the mean. Therefore, variance is the squared value from the standard deviation. Every variable ought to have variance and the variance should be positive, otherwise a zero variance would make the variable a constant.

VAR (X) $= \sum(xi - \mu)^2 / N$ (Population Data)

VAR (X) $= \sum(xi - x\hat{}\,)^2 \; /(N-1)$ (Sample Data)

Where:

Xi : data at i^{th} observation

N : population or sample size

μ : population mean

x^ : sample mean

∑ : summation

Covariance shows a linear relationship that takes place between two variables, X and Y. If a variable has positive linear relationship, it will have positive covariance. If the relationship between the two is negative, the covariance is negative. If there is no relationship, the covariance is zero. Covariance has no limitations in value and can be negative or positive. It is measured as follows:

COV (X, Y) $= \sum(xi - \mu s)\,(yi - \mu y)\,/N$ (Population Data)

COV (X, Y) $= \sum(xi - x\hat{}x\,)(yi-x\hat{}y)\,/(N-1)$ (Sample Data)

In these variance-covariance matrix (or covariance matrix), the variance is in the main diagonal line and the variance means the covariance between a variable. Those outside the diagonal line in the matrix are the covariance. The covariance matrix is in the following triangular form:

S =	COV (X,X)	COV (Y,X)	=	VAR (X)	
	COV (X,Y)	COV (Y,Y)		COV (X,Y)	VAR (Y)

The sample covariance matrix is very important to LISREL as the input in LISREL is usually in the form of this covariance matrix data. However, if the variable is standardized (has zero mean and 1 standard deviation), the covariance between X and Y becomes as follows:

COV (standardized X, standardized Y) = COV (X,Y)/SxSy

= rxy

Where Sx and Sy are the standard deviations from X and Y and rxy is the correlation between the variable X and variable Y (correlation ranges from -1 to 1; where a correlation value of 1 shows a perfect relationship and a zero correlation shows no relationship at all).

The following gives the simple rule in manipulating variance and covariance. Based on two variables, X and Y, as well as two constants a and b:

VAR (a+X) = VAR (X)

VAR (aX) = a^2 VAR (X)

VAR (X+Y) = VAR (X) + VAR (Y) + 2 COV (X,Y)

VAR (X-Y) = VAR (X) + VAR (Y) – 2 COV (X,Y)

VAR (aX + bY) = a^2 VAR (X) + b^2 VAR (Y) + 2ab COV (X,Y)

VAR (aX – bY) = a^2 VAR (X) + b^2 VAR (Y) – 2ab COV (X,Y)

COV (a, X) = 0

COV (aX, bY)= abCOV (X,Y)

COV (X, Y+Z) = COV (X,Y) + COV (X,Z)

The Implied Covariance Matrix gives the prediction performed based on the variance and covariance of a variable in the model. Taking an example of a simple regression with two variables X and Y:

Y = a + bX + e

Where a and b are regression coefficients (parameter). a is the intercept and b is the slope of the regression line while e is the error. Based on the above model, the expectation to obtain the variance from Y and the covariance between X and Y in the population is as follows:

VAR (Y) = VAR (a + bX + e)

COV (X, Y) = COV (X, a+bX+e)

Applying the rules for manipulating variance and covariance, the above conditions can be restated as follows:

VAR (Y) = b^2 VAR(X) + VAR(e)

COV (X,Y) = bVAR (X)

Thus, the implied covariance matrix can be obtained as follows:

$$\sum(\theta) = \begin{matrix} b^2\ VAR\ (X) + VAR\ (e) & \\ bVAR\ (X) & VAR\ (X) \end{matrix}$$

Where θ is the vector that contains the model's parameter. Thus, $\sum(\theta)$ is a covariance matrix between the variabels in the model that is depicted as the function of the model's parameter. If the model is true and if we know the parameter values, thus the covariance matrix, $\sum$ will be equal to $\sum(\theta)$.

This is the fundamental equation in SEM. However, the population variance and covariance or the parameter at (θ) are unknown. What is done in this method is to produce estimation from the unknown parameters, that is derived based on the sample covariance matrix, S. The estimations from this sampel is then used as a prediction on the variance and covariance of a population and thus the covariance matrix from the model becomes:

$\sum$^ = $\sum(\theta)$^

This is often what is called as implied covariance matrix and the purpose of SEM analysis is to find the estimation of parameter values that have difference between the sample covariance matrix and the implied covariance matrix. The difference between the sample and implied covariance matrices is called the residual matrix. Ideally, the elements in a residual matrix is zero, which indicates the perfect fit between ∑^ and S. However, this is very difficult to achieve and this is where goodness of fit measurements are used to measure the level of fit for the model.

The indicators include chi-square and p-value, goodness of fit indices, adjusted goodness of fit index, root mean square error of approximation, expected cross validation index, Akaike's Information Criterion and CAIC, Normed Fit Index.

There are seven methods that can be used to estimate the parameter of a model, which are instrumental variables, two stage least square, unweighted least square, generalized least square, generally weighted least square, diagonally weighted least square and maximum likelihood. These measures can be grouped into two main estimation techniques, which are:

a. Limited Information Techniques

   Examples from the technique of using limited information are the instrumental variables (IV) and two stage least squares (TSLS), which are fast estimation methods that do not use iterations. Both methods estimate the equation independently and separately where the two methods do not use information from the other equation on a model. Both methods are commonly used to produce starting values to be used for other estimation methods for the model. IV is usually used to produce starting values to be used for ULS estimation method. TSLS is used to produce starting values for GLS, ML, WLS and DWLS estimation method

b. Full Information Techniques

   Full Information Techniques is a technique to estimate all the equation systems simultaneously where information is used to estimate a parameter obtained from the whole equation systems in a model. The drawback of this model is that when a model has specification error due to the inclusion of irrelevant relationship or the erasure of a highly relevant relationship, it will affect the whole model.

The following gives more detail on each type of Full Information Techniques and the assumptions that have to be fulfilled including suggested sample size:

Maximum Likelihood

The most popular method in SEM and is set as the default estimation method in LISREL. ML will produce valid, efficient and reliable parameter estimation if the data used demonstrates multivariate normality and will be robust against any moderate multivariate normality deviations. However, ML estimation will be biased if the deviation in multivariate normality is significant.

ML has valid result with minimum sample of 50, however it is recommended that the sample is more than 100 – 200. Another weakness of ML is its “over-sensitivity” and producing poor goodness of fit index once the data used is too large (between 400 – 500).

Generalized Least Square

GLS produces estimate almost similar to ML when the multivariate normality assumption is met and the sample size is the same. However, GLS is slightly more robust against any violations of multivariate normality assumption. GLS will produce poor estimation with small sample size less than 2,000.

Weighted Least Square

WLS or Asymptotical Distribution Free is a method that is not affected by violations of multivariate normality. The weakness is that the variables cannot be more than 20 in the model and it requires almost unreasonable sample size of around 1,000.

Assumptions that should be met in LISREL

Normality

This is the most fundamental assumption in multivariate analysis that is a measure of the form of data distribution. If this assumption is not met and the deviation is large, the whole statistic test is not valid because the t-values testing and other estimates are based on the assumption of normal data.

Univariate normality can be tested for ordinal as well as continuous data while multivariate normality can only be tested for continuous data. If the data demonstrates multivariate normality it will demonstrate univariate normality but not vice versa To test the normality, z-statistics for skewness or curtosis can be be used. The z skewness can be measured as follows:

Z skewness = skewness/ √(6/N)

Where N is the sample size. The z-statistics for curtosis can be measured using the following formula:

Zcurtosis = curtosis/√(24/N)

If the z values for both curtosis and skewness are significant (less than 0.05 at 5%) then the data distribution is not normal. The rules of thumb is:

1. Normal data : skewness score less than 2 and curtosis score less than 7
2. Moderately non-normal : skewness score between 2 and 3 and curtosis score between 7 and 21
3. Extremely non-normal : skewness score more than 3 and curtosis score more than 21

When the normality assumption cannot be met, the solution is to add an asymptotic covariance matrix estimation that allows parameter estimation and goodness of fit statistics analyzed under the assumption of non-normal data. If the data is continuous, transformation of data is allowed, but in ordinal data, this is not advisable. If the sample size is sufficient, generalized least square or weighted least square methods can be used.

Another important assumption is multicollinearity, whereby there should not be any perfect correlation between the independent variables. The correlation that is not permitted is those higher than 0.9.

There are two types of data, which are continuous and ordinal data. Ordinal data is data that has consecutive categories such as Likert scale (1-5) and dummy. Ordinal variable is not continuous variable and should not be treated as continuous and since these variables are not metric measures, thus the mean, variance and covariance becomes meaningless. Therefore, the analysis with data ordinal should use polychoric correlation instead as the data input and to use the weighted least square estimation procedure.

However, it is difficult to meet the following assumptions in performing WLS:

1. Sample size more than 1,000
2. Observed variables less than 25
3. Assumption that the latent variables is continuous and fulfills multivariate normality assumption

An alternative is to treat categorical variables as continuous and correct the statistics test rather than using WLS< by using the Satorra-Bentler Chi-Square.

Parameter significance in LISREL is not measured directly. Every parameter estimation in LISREL has three important information, which are regression coefficient, standard error and t-values. The standard error measures the preciseness of every parameter estimation. The t-value is obtained by the dividing the estimated value with the standard error. The t-value has to be higher than the t-value in the t-table based on the level of significance and sample size.

Model Identification

In structural equation, it is important that the model has unique value so that the model can be estimated. The parameter estimate will be arbitrary if the model has several estimates that can fit the model. The structural model can thus be considered good if it has one unique solution for the parameter estimation. The problem faced in SEM is when the information in the empirical data (variance and covariance for manifest variable) is not adequate to produce unique solution to obtain model parameter.

In this case, LISREL will produce several solutions to the equation system that relates the variance and covariance of the observed variables to the model parameter, thus it can fit every number in the covariance matrix to a model. When this happens, where there are several appropriate solutions, the problem is called unidentified or underidentified. Thus, to solve an equation system in SEM, the minimum equation number has to be equal to the unknown number of numbers. To determine whether the model contains identification problem, the following condition must be met:

t < or = to s/2

where t = number of parameters estimated

p = number of y variables

q = number of x variables

s = number of variance and covariance between manifest variable that is (p+q)(p+q+1)

If t is more than 2, the model becomes unidentified and this can be solved by constraining the model. The constraints can be added by adding manifest indicators to the model, fix the additional parameter to 0 (most often used) or assume that the particular parameter with the other parameter has same value. The constraint should be supported by theoretical explanations. If t is equal to s/2, the model becomes just-identified where there is a unique solution that can be estimated to estimate the parameter. When the model is just-identified, the degrees of freedom is 0.

If it is less than 2, the model becomes over-identified where there are more than one estimate for each parameter that can be obtained because the number of equations available exceed the parameters to be estimated. Different from just-identified, in the case of over-identified model, the remaining equation can be used to test the fitness of the model, whereby if the two estimations yield significantly different results, the model might be wrong. The number of parameter consists of the number of loading factors and error variances.

Appendix 6

West Java Origin-Destination Transport Data in 1996 from the Indonesian Ministry of Transport

Distance Matrix for Districts in West Java (table 1 out of 3 tables)

	Jakarta Selatan	Jakarta Timur	Jakarta Pusat	Jakarta Barat	Jakarta Utara	Pandeglang	Lebak	Bogor	Sukabumi	Cianjur
Jakarta Selatan	0	20.03	13.26	14.53	24.52	139.62	116.31	70.63	110.58	111.11
Jakarta Timur	20.03	0	17.09	20.87	26.28	149.32	126.01	56.22	96.17	96.7
Jakarta Pusat	13.26	17.09	0	13.38	16.38	142.1	116.79	64.4	104.35	104.88
Jakarta Barat	14.53	20.87	13.38	0	21.9	131.62	108.31	74.8	114.75	115.28
Jakarta Utara	24.52	26.28	16.38	21.9	0	152.84	129.53	79.43	119.38	119.91
Pandeglang	139.62	149.32	142.1	131.62	152.84	0	21	118.9	186.25	254.13
Lebak	116.31	126.01	118.79	108.31	129.53	21	0	97.9	165.25	233.13
Bogor	70.63	56.22	64.4	74.8	79.43	118.9	97.9	0	67.35	67.88
Sukabumi	110.58	96.17	104.35	114.75	119.38	186.25	165.25	67.35	0	27.13
Cianjur	111.11	96.7	104.88	115.28	119.91	254.13	233.13	67.88	27.13	0
Bandung	141.68	127.27	135.45	145.85	150.48	284.7	263.7	98.45	57.7	30.57
Garut	210.27	195.86	204.04	214.44	219.07	353.29	332.29	167.04	126.29	99.16
Tasikmalaya	323.81	309.4	317.58	327.98	332.61	466.83	445.83	280.58	239.83	212.7
Ciamis	264.43	250.02	258.2	268.6	273.23	407.45	386.45	221.2	180.45	153.32
Kuningan	294.92	275.21	289.52	295.61	300.22	440.15	419.15	253.9	213.15	186.02
Cirebon	231.98	212.27	226.58	232.67	237.28	417.18	396.18	230.93	190.18	163.05
Majalengka	234.16	214.45	228.76	234.85	239.46	384.89	363.89	198.64	157.89	130.76
Sumedang	194.44	180.03	188.21	198.61	203.24	337.46	316.46	151.21	110.46	83.33
Indramayu	186.96	167.25	181.56	187.65	192.26	344.98	323.98	228.08	230.03	202.9
Subang	159.2	139.49	153.8	159.89	164.5	317.22	296.22	198.32	104.23	77.1
Purwakarta	93.75	74.04	88.35	94.44	99.05	251.77	230.77	132.87	103.42	76.29
Karawang	55.63	35.92	50.23	56.32	60.93	213.65	192.65	94.75	80.94	81.47
Bekasi	42.01	22.3	36.61	42.7	47.31	173.07	152.07	54.17	121.52	122.05
Tangerang	52.54	62.24	55.02	44.54	65.76	87.08	63.77	63.63	130.98	131.51
Serang	118.8	128.5	121.28	110.8	132.02	20.82	41.82	129.89	197.24	197.77
Kota Bogor	56.93	42.52	50.7	61.1	65.73	105.2	84.2	13.7	53.65	54.18
Kota Sukabumi	103.72	89.31	97.49	107.89	112.52	193.11	172.11	74.21	6.86	20.27
Kota Bandung	155.65	141.24	149.42	159.82	164.45	298.67	277.67	112.42	71.67	44.54
Kota Cirebon	244.38	224.67	238.98	245.07	249.68	429.58	408.58	243.33	202.58	175.45
Kota Tangerang	20.2	29.9	22.68	12.2	33.42	119.42	96.11	31.29	98.64	99.17
Kota Bekasi	28.53	8.82	23.13	29.22	33.83	159.59	138.59	40.69	108.04	108.57
Kota Cilegon	140.3	150	142.78	132.3	153.52	42.32	63.32	151.39	218.74	219.27
Kota Depok	20	40.03	33.26	34.53	44.52	125.2	104.2	33.7	73.65	74.18
	3994.88	3729.43	3888.26	4012.52	4265.26	7269.41	6684.24	3901.9	4069.35	3873.78

Distance Matrix for Districts in West Java (table 2 out of 3 tables)

	Bandung	Garut	Tasikmalaya	Ciamis	Kuningan	Cirebon	Majalengka	Sumedang	Indramayu	Subang	Purwakarta	Karawang
Jakarta Selatan	141.68	210.27	323.81	264.43	294.92	231.98	234.16	194.44	186.96	159.2	93.75	55.63
Jakarta Timur	127.27	195.86	309.4	250.02	275.21	212.27	214.45	180.03	167.25	139.49	74.04	35.92
Jakarta Pusat	135.45	204.04	317.58	258.2	289.52	226.58	228.76	188.21	181.56	153.8	88.35	50.23
Jakarta Barat	145.85	214.44	327.98	268.6	295.61	232.67	234.85	198.61	187.65	159.89	94.44	56.32
Jakarta Utara	150.48	219.07	332.61	273.23	300.22	237.28	239.46	203.24	192.26	164.5	99.05	60.93
Pandeglang	284.7	353.29	466.83	407.45	440.15	417.18	384.89	337.46	344.98	317.22	251.77	213.65
Lebak	263.7	332.29	445.83	386.45	419.15	396.18	363.89	316.46	323.98	296.22	230.77	192.65
Bogor	98.45	167.04	280.58	221.2	253.9	230.93	198.64	151.21	226.08	198.32	132.87	94.75
Sukabumi	57.7	126.29	239.83	180.45	213.15	190.18	157.89	110.46	230.03	104.23	103.42	80.94
Cianjur	30.57	99.16	212.7	153.32	186.02	163.05	130.76	83.33	202.9	77.1	76.29	81.47
Bandung	0	68.59	113.54	122.75	155.45	132.48	100.19	52.76	172.33	46.53	54.72	83.84
Garut	68.59	0	52.04	68.42	140.7	179.16	146.87	99.44	179.88	115.12	114.31	152.43
Tasikmalaya	113.54	52.04	0	16.38	88.66	117.36	99.14	151.48	179.88	160.07	159.26	197.38
Ciamis	122.75	68.42	16.38	0	72.28	100.98	82.76	167.86	163.5	169.28	168.47	206.59
Kuningan	155.45	140.7	88.66	72.28	0	28.7	55.26	102.69	91.22	201.98	201.17	239.29
Cirebon	132.48	179.16	117.36	100.98	28.7	0	58.51	79.72	62.52	163.52	171.63	176.35
Majalengka	100.19	146.87	99.14	82.76	55.26	58.51	0	47.43	121.03	146.72	145.91	178.53
Sumedang	52.76	99.44	151.48	167.86	102.69	79.72	47.43	0	142.24	99.29	98.48	136.6
Indramayu	172.33	179.88	179.88	163.5	91.22	62.52	121.03	142.24	0	101	126.61	131.33
Subang	46.53	115.12	160.07	169.28	201.98	163.52	146.72	99.29	101	0	46.53	103.57
Purwakarta	45.72	114.31	159.26	168.47	201.17	171.63	145.91	98.48	126.61	46.53	0	38.12
Karawang	83.84	152.43	197.38	206.59	239.29	176.35	178.53	136.6	131.33	103.57	38.12	0
Bekasi	124.42	193.01	237.96	247.17	279.87	216.93	219.11	177.18	171.91	144.15	78.7	40.58
Tangerang	162.08	230.67	344.21	284.83	365.27	302.33	304.51	262.58	257.31	229.55	164.1	125.98
Serang	228.34	296.93	410.47	351.09	431.53	368.59	370.77	328.84	323.57	295.81	230.36	192.24
Kota Bogor	84.75	153.34	266.88	207.5	267.6	244.63	212.34	137.51	239.78	212.02	146.57	108.45
Kota Sukabumi	50.84	119.43	232.97	173.59	206.29	183.32	151.03	103.6	223.17	97.37	96.56	74.08
Kota Bandung	13.97	54.62	99.57	108.78	141.48	118.51	86.22	38.79	158.36	32.56	59.69	97.81
Kota Cirebon	144.88	191.56	129.76	113.38	41.1	12.4	70.91	92.12	74.92	175.92	184.03	188.75
Kota Tangerang	129.74	198.33	311.87	252.49	332.93	269.99	272.17	230.24	224.97	197.21	131.76	93.64
Kota Bekasi	110.94	179.53	224.48	233.69	266.39	203.45	205.63	163.7	158.43	130.67	65.22	27.1
Kota Cilegon	249.84	318.43	431.97	372.59	453.03	390.09	392.27	350.34	345.07	317.31	251.86	213.74
Kota Depok	104.75	173.34	286.88	227.5	287.6	264.63	232.34	157.51	259.78	232.02	166.57	128.45
	3934.58	5547.9	7569.36	6575.23	7418.34	6384.1	6087.4	5183.85	6152.46	5188.17	4145.38	3857.34

Distance Matrix for Districts in West Java (table 3 out of 3 tables)

	Bekasi	Tangerang	Serang	Kota Bogor	Kota Sukabumi	Kota Bandung	Kota Cirebon	Kota Tangerang	Kota Bekasi	Kota Cilegon	Kota Depok	
Jakarta Selatan	42.01	52.54	118.8	56.93	103.72	155.65	244.38	20.2	28.53	140.3	20	3994.88
Jakarta Timur	22.3	62.24	128.5	42.52	89.31	141.24	224.67	29.39	8.82	150	40.03	3728.92
Jakarta Pusat	36.61	55.02	121.28	50.7	97.49	149.42	238.98	22.68	23.13	142.78	33.26	3886.26
Jakarta Barat	42.7	44.54	110.8	61.1	107.89	159.82	245.07	12.2	29.22	132.3	34.53	4012.52
Jakarta Utara	47.31	65.76	132.02	65.73	112.52	164.45	249.68	33.42	33.83	153.52	44.52	4265.26
Pandeglang	173.07	87.08	20.82	105.2	193.11	298.67	429.58	119.42	159.59	42.32	125.2	7269.41
Lebak	152.07	63.77	41.82	84.2	172.11	277.67	408.58	96.11	138.59	63.32	104.2	6686.24
Bogor	54.17	63.63	129.89	13.7	74.21	112.42	243.33	31.29	40.69	151.39	33.7	3899.9
Sukabumi	121.52	130.98	197.24	53.65	6.86	71.67	202.58	98.64	108.04	218.74	73.65	4069.35
Cianjur	122.05	131.51	197.77	54.18	20.27	44.54	175.45	99.17	108.57	219.27	74.18	3873.78
Bandung	124.42	162.08	228.34	84.75	50.84	13.97	144.88	129.74	110.94	249.84	104.75	3943.58
Garut	193.01	230.67	296.93	153.34	119.43	54.62	191.56	198.33	179.53	318.43	173.34	5547.9
Tasikmalaya	237.96	344.21	410.47	266.88	232.97	99.57	129.76	311.87	224.48	431.97	286.88	7569.36
Ciamis	247.17	284.83	351.09	207.5	173.59	108.78	113.38	252.49	233.69	372.59	227.5	6575.23
Kuningan	279.87	365.27	431.53	267.6	206.29	141.48	41.1	332.93	266.39	453.03	287.6	7418.34
Cirebon	216.93	302.33	368.59	244.63	183.32	118.51	12.4	269.99	203.45	390.09	264.63	6384.1
Majalengka	219.11	304.51	370.77	212.34	151.03	86.22	70.91	272.17	205.63	392.27	232.34	6087.4
Sumedang	177.18	262.58	328.84	137.51	103.6	38.79	92.12	230.24	163.7	350.34	157.51	5183.85
Indramayu	171.91	257.31	323.57	239.78	223.17	158.36	74.92	224.97	158.43	345.07	259.78	6154.46
Subang	144.15	229.55	295.81	212.02	97.37	32.56	175.92	197.21	130.67	317.31	232.02	5188.17
Purwakarta	78.7	164.1	230.36	146.57	96.56	59.69	184.03	131.76	65.22	251.86	166.57	4136.38
Karawang	40.58	125.98	192.24	108.45	74.08	97.81	188.75	93.64	27.1	213.74	128.45	3857.34
Bekasi	0	85.4	151.66	67.87	114.66	138.39	229.33	53.06	13.48	173.16	87.87	4059.68
Tangerang	85.4	0	66.26	77.33	124.12	176.05	314.73	32.34	71.92	87.76	72.54	4898.94
Serang	151.66	66.26	0	143.59	190.38	242.31	380.99	98.6	138.18	21.5	138.8	6599.75
Kota Bogor	67.87	77.33	143.59	0	46.79	98.72	257.03	44.99	54.39	165.09	24	3849.08
Kota Sukabumi	114.66	124.12	190.38	46.79	0	64.81	195.72	91.78	101.18	211.88	123.72	3954.78
Kota Bandung	138.39	176.05	242.31	98.72	64.81	0	130.91	143.71	124.91	263.81	175.65	4145.18
Kota Cirebon	229.33	314.73	380.99	257.03	195.72	130.91	0	282.39	215.85	402.49	264.38	6755.85
Kota Tangerang	53.06	32.34	98.6	44.99	91.78	143.71	282.39	0	39.58	120.1	40.2	4155.12
Kota Bekasi	13.48	71.92	138.18	54.39	101.18	124.91	215.85	39.58	0	159.68	107.87	3675.28
Kota Cilegon	173.16	87.76	21.5	165.09	211.88	263.81	402.49	120.1	159.68	0	158.8	7264.75
Kota Depok	87.87	72.54	138.8	24	123.72	175.65	264.38	40.2	107.87	158.8	0	4298.47
	4059.68	4898.94	6599.75	3849.08	3954.78	4145.18	6755.85	4154.61	3675.28	7264.75	4298.47	

Origin-Destination Data for the Transport of Goods in West Java in 1996 (Table 1 out of 3 tables)

	Jakarta Selatan	Jakarta Timur	Jakarta Pusat	Jakarta Barat	Jakarta Utara	Pandeglang	Lebak	Bogor	Sukabumi	Cianjur
Jakarta Selatan	-	135,351	-	82,173	-	5,820	346,244	1,208,198	1,299,162	15,185
Jakarta Timur	-	-	5,297	52,506	39,096	53,074	35,439	924,344	407,242	20,891
Jakarta Pusat	-	178,258	-	38,215	-	196,208	61,430	1,183,033	173,030	8,537
Jakarta Barat	23,387	1,021,681	2,891	-	12,062	42,344	124,656	714,777	889,058	9,040
Jakarta Utara	-	233,252	-	1,391		54,858	34,546	1,675,588	111,442	78,582
Pandeglang	350,618	894,679	387,538	238,847	29,885		1,722,868	71,853	107,521	130,153
Lebak	44,876	1,131,529	417,869	232,068	55,169	745,836		216,233	20,404	-
Bogor	686,683	9,876,532	1,520,608	722,408	8,704,388	1,051,853	362,500		1,458,085	714,856
Sukabumi	97,796	1,976,152	89,048	120,724	167,058	52,321	163,225	2,381,387		1,042,457
Cianjur	49,007	2,323,152	136,379	87,284	652,874	229,961		2,509,691	1,327,711	
Bandung	120,418	262,727	205,137	146,024	146,875	193,444	181,354	911,201	1,035,767	942,416
Garut	550,113	302,026	64,147	163,673	770,146		1,200	468,341	138,953	295,529
Tasikmalaya	1,455,672	93,190	736,296	49,810	1,366,811	555	-	365,857	109,701	1,150,106
Ciamis	7,596	603,864	132,100	108,479	20,373	11,877	-	133,346	30,357	74,924
Kuningan	71,162	248,010	1,996,447	10,951	4,921		-	80,331	1,171,825	10,697
Cirebon	148,323	3,249,859	126,202	44,127	797,602	16,198	631	642,230	37,126	49,725
Majalengka	108,812	26,993	8,471	490,859	308,308		-	41,710	296,218	123,178
Sumedang	-	646,835	253,895	1,344	-		-	259,947	-	37,321
Indramayu	75,498	54,570	197,110	18,914	810,854		-	737,489	-	-
Subang	99,830	593,204	92,460	20,207	33,821		-	18,373	20,117	35,186
Purwakarta	955,131	124,587	79,829	158,939	105,352	6,115	-	48,688	45,083	14,540
Karawang	75,607	578,392	103,981	154,460	222,005	126,954	19,062	464,009	231,128	143,674
Bekasi	124,526	1,261,635	831,327	485,922	1,030,056	102,774	60,451	2,213,882	159,502	78,186
Tangerang	439,277	10,143,129	3,530,356	1,044,360	7,557,623	77,751	90,717	1,366,226	337,251	187,405
Serang	83,775	214,209	85,991	319,896	152,237	2,440,629	870,574	223,778	10,128	146,033
Kota Bogor	518,671	2,853,301	44,835	66,679	6,900		-	4,171,140	562,203	12,971
Kota Sukabumi	-	-	-	156,245	-		-	-	-	209,472
Kota Bandung	154,227	2,214,938	658,926	44,488	1,325,087	84,632	24,145	448,152	915,627	477,381
Kota Cirebon	-	69,731	-	-	2,023,643		-	-	12,688	20,843
Kota Tangerang	93,285	57,495	11,391	59,554	11,311	29,984	147,533	1,219,932	64,155	17,982
Kota (Kotip) Bekasi	-	1,218,432	51,954	164	73,076		-	11,605	85,159	-
	6,334,290	42,587,713	11,770,485	5,120,711	26,376,375	5,523,188	4,246,575	24,711,341	11,056,643	6,047,270

Origin-Destination Data for the Transport of Goods in West Java in 1996 (Table 2 out of 3 tables)

	Bandung	Garut	Tasikmalaya	Ciamis	Kuningan	Cirebon	Majalengka	Sumedang	Indramayu	Subang
Jakarta Selatan	1,620,605	-	55,698	-	1,361,282	622,032	-	-	20,881	15,448
Jakarta Timur	1,500,205	40,895	202,968	66,613	155,020	383,383	100,697	-	39,116	87,520
Jakarta Pusat	693,295	69,752	265,308	20,373	253,495	617,535	1,784	260,786	40,228	254,305
Jakarta Barat	631,694	38,755	43,554	104,759	248,073	429,720	-	-	120,903	282,599
Jakarta Utara	1,215,916	86,785	138,385	17,660	-	1,612,873	-	66,416	471,202	47,919
Pandeglang	560,025	-	-	-	-	3,634	-	-	-	291
Lebak	50,109	-	123,998	-	1,794	11,860	-	-	-	-
Bogor	952,301	59,343	-	97,710	751,762	203,045	24,664	26,913	22,707	42,356
Sukabumi	1,100,427	21,282	108,386	10,101	7,910	164,617	272,037	53,751	398,979	98,589
Cianjur	2,611,593	41,914	70,985	96,722	-	142,136	237	178,269	3,887	108,812
Bandung		968,729	723,878	478,455	153,638	961,696	278,086	254,470	124,455	131,076
Garut	4,204,403	-	1,885,189	310,298	43,224	306,370	104,495	90,243	-	-
Tasikmalaya	1,845,610	14,333		2,372,190	64,753	206,559	236,153	21,473	60,926	4,236
Ciamis	1,099,229	315,389	1,863,670		250,761	986,157	348,051	858	25,314	11,321
Kuningan	60,939	2,277	99,625	375,436		1,360,366	1,202,908	19,316	318,348	604,513
Cirebon	715,374	141,851	182,344	123,572	123,373		4,420,194	195,137	441,187	65,993
Majalengka	1,721,913	178,191	117,049	415,731	464,371	883,683		581,826	191,193	30,563
Sumedang	811,790	71,404	-	186,004	1,477	355,740	467,993		41,202	54,247
Indramayu	686,303	58,101	11,228	52,144	236,792	5,205,730	1,037,658	44,178		476,103
Subang	970,676	142,799	-	34,272	-	257,099	85,821	461,137	1,483,381	
Purwakarta	960,571	21,433	139,044	14,722	-	152,721	54,106	66,483	48,361	10,052
Karawang	376,182	21,921	-	5,281	-	798,706	7,147	1,062,134	2,073,486	956,835
Bekasi	618,659	18,283	22,255	181,354	8,146	187,773	24,576	54,413	822,138	72,194
Tangerang	805,773	27,063	3,641	3,342	24,181	58,176	-	5,069	4,683	29,107
Serang	294,043	-	2,758	-	-	174,516	3,950	-	-	1,101
Kota Bogor	83,567	-	-	-	168	232,739	-	673	1,779	345
Kota Sukabumi	6,170,647	-	-	-	-	-	-	-	-	-
Kota Bandung	230,724,483	1,381,000	507,774	122,585	53,879	479,269	64,083	365,416	263,184	397,378
Kota Cirebon	329,785	214,476	-	243,442	310,857	2,146,028	-	350,326	985,699	61,630
Kota Tangerang	380,304	495	-	20,933	840	41,510	-	-	-	-
Kota (Kotip) Bekasi	87,247	-	-	-	-	6,701	2,892	-	364	51,337
	263,883,668	3,936,471	6,567,737	5,353,699	4,515,796	18,992,374	8,737,532	4,159,287	8,003,603	3,895,870

Origin-Destination Data for the Transport of Goods in West Java in 1996 (Table 3 out of 3 tables)

	Purwakarta	Karawang	Bekasi	Tangerang	Serang	Kota Bogor	Kota Sukabumi	Kota Bandung	Kota Cirebon	Kota Tangerang	Kota (Kotip)
Jakarta Selatan	30,315	942,416	2,643,243	3,248,246	144,324	627,764	-	348,053	-	8,770	1,669,003
Jakarta Timur	185,797	1,876,383	3,373,130	566,505	108,007	1,918,173	-	1,087,655	-	10,990	1,386,393
Jakarta Pusat	184,578	1,049,245	1,106,019	259,945	404,274	-	-	119,614	-	-	232,182
Jakarta Barat	193,750	456,173	3,566,387	2,100,199	306,774	152,220	-	104,440	9,910	8,939	868,501
Jakarta Utara	332,019	718,821	3,351,669	400,345	153,236	627,764	-	277,584	15,505	4,725	1,045,494
Pandeglang	8,393	14,923	-	508,748	1,964,732	-	-	15,029	-	92,136	-
Lebak	2,538	13,954	56,346	197,198	758,480	30,039	-	112,187	-	37,836	1,630
Bogor	64,818	693,862	1,902,642	2,461,324	1,493,752	3,536,407	302,257	88,369	-	398,365	23,459
Sukabumi	-	113,438	459,851	356,664	562,203	210,875	211,586	277,646	-	73,393	103,758
Cianjur	-	20,169	724,977	28,963	-	70,507	30,232	703,896	-	19,206	-
Bandung	108,257	312,204	282,185	427,290	154,566	362,708	976,521	53,296,287	1,517,334	21,881	20,977
Garut	47,767	76,734	769,981	340,376	8,037	6,765	-	342,649	-	3,793	-
Tasikmalaya	-	284,127	841,477	82,698	156,944	-	-	7,041,373	82,531	36,391	-
Ciamis	-	69,433	89,535	10,816	1,080	77,497	-	384,000	-	-	1,940
Kuningan	10,504	71,369	-	10,400	-	-	-	326,437	-	-	7,650
Cirebon	471,520	61,977	160,114	447,340	2,081,945	217,625	-	150,590	77,497	4,433	594
Majalengka	-	4,076,583	50,553	538,023	-	-	-	364,833	3,380,444	-	1,385
Sumedang	-	1,949	50,657	4,325	3,756	-	-	8,324,150	-	-	-
Indramayu	145,142	180,656	770,935	55,874	13,952	49,577	-	157,485	131,185	-	25,153
Subang	871,709	1,009,649	654,009	44,898	42,763	38,430	-	526,358	-	134,614	3,764
Purwakarta		462,881	396,787	68,121	10,609	-	-	117,186	-	42,464	3,478
Karawang	632,299		1,548,122	386,917	24,402	108,812	-	846,318	193,444	73,403	11,938
Bekasi	263,400	1,001,660		423,789	333,635	253,895	-	210,979	-	91,261	567,441
Tangerang	48,208	242,699	3,554,536		4,357,335	59,416	-	3,278,881	-	714,558	7,325
Serang	-	104,663	118,345	686,994		84,632	-	18,811	-	59,792	5,262
Kota Bogor	24,181	42,322	501,752	955,131	757,457		-	63,504	-	-	7,795
Kota Sukabumi	-	-	-	-	-	-		-	-	-	-
Kota Bandung	58,925	162,011	69,500	259,947	70,837	204,055	28,389		797,957	232,729	-
Kota Cirebon	-	-	-	-	-	-	-	2,601,827		-	-
Kota Tangerang	49,436	25,702	831,047	2,143,383	125,868	256,398	-	66,166	-	-	3,180
Kota (Kotip) Bekasi	8,979	150,776	742,013	1,554	335	-	-	10,127	-	-	-
	3,742,535	14,236,779	28,615,812	17,016,013	14,039,303	8,893,559	1,548,985	81,262,434	6,205,807	2,069,679	5,998,302

Appendix 7

LISREL Syntax and Output

Stage 1

1. Structural Equation for Accessibility, Willingness to Travel and Level of Usage

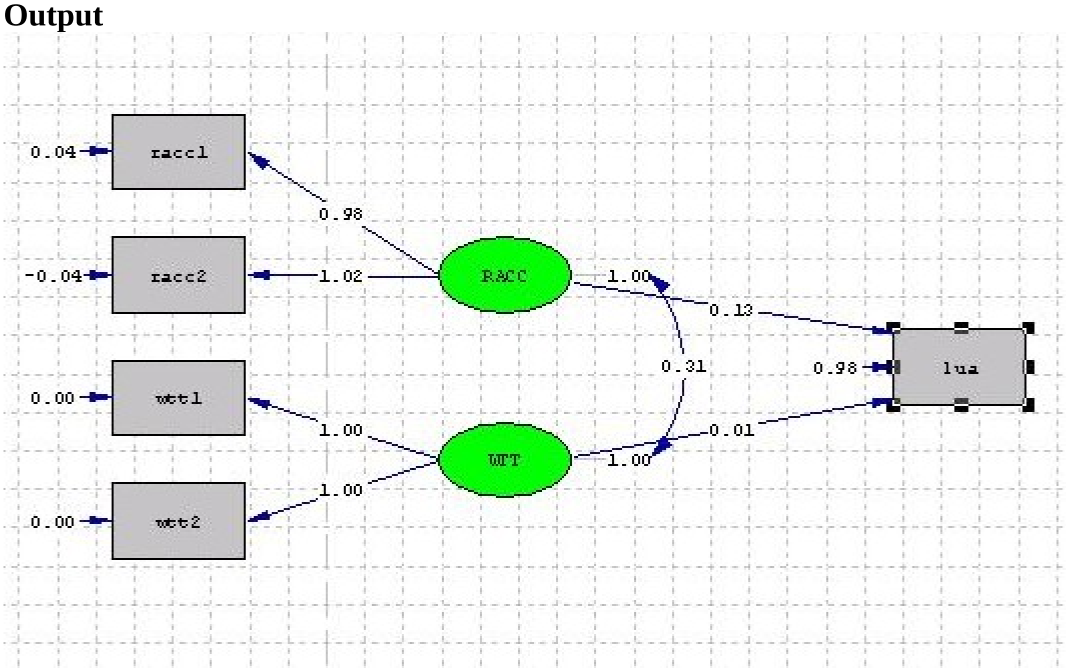
Syntax:
Observed Variables racc1 racc2 wtt1 wtt2 lua
Correlation Matrix from file C:\uji10.cor

Sample Size 150
Latent Variables RACC WTT

Relationships
racc1 = RACC
racc2 = RACC
wtt1 = WTT
wtt2 = WTT
lua = RACC WTT

Path Diagram
End of Problem

Output



2. Structural Equation for Rural Amenities, Modernity and Level of Usage

Syntax:

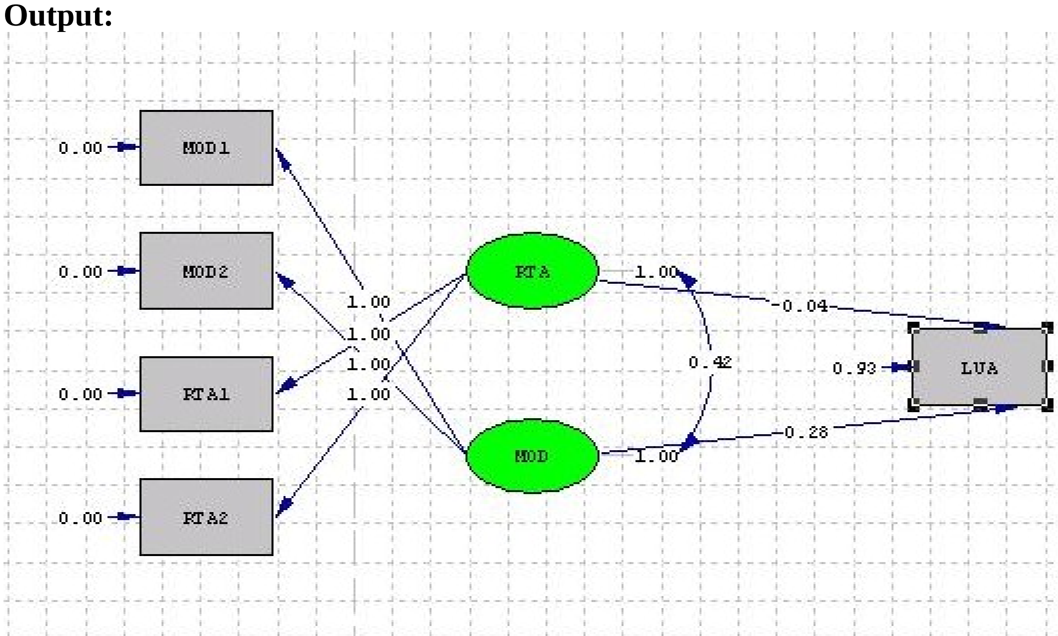
```
Observed Variables rta1 rta2 mod1 mod2 lua
Correlation Matrix from file C:\uji8.cor

 Sample Size 150
 Latent Variables RACC WTT

 Relationships
 racc1 = RACC
 racc2 = RACC
 wtt1 = WTT
 wtt2 = WTT
 lua = RACC WTT

 Path Diagram
 End of Problem
```

Output:



Stage 2

1. Structural Equation for Accessibility, Willingness to Travel and Level of Usage

Syntax:

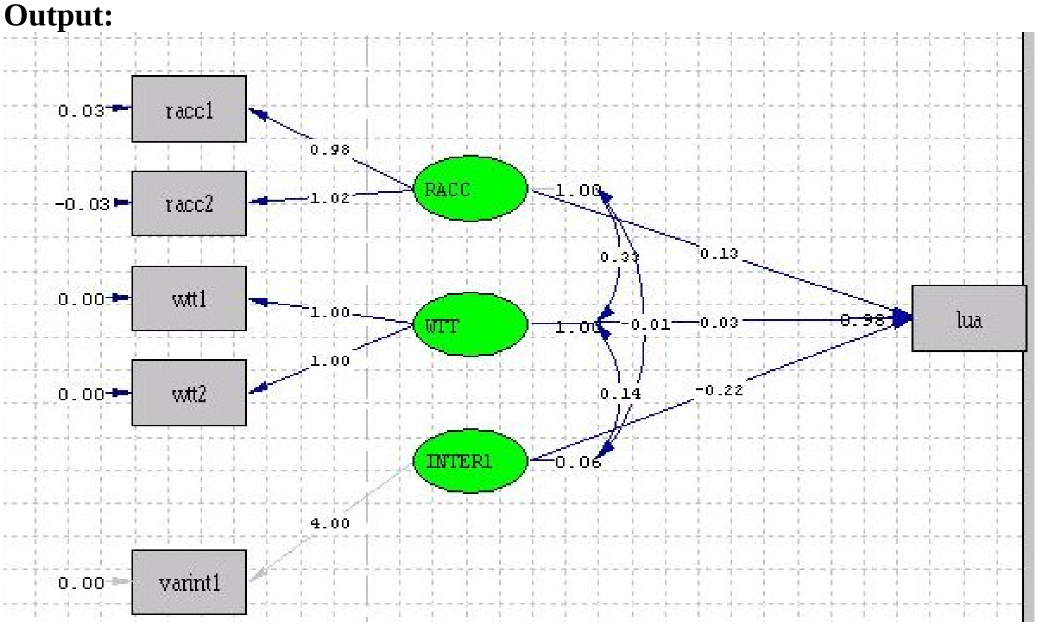
```
Observed Variables racc1 racc2 wtt1 wtt2 lua varint1
Correlation Matrix from file C:\uji11.cor

 Sample Size 150
 Latent Variables RACC WTT INTER1

 Relationships
 racc1 = RACC
 racc2 = RACC
 wtt1 = WTT
 wtt2 = WTT
 varint1=4*INTER1
 lua = RACC WTT INTER1

 Set the error variance of varint1 to 0.004
 Set the correlation between INTER1 and RACC to 0
 Set the correlation between INTER1 and WTT to 0
 LISREL OUTPUT: AD=OFF IT=1000
 Path Diagram
 End of Problem
```

Output:



2. Structural Equation for Rural Amenities, Modernity and Level of Usage

Syntax:

```
Observed Variables mod1 mod2 rta1 rta2 lua varint2
Correlation Matrix from file C:\UJI9.COR

Sample Size 150
Latent Variables RTA MOD INTER2

 Relationships
 rta1 = RTA
 rta2 = RTA
 mod1 = MOD
 mod2 = MOD
 varint2 = 1.7608*INTER2
 lua = MOD RTA INTER2

 Set the error variance of rta2 to 1
 Set the error variance of rta1 to 1
 Set the error variance of varint2 to 3.8214
 Set the correlation between INTER2 and MOD to 0
 Set the correlation between INTER2 and RTA to 0
Path Diagram
End of Problem
```

Output: