ANALYSIS OF
FACTORS CAUSING AGRICULTURAL LAND CONVERSION
IN DIFFERENT COUNTRIES DURING 1961-2003

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ABSTRACT

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The conversion of agricultural land to no-agricultural uses in urban fringe area has been arguably the most widespread phenomenon in the world's history. This research examines the level of intensity, the trend, and the factors causing agricultural land conversion in countries divided into three different groups based on the World Bank classification; less developed, developing, and developed countries during 1961-2003.

A stratified random sampling of 94 out of 123 countries was selected. Data used were secondary data collected from two online data base, Nation Master and Earth Trends provided by internet for the period 1961-2003. Mean comparison, trend, correlation, and regression analysis were used to analyze the data. The empirical results reveal that a difference in level of intensity and trend or pattern of agricultural land conversion did exist in different groups of country. Agricultural land loss was more severe problem in developing countries which have been experienced rapid economic growth and transition in their economic structure. The result also showed that there is a positive correlation between agricultural land conversion and productivity, capital-labor ratio, and urban population in all countries. Urban population was the main factor causing agricultural land conversion in all countries, even in developed countries. The amazing growth of urban population encourages the increasing demand for land for housing, commercial and parking area, recreational sites, road infrastructure, educational and health facilities, and other facilities supporting human activities. Consequently, the possibility of agricultural land converted to non-agricultural land increases. The urbanization process does exist in less developed, developing, and developed countries. However, the developed countries are success in managing urban development and agricultural land conversion so the effect is much lesser than that of developing and less developed countries.

This research conclude that considering the increasing trend of agricultural land conversion in the future and its economic, environmental and social impact, the government intervention through land policies is needed to preserve agricultural land. However, this implementation of these policies should be accompanied by strong law enforcement; otherwise they will fail to slow this phenomenon.

Keywords : agricultural land conversion, urban population, less developed countries, developing countries, developed countries.

GUIDELINE FOR USING THESIS

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PREFACE AND ACKNOWLEDGEMENT

Agricultural land conversion is a common phenomenon that is unavoidable in development process. This phenomenon took place due to the competition among land uses. Although it is considered as a daily problem, in long period the agricultural land conversion might affect human life economically, environmentally, and socially. Therefore, many studies have been written about agricultural land conversion and how it affects food security and causes environmental problems.

This study analyzes the phenomenon in different countries that are divided into three categories; less developed, developing, and developed countries. It identifies the differences in the intensity level, the trend, and the causing factors of agricultural land conversion in those countries. It also discusses how the developing and developed countries use their land policies to manage urban development and agricultural land conversion.

Finally, this thesis would not have been possible without the support of many people. First of all, I would like to express my gratitude to Allah SWT Almighty. I wish to express my gratitude to Prof. Peter Ho, Dr. Hossein Azadi, and Bapak Dr. Pradono as my supervisors for their invaluable advices, assistances, support, and guidance. Special thanks to all my friends, especially group members of DD ITB-RUG 2007 for sharing great moments in Bandung and Groningen. Deepest gratitude are also due to Bappenas and Pemda Kabupaten Cianjur for giving me an opportunity to study in ITB and University of Groningen. I would also like to convey thanks to Netherlands Education Support Office (NESO) for the financial support. I wish to express my love and gratitude to my beloved families, my parents, my husband, and my two little princes, Titan Kesuma Endasmoro and Tristan Ariq Wicaksono, for their understanding and endless love, through the duration of my studies.

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Lusi Hasfiati

LIST OF ABBREVIATIONS

ANOVA	Analysis of Variance
CIA	Central Intelligence Agency
FAO	Food and Agricultural Organization
GDP	Gross Domestic Product
GNI	Gross National Income
Kepres	Keputusan Presiden (President Decree)
LDCs	Less Developed Countries
OECD	Organization for Economic Co-operation and Development
PMK	Peraturan Menteri Keuangan (Ministry of Finance Regulation)
RTRW	Rencana Tata Ruang Wilayah (Spatial Plan)
SE MNA/KBPN	Surat Edaran Menteri Negara Agraria/Kepala Badan Pertanahan
TVEs	Township Village Enterprises
UN	Uniteed Nations
UNDP	United Nations Development Program
USA	United States of America
USAID	United States Agency for International Development
WHO	World Health Organization

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CHAPTER I
INTRODUCTION

This chapter represents the flow of this research. It discusses the background, research question, problem statement, significance of research, research objective and methodology. Firstly, the background provides a general description of agricultural land conversion phenomenon, the reason of the research and research question. Secondly, the significance of research explains about how this research contributes to the knowledge. Finally, the methodology corresponds to the way this research will be carried out.

1.1. Background

The rapid development in city centers attracts people to move to cities. The population in the city centers grows yearly, and causes an increasing demand for more land to fulfill the individual's primary needs, such as housing, education, recreation, etc. Land, unlike other production factors, has special characteristics. To some extent, it is fixed in supply, as no more can be created. Land is also unique or irreplaceable. It means that land is unique in terms of size, physical features, and location. For these reasons land cannot exactly be replaced by another production factor. Meanwhile, demand for land keeps increasing. Consequently, land in the city centers becomes scarce and expensive. People migrate from urban centers to rural communities in the fringe areas. Some of their needs like housing, leisure and amenity cannot be met in the city center, due to the limited land resources. Therefore, people try to find such facilities outside of city centers and by living in these areas they are still connected to urban centers. In addition, there are also some high income people who create advantageous investment for land development in the outskirts.

However, if urban development is allowed to spread up to agricultural land or other lands, it can increase land supply for urban uses while diminishing another. So, the people's migration from urban centers to fringe area causes

competition among different land uses and result in the conversion of land from agricultural use to others.

Land conversion is a process by which land is converted from agricultural to urban uses. There is a debate of whether agricultural land in the urban fringe should be maintained or could be converted to other uses. This debate can be shown from the pro-ruralist and the pro urbanist perspectives (Ludyanto, 2006). Pro-ruralists view that land conversion has negative impact on the loss of prime agricultural land, loss of agricultural jobs, loss of investment in irrigation infrastructure. Consequently, it would affect agricultural production. Land conversion would threaten the food security of one nation. Pro-ruralists urged that the agricultural land should be kept to maintain food production. However, the urbanists argued that land conversion is a logical consequence of urban growth. The decline of agricultural production can be solved by intensification and technological production. So, the land conversion is not considered as a threat.

It is true that land conversion is the phenomenon that is almost unavoidable during economic development and population growth periods (Tan, et.al, 2008). However, uncontrolled land conversion has great impacts not only on agricultural production but also on ecological and environmental problems. Subsequently, there is an idea to preserve agricultural land from being converted to other uses in some countries such as China, Japan, United States, etc (Lichtenberg and Ding, 2008; Solomon, 1984; Dawson, 1985).

The phenomenon of agricultural land conversion in countries is varied, in terms of intensity, trend and causing factors. According to Setiawan and Purwanto in Firman (1997), there are two main factors that contribute to agricultural land conversion, which are internal and external factors. The former would be related to the location and land potential (including land productivity), ownership pattern, (including land size), household size and income. The later includes urbanization, socio-economic conditions, and government policies.

Since 1980, the conversion of agricultural land to non-agricultural land has been arguably the most widespread and intense in China (Ho and Lin, 2004). High

population density, rapid economic growth, and urbanization process are believed as factors causing agricultural land in China. In 1995, the conversion of agricultural to non agricultural uses accounted for more than two-third of the loss in cultivated land in several areas. As a developing country, Indonesia has experienced rapid agricultural land conversion. Winoto in (Fahmudin and Irawan 2006) stated that in Indonesia, 42 % of irrigated paddy field areas are converted to non agricultural uses while 58 % are maintained. This proportion in West Java, one of the provinces in Indonesia, is worse than Indonesia: 60.15 % of irrigated paddy field is converted to other uses, while only 39.85 % is maintained (Fahmudin and Irawan, 2006).

Germany and The Netherlands are European developed countries that have experienced low rate of agricultural land conversion. During 1996-2000, the rate of agricultural land conversion in The Netherlands is only 17 ha per day. While, in Germany in 2006 the rate was 114 ha per day. It is much lesser than in China and Indonesia. In 2004, China experienced agricultural land conversion 802 ha per day (Tan, et.al, 2008). Mean while, in Indonesia, during 2000-2002 the rate of the conversion is 514 ha per day (Irawan, 2008).

1.2. Research Question

This study tries to understand the phenomenon of agricultural land conversion in different countries and identify internal and external factors affecting the phenomenon based on time series data. Studies on agricultural land have accumulated quickly for the last decade. Despite some case studies (which are mentioned in Chapter 2), little work has been done to examine factors causing agricultural land conversion globally. Most of the studies are qualitative and fragmented, while this study emphasizes on the overview of agricultural land conversion in different countries from all over the world. This is the first time that such as study has ever been carried out.

The study examines the intensity, trend of agricultural land conversion and test the relationship between agricultural land conversion and variables hypothesized as causing factors in 94 countries during 1961-2003. Those

countries are divided into three categories; less developed, developing, and developed countries based on World Bank Classification. For this purpose, this research is addressed to the specific question: **What factors influence agricultural land conversion in less developed, developing and developed countries?**

This question can be divided into several sub-questions :

1. What is the agricultural land conversion trend in less developed, developing, and developed countries?
2. Is there any difference among less developed, developing and developed countries in agricultural land conversion?
3. How do stages of development of country relate to agricultural land conversion?

1.3. Problem Statement

Agricultural land conversion particularly in urban fringe area grows to be a common problem that is unavoidable in development process. It is a phenomenon primarily caused a competition between agricultural sector and non-agricultural sector. The non-agricultural sector has higher income elasticity than agricultural sector is believed can trigger economic growth. The transformation of economic structure from agricultural sector to higher productivity sectors is also hypothesized as one of factors influencing the increase of land demand for non-agricultural uses.

Development is a multidimensional process involving major changes in social structures, popular attitudes, and national institutions. This is also a process including the acceleration of economic growth, the reduction of inequality, and the alleviation of poverty (Todaro, 1999). The increasing of economic growth becomes countries' target in their development. The shift of development pattern from agricultural basis to non-agricultural basis became one of ways to accelerate economic growth. The development of industrial areas and commercial areas increase land demand for those uses. Moreover, this development will attract

people to move to those areas. Due to land scarcity, the population growth caused by migration generates another land demand for non-agricultural uses. The development of residential areas, recreation sites, road infrastructure, and other facilities supporting people's life increases the need for land.

The rural-urban migration is the most important factor contributing the rapid growth of cities. Urban migrants contribute one-third to one-half of the annual growth of developing countries cities (Todaro, 1995). Most of migrants are young adults in the peak reproductive age groups. So their contribution on rapid growth of urban population is very significant.

As mentioned above, development is a multidimensional continuous process. It is a series of successive stages of economic growth through which all countries must pass. Every country makes every effort to achieve the improvement of income and output. Economic growth is an important element in development; however it is not the only element. There are other dimensions involve in development process including the change in economic structure, institutional, social (people's custom and belief), etc. The transformation of economic structure from agricultural to industrial sector is a common characteristic of developing country in order to move to further stage of development.

1.4. Significance of Research and Definition

So far, there have been some studies examining land conversion and it's causing factors. However, the phenomenon of agricultural land conversion has not been systematically studied comparatively between less developed, developing, and developed countries. For this purposes, this study will make a quantitative analysis of time series data over 1961-2003 derived mainly from two data bases (Nation Master and Earth Trends) for a total of 94 countries. It is hypothesized that agricultural land conversion is driven by three factors: productivity, capital labor ratio, urban population. Following this research design the approach of this thesis might make a better understanding of the various driving factors of agricultural land conversion around the world.

Land conversion can be defined as farmland loss or farmlands (arable lands) that are converted to urban uses (Furuseth, 1982; Han and He, 2000). In this study land conversion refers to agricultural land conversion. Agricultural land refers to the share of land that is arable[1], under permanent crops, and under permanent pastures (Nation Master).

In this study, there are some criteria used to measure agricultural land conversion in different countries. Those criteria are :

1. Productivity is cereal yield, measured as kilogram per hectare of harvested land, includes wheat, rice, maize, barley, oats, re, millet, sorghum, buckwheat, and mixed grains.
2. Technology Intensity is the use of machines in agricultural production process. In this study it refers to a ratio between tractor uses and number of workers/labor in agricultural sector.
3. Urban Population is the population of areas defined as urban in each country as reported to the United Nations.

As discussed above, this study will try to understand the agricultural land conversion phenomenon in less developed, developing, and developed countries. This study will use World Bank definition for these categories, such as:

1. Developed countries as defined by World Bank, 2009, are countries with high income, in which most people have a high standard of living. Sometimes are also defined as highly industrialized countries.
2. Developing countries are countries with low or middle levels of GNP per capita and some of which have a transition in their economies.

[1] Arable land as defined by FAO is land under temporary crops (double-cropped areas are counted once), temporary meadows for mowing or for pasture, land under market or kitchen gardens, and land temporarily fallow. Land under permanent crops is land cultivated with crops that occupy the land for long periods and need not be replanted after each harvest, such as cocoa, coffee, and rubber. This category includes land under flowering shrubs, fruit trees, nut trees, and vines, but excludes land under trees grown for wood or timber. Meanwhile, permanent pasture is land used for five or more years for forage, including natural and cultivated crops. Therefore, the agricultural conversion in the process by which land is converted from agricultural to urban uses or to other uses.

3. Less developed countries generally have common characteristics such as low living standard (low real income per capita, poor health, high income inequality, inadequate education, and limited life expectancy), low level of productivity due to unskilled labor, limited resources, and backward technology. These countries also experience high population growth, large scale of unemployment, large scale but neglected agricultural and outward migration from rural to urban areas (tutor2u, 2009)

World Bank (2008) divided these countries into categories based on Gross National Income (GNI). However, according to United Nations, development of a country is measured not only by its income or income per capita as a measure of economic development, but also other social development such as life expectancy, rate of literacy, and democracy life (democratic government and human right guarantee) (State Master, 2009). Therefore, high economies country might be classified as either developed or developing countries. Malta and Cyprus are the example of countries that have high income per capita but according to UN categorized as developing countries (State Master, 2009)

1.5. Research Objective

Based on the above given background, research questions, and problem statement, the objectives of this study can be determined as follows:

1. To analyze the phenomenon of agricultural land conversion in different countries ;
2. To examine factor affecting agricultural land conversion in different countries;
3. To understand how agricultural land conversion could happen in different stages of development.

1.6. Research Methodology

The study is carried out by means of quantitative analysis. There are 4 quantitative analyses used to answer research questions; (1) compare mean analysis; (2) trend analysis, (3) correlation analysis, (4) regression analysis.

Compare mean analysis is used to answer research question number two and three. Compare means analysis is used when data are divided into groups accordingly to only one factor (agricultural land conversion). The purpose of the analysis is to understand whether there is significant difference in agricultural land conversion behavior between the groups.

Trend analysis is used to answer research question number one. Trend analysis attempts to examine the pattern of agricultural land conversion. It is aimed at predicting future movements of this phenomenon. It also could be used to estimate agricultural land conversion pattern in the past. Trend analysis is based on the idea that what has happened in the past gives an idea of what will happen in the future. Obviously, there must be some factors driving the movement pattern. Hence, correlation and regression analysis would be run to explore the factors contribute to agricultural land conversion.

Correlation analysis provides an empirical indication of possible relationship between variables. However, merely because a correlation is discovered; it doesn't mean that the existence of a causal relationship is proven (Yafee, no date). Therefore, the further analysis named regression analysis is needed. Regression analysis focuses on the relationship between agricultural land conversion as dependent variable and productivity, technology intensity, and urban population as independent variable. It helps to understand how the value of dependent variable changes, when one independent variable changes, while other independent variables are remained fixed. Regression analysis is broadly used for prediction. It is also used to explore the form of the relationship between these two variables. Moreover, it can be used to seek the causal effect of one variable upon another (Sykes, no date).

The study uses secondary data collected from nation master and earth trends sites. Much of the information on the internet is fragmented. However, these two sites provide comprehensive data. Nation master is a central and vast compilation of data from sources such as CIA World Fact Book, WHO), and OECD. Earth Trends is a comprehensive online data base, maintained by World Resource Institute that focuses on the environmental, social, and economic rend

that shape the world. The information source of this site are UN (FAO, WHO), UNDP, and USAID.

1.7. Thesis Structure

This thesis is divided into five chapters. Content of chapter can be described as follow:

Chapter 1 : Introduction

Consists of background, research problem, research question, research objective, significance of research, and research methodology of this study.

Chapter 2 : Literature Review

This chapter provides literature reviews of this study that explains about high and best use concept, some factors influencing agricultural land conversion, the relationship between agricultural land conversion and stages of development, and the analytical framework of this study.

Chapter 3 : Research Methodology

This chapter describes the methodology of this study that explains about preparing and collecting the data, and analyzing the data.

Chapter 4 : Result Analysis

This chapter discusses about general overview of study area (three groups of country), result of data analysis, and lesson that can be learned from developed countries by developing countries on how to manage urban development and agricultural land conversion.

Chapter 5 : Conclusion and Recommendation

This chapter consists of some concluding remarks of the discussion in the previous chapters, and recommendation.

CHAPTER II
LITERATURE REVIEW

This chapter starts with explaining the internal and external factors causing agricultural land conversion derived from literatures. Subsequently, it discusses the relationship between agricultural land conversion and stages of development. Finally, it provides the analytical framework of this study.

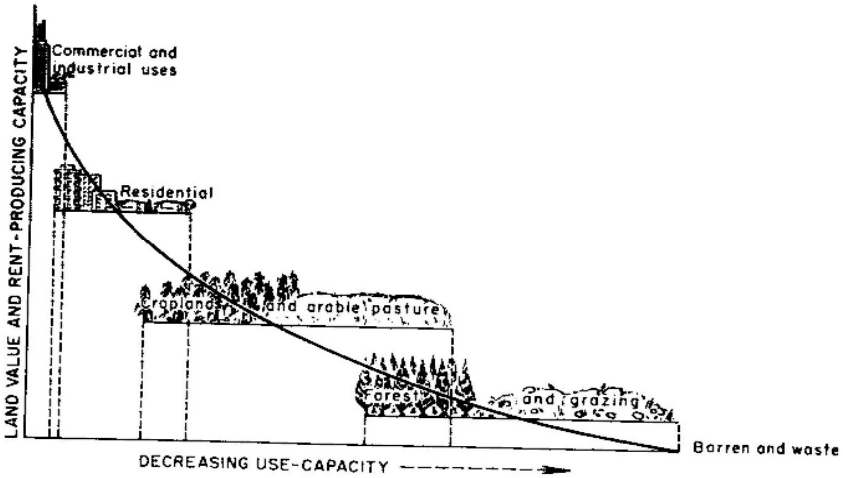
2.1. Highest and Best Use Concept

As the supply of land resources is limited, while the demand increases in line with population growth, economic transformation, etc., competition among land uses has impact on land supply. Land owners or operators have an economic incentive to use their land resources for purposes that generate the highest return. In this respect, they allocate land resources in accordance with the concept of highest and best use. Land resources are at their highest and best use when they are used in a way that provides an optimum return to their owners. The return can be measured by monetary terms, intangible and social values or some combination of these values.

In modern society, land resources generally provide a higher return when used for industrial or commercial purposes than for other types of use. Consequently, land resources are mostly allocated for these uses defeat other types of uses. Residential uses ordinarily have next priority, followed by various types of crop land, pasture (agricultural uses), grazing, and forest uses.

As seen in Figure 2.1, the highest and best value land at the city center is used for industrial and commercial purposes, while areas with lower value are used for residential, agricultural, grazing and forest purposes respectively. However, due to highest price and scarcity of land in city center, the city is expanded to the fringe area in which agricultural land is allocated. Financially speaking, agricultural lands don’t have the best and highest use, so it is easy to be converted to nonagricultural uses. However, when it is bought by developer suddenly it has that best and highest use due to development possibilities (Fisher, 2006).

Figure 2. 1. Highest and Best Use Concept



Source : Barlowe, 1986

2.2. Factors Causing Agricultural Land Conversion

There are some factors contribute to agricultural land conversion, including internal and external factors. Some factors would be elaborated in the next sections.

2.2.1. External Factors

2.2.1.1. Industrialization

In the development process many developing economy is transformed over time from traditional agricultural to industrial production. Industrial development is widely seen as an engine of economic growth (Lichtenberg and Ding, 2006). Ho and Lin (2004), found that the conversion of land to non-agricultural use has been arguably the most widespread and intense in China's history, and the process mostly occurred in China's coastal provinces, where population density is high and economic growth has been the most rapid. Industrialization is one of factors that contribute to agricultural land conversion in these China's provinces.

The economic growth of China in the 1980 and 1990 is closely supported by the development of China's rural non-agricultural sector, particularly the growth of enterprises owned by rural community, called TVEs (Township Village Enterprises) (Ho and Lin, 2004). In China, rural industries are located in areas where agriculture is better developed and the locations close to urban centers. The 62 % of TVEs were concentrated in coastal provinces; hence, the rural industries influenced significantly more pressure on rural community to convert agricultural land to non-agricultural uses.

Furthermore, the development of stand-alone industry and mining sites has contributed to the conversion of agricultural land to non-agricultural uses. The rapid growth of industries in urban centre generated congestion that seriously reduced the accessibility and productivity of industrial activities. The government issued a policy to create new enclave industrial zone in suburban area. The purpose of this policy is to relocate industrial activities to suburban estates and alter the agricultural land to more productive commercial uses.

Firman (1999) in his paper found that industrial estates development, particularly in regions surrounding Jakarta, had become the main factor causing extensive prime agricultural land conversion in Indonesia. This land conversion was followed by other transformation. There are some regencies (peripheral areas) that show the transition from agricultural economy to industrial and service-based activities. This transition is also reflected by employment structure. The employment structure transformed from a primary economy to secondary and tertiary industries. In addition, the number of households involved in agricultural activities was also declined.

The strategy of Asian industrialized countries such as Japan, South Korea, Hong Kong, and Singapore to relocate labor-intensives industries in low-wage countries due to increasing production cost, was responded by the government that issued almost 200 licenses to foreign trade company representatives and about 50 limited importer identity cards for foreign investment (Firman, 1999). The strategy to attract foreign direct investment and to improve global competitiveness of Indonesia's industrial sector encourages rapid agricultural land conversion in urban periphery. This strategy stimulates the

development of many light industries such as footwear, electronics, plastics manufacturing and others, have also been developed individually outside the available industrial estates. This development made agricultural land conversion more severe.

2.2.1.2. Urbanization

The process of rural-urban migration and of urbanization as the factor influencing agricultural land conversion has been widely studied. Han and He (2000) in their paper studied the distribution pattern of farmland loss in several cities in China and also examined the relationship between urbanization and farmland conversion in these cities. Han and He found that there was a significant correlation between the growth of urban population as the measurement of urbanization and farmland conversion in coastal cities. This result supports the finding of Ho and Lin (2004), that industrialization caused farmland conversion also in coastal cities in China. Therefore, it can be concluded that the industrialization process in China often results in urbanization, and finally affect farmland conversion as well.

The development of industrial zone in urban centre stimulates rural-urban migration. Subsequently, due to government policy to remove industrial zone to urban fringe areas (rural area) to reduce congestion in urban centre often foster people to migrate to those areas. The rapid population growth influenced agricultural land conversion because larger population led to the expansion of built up-areas in providing more housing and employment opportunities. Fazal (2000) also discussed about how urbanization influences agricultural land conversion in India. He argued that the urbanization pattern and high population growth in developing and underdeveloped countries result in high pressure on the land. This urban expansion encroaches upon fertile agricultural land. India has experienced huge loss of agricultural land due to rapid urbanization and extension of urban areas, combined with continuing population growth.

Housing development was one of the main activities occupy agricultural land in urban fringe area. In Indonesia, during the last 20 years housing

development has taken place very intensively in outskirts of Jakarta city (Firman, 1997). Most of these new settlements are of low density, single-family houses and most of which are exclusive residential areas for specifically targeted socioeconomic groups, particularly the middle and high-income groups. Surprisingly, many new luxury houses were not occupied, because they were purchased not for owner-occupation, but only for low-risk investment and for speculative purposes due to rapid increasing of land prices in these new towns. For that reason according to Firman (1997), the uncontrolled and rapid agricultural land conversion in Indonesia is mainly affected by land speculation.

Han and He (2000) in their study also discussed that the real estate speculation, which is a new phenomenon in China, is a cause for fast reduction of farmland. They argued that another problem in real estate development that directly affects farmland conversion was ineffective use of converted land. There were a large proportion of the parcels tagged for industrial development or residential development was left vacant for a long time period. According to Ministry of Land and Natural Resources, in 1996 about 40 % of urban construction land was utilized ineffectively. There were 1,160 km^2 of converted land parcels left idle after being acquired.

Metro Manila, is another city in developing countries that suffered from agricultural land conversion due to urbanization process (Malaque and Yokohari, 2007). There were two periods of land development in urban fringe of Metro Manila, between 1982 and 1997. In 1990, a very important year in land development, a total 347 applications for land conversion were approved, covering 1,790 ha. In the previous year, there were only 39 applications were approved, covering 551 ha. The later period was mostly influenced by policy that encouraged the spreading industries to rural area, making land conversion a common phenomenon of social, economic condition in urban fringe of Metro Manila.

Housing development is not the only activity occupying agricultural land conversion in urban fringe area. As the people's income grows the need for recreation also increases. A development of golf course in urban fringe of Jakarta encroached on agricultural land about 165 km^2 (Firman, 1997). It is expected to

attract businessmen and foreign investor who work in Jakarta. Two golf courses in urban fringe of Metro Manila also resulted from land conversion of mango plantation (Malaque and Yokohari, 2007). Meanwhile, in order to attract foreign investor, Chinese governments set up development of parks in urban fringe area. Even in Shanghai all the levels of the governments have their own development parks. Development parks were established by municipal, district, county, and township governments. Most of the parks were set up illegally, and occupied 7,160 km^2 which were effectively agricultural land (Han and He, 2000).

2.2.1.3. Road Infrastructure Development

Infrastructure construction such as road construction also contributes to agricultural land conversion in some countries. China faces the pressure of this construction on reduction of its agricultural land (Lichtenberg and Ding, 2008). As the industry grows rapidly, as the agricultural sector becomes commercialized, as the people's income grows, as the number of traveled people increases, China's inadequate road system becomes more congested. The reliable and efficient transport infrastructure is needed for sustained economic growth. Central and local governments invested seriously on road infrastructure to support the transport of agricultural goods to the market and to promote rural industrialization.

According to Ho and Lin (2004), the various projects road in China demand large amount of agricultural lands be converted to these projects. Due to location of industrial site that close to urban settlement while this settlement generally surrounded by farmland, many scholars believed that the road construction that support the industrial development and link with highway have, to some extent, encroached on fertile agricultural land. This fact was supported by Landsat images of various regions in coastal China, for example, of the 12,682 hectares of construction land developed between 1987 and 1997 in the Jinan metropolitan region in Shandong, 54% were converted from cultivated land (Dou Yixiang, in Ho and Lin, 2004). Anthony Yeh and Li Xia in Ho and Lin (2004), using *Landsat* images of Dongguan (a county-level city in the Pearl River Delta in

Guangdong) taken in 1988 and 1993, constructed a land use conversion matrix for the region; they found that nearly 94% of the construction sites in 1993 was agricultural land in 1988.

Irawan (2008) in his paper discussed that in Indonesia, at national scale, the agricultural land conversion is mostly allocated for residential development (53,930 ha or 48.96 %) and road construction (31,160 ha or 28.29%). The conversion for residential development has been taken place in Java Island, in the other hand, the land conversion for road construction mostly happen in outside Java Island. The land conversion in Java generally stimulated by rapid economic growth and population growth, while outside Java it is necessary to support economic growth.

2.2.1.4. Government Policy

Irawan (2006) explained that the increasing demand for land for urban uses is strongly stimulated by economic growth, population growth, and economic structure transformation. Economic development policy tends to foster industrial growth, indirectly stimulate intensive land conversion in some developing countries, like Indonesia, China, Vietnam, Philippines, etc (Irawan, 2008, Lichtenberg and Ding, 2008, van den Berg, et.al., 2003, Malaque and Yokohari, 2007). Furthermore, spatial development policy determining an area as industrial site or residential site encourages the conversion of agricultural land in that area. The policy of establishing industrial zone in urban periphery of Jakarta, such as Tanggerang, Bekasi, and Karawang caused extensive agricultural land conversion in Indonesia (Firman, 1997). China's government decided to relocate industrial zone to suburban area to solve congestion problem also affected on huge farmland loss in coastal provinces (Ho and Lin, 2004).

Lictenberg and Ding (2008) discussed about how government policies in China creates incentive for local governments to convert agricultural land to urban uses. There are three policies discussed by Lichtenberg and Ding in their paper; first, arbitrage opportunities in farmland conversion. Urban land in China mainly allocated in secondary market. Under market operation, land would be allocated for efficient uses. Therefore, the market would create excessive farmland

conversion to urban uses. Municipal government as the owner of uses right obtain conveyance fee from every transaction of land that converted to urban uses. The transaction of converting farmland to urban uses becomes a major source of funding for local government.

Secondly, current housing regulation fosters local government to provide housing for the growing population by expanding into rural areas rather than intensifying density within urban areas. Local government considers that redevelopment of existing municipal land requires governments to pay compensation to current tenants and to cover resettlement expenses. Compensation paid to current residents is much higher than that paid to the rural inhabitants. Furthermore, it is more expensive to provide new infrastructure in high dense population area. For that reasons, it is more profitable for local government to fulfill the housing need by converting farmland to residential area rather than increasing density within urban boundaries.

Finally, the policy to promote economic growth by focusing on developing industrial sector contributes to farmland conversion in coastal China. Industrial development is broadly seen as the key to economic growth, and a rising standard of living for municipalities as well as for improvement of local government officials. However, this policy encourages local government to acquire farmland speculatively, in the hope it can attract investments. According to Ho and Lin in Lichtenberg and Ding (2008), much of that land has remained idled as hoped-for investment failed to develop. In 1996, there were about 116,000 ha of idle undeveloped land in economic development zones, over half of which was converted farmland that could no longer be converted back.

2.2.2. Internal Factor

2.2.2.1. Land Productivity

Land productivity is one of internal factors affecting agricultural land conversion. Levia and Page (2000) examined the driving forces of agricultural land conversion to residential uses. Farm size, farm slope, and distance to nearest cities and highway are variables hypothesized as factors fostering farmland

conversion in Massachusetts, US. In their study, Levia and Page found that all variables are the primary determinant of agricultural land conversion.

Farm size is an important variable to consider due to economy of scale and land value. From the point of view of housing developers, it is more feasible and profitable to choose large farms rather than small farms due to economy of scale. Therefore, the land value increases parallel with the farm size. The vast majority of farmland conversion is farms that have little slope. Farms with slopes greater than 15^0 are less profitable for residential development due to high cost of landscape leveling. Construction costs on level land are almost always less than on hilly land. The costs of roads construction, foundations, and wells are generally less on flat than on hilly land (Nelson, 1990).

In addition, Lockeretz in Firman (1997) stated that better quality land, as flat and well drained are attractive for housing development. Farms close to the city and major highway are prone to be converted to urban uses. This is due to the prime location of the farm related to employment, shopping centre, and entertainment opportunities. This prime location attract housing development and bid high prices for the farms.

Farms which have such characteristics generally are productive farmlands due to their location and geographic features. Productive farmland often located on flat area (not hilly land), closes to water body, urban areas, and well drained. High productive farmlands prone to be converted because housing developer found that it is more profitable to choose productive land due to low construction cost. In the other hand, farmland owner would obtain high return from selling the farm due to high land value.

2.2.2.2. Technology Intensity in Agricultural Production

Technology application in agricultural production encourages agricultural land conversion. Some scholars argued that using chemicals, fertilizers, and modern technology convert low productive land into high productive land (Nelson, 1990). Hence, the agricultural land conversion will not threat food security because the reduced agricultural land would be replaced by new land and cultivation and production of foods and commodities would continue.

Furthermore, with improving modern technology farming use fewer labors. This condition create labor surplus in agricultural sector; this surplus would seek job in urban areas. City creates more jobs and requires more lands to serve economic and population growth. As the city growth expand to fringe area, the possibility of prime agricultural land conversion increases.

2.3. Agricultural Land Conversion and Stages of Development

The development process involves some changes including economic structure transformation. Transformation of economic structure from less productive sector such as agriculture to higher productive sector such as industrial sector encourages increasing demand land conversion to urban uses. This transformation is unavoidable for nations in order to accelerate their economic growth. Combined with population growth the transformation process causes agricultural land conversion. The intensity level of land conversion in different countries must be different depend on the stage of development of the country. In the US, urbanization is also often considered as a threat to agricultural land (Fischel, in Firman 1999). However, the loss of agricultural land due to urbanization is most severe in low and middle income nations, because the expansion of settlement and industrial estates over agricultural land is better managed in high income nations (Fazal, 2000).

Liu et.al. in 2008 tested the hypothesize of the relationship between farmland conversion and economic growth in China by using Environmental Kuznets Curve (EKC). The curve refers to a systematic relationship between income changes and environmental quality. The EKC postulates that as income grows, level of pollution will start to rise, gradually reach certain point, and subsequently decreased if income growth continue far enough. This pattern is typically called as inverted-U-shaped relationship.

Related to farmland conversion, in addition to its function as factor of production in agricultural production, farmland has been also recognized as a provider for environmental amenity. As a piece of farmland converted to non agricultural uses the quality of environmental amenity in that neighborhood turns

into worse. Farmland conversion can be considered as one form of natural resources depletion, destroys farmland's multifunction (including water and air purification, habitats, recreational services etc.), decreases the biodiversity of agro ecosystem, worsens environmental amenity. As people's income in a region grows, the income elasticity of environmental amenity is high and keeps rising. As a result farmland conversion would be low. Contrast to low income region, its income elasticity of environmental amenity is very low. So the scale of farmland conversion would be high.

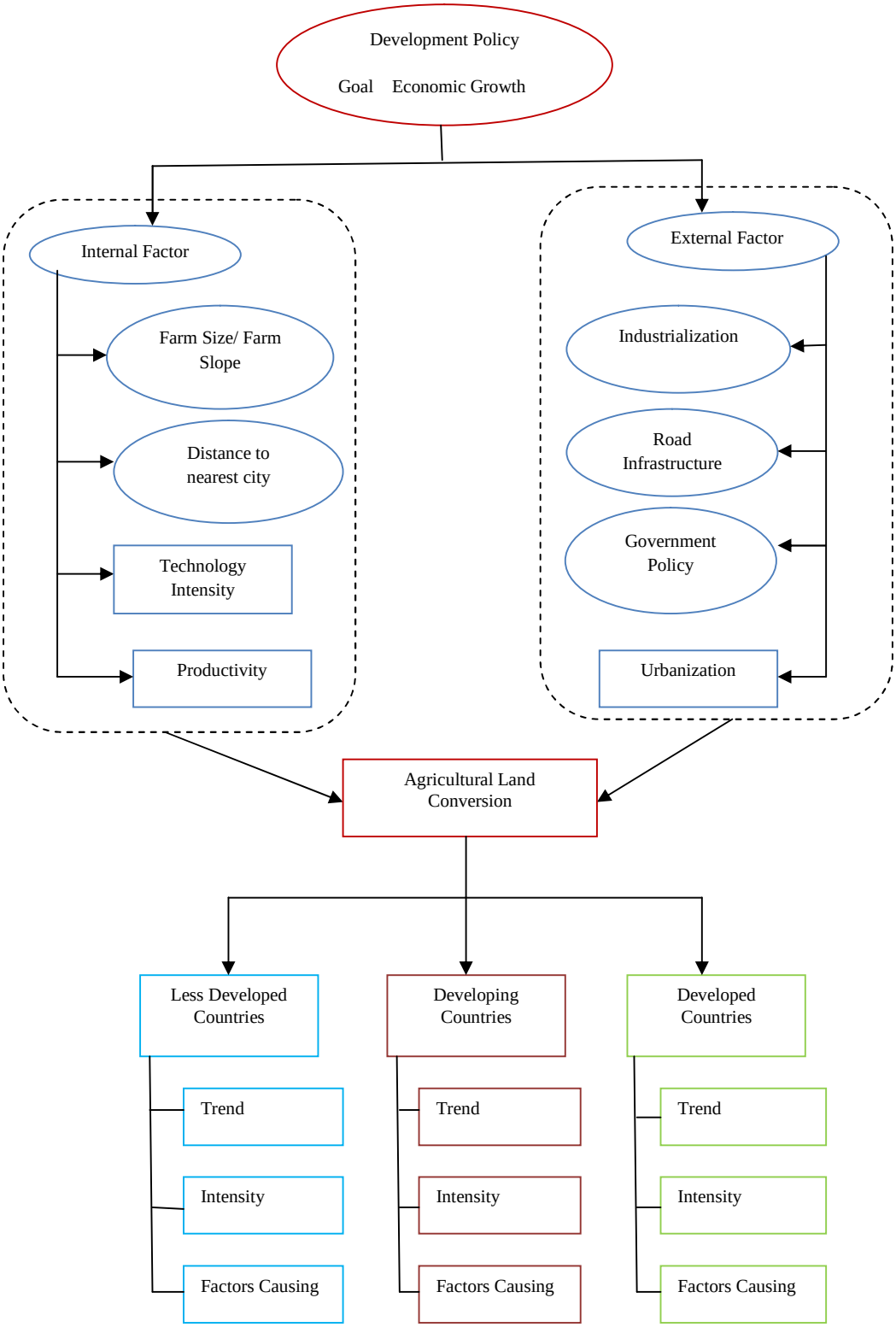
Liu et al., examined the trend of farmland conversion and GDP per capita in several provinces in China, and then tested the EKC model using GDP per capita as the income variable and area of farmland conversion as the scale variable. They found that the EKC hypothesis between economic growth and farmland conversion in China is acceptable. The scale of farmland conversion will start to increase in early stages, and the turning point is certain time when real per capita GDP in China reaches 16,002.42 RMB, after that the scale of farmland conversion will decline as economic growth continues.

Furthermore, compare to present economic level of China, there is still a long way to reach the turning point. Up to now, only Shanghai has already exceeded the turning point, while other regions have to struggle to reach that point. Therefore, it can be concluded that if the scale of farmland conversion can perform the EKC path with economic growth, the farmland would be taken place excessively in the future without government intervention. Based on the present situation in China, to achieve the downturn of farmland conversion might be a long process that takes several decades. Therefore, if the government let farmland conversion follow the market and evolve by itself, at last farmland conversion would create serious economic and environmental problem. Hence, in order to control the progress, the government intervention through land policies is needed (Liu, et al, 2008)

2.4. Analytical Framework

Based on the above discussed literature, the analytical framework of this study could be drawn as shown in the Figure 2.2.:

Figure 2. 2. Research Analytical Framework



Source: Drawn by Author

The figure above describes that there are two measurement drive agricultural land conversion, which are: (1) internal factor, and (2) external factor. The internal factors consist of farm size/farm slope, distances to nearest city, technology intensity, and productivity, while external factors are industrialization, road infrastructure, government policy, and urbanization. Most of these factors are the impact development policy of a country to pursue higher economic growth. The internal factors typically influence the supply of land for non-agricultural uses, while the external factors affect the demand for non-agricultural uses.

This study is intended to compare the agricultural land conversion phenomenon in different groups of country: less developed, developing, and developed countries. The comparison includes the level of intensity, the trend/pattern, and the causing factor. It is realized that ideally this study should considers all the factors above as factors causing agricultural land conversion. However, due to data availability and limited time, this study use some criteria used to measure agricultural land conversion in those different countries. Moreover, because this study uses secondary data provided by internet, so those criteria are chosen based on their availability in the data web site. Therefore, in the figure the criteria used as measurement in this research are placed in the rectangular box, while the criteria discussed in the literature review, but not used as measurement in this research are placed in the circle box.

CHAPTER III
RESEARCH METHODOLOGY

The research process is set based on four main activities, which are data collection, data preparation, data analysis, and discussion. Data analysis is mainly divided into 3 steps, which are examining the difference of intensity of agricultural land conversion in difference countries, understanding the trend or pattern of agricultural land conversion, and exploring factors driving agricultural land conversion in those countries. Detailed procedure is elaborated below:

3.1. Data Collection and Data Preparation

Collecting time series data for agricultural land, productivity, agricultural machinery (tractor uses), labor uses, and urban population of 94 countries is conducted to answer the research question number 1, 2, and 3 (see page 9). Data are collected from data base site on the internet called Nation Master and Earth Trend.[2]

In this stage all the collected data are prepared to be analyzed. The calculation of agricultural land conversion and capital labor ratio are done in this stage. Agricultural land conversion data is acquired by deducting number of agricultural land per capita of current year with number of agricultural land per capita of previous year. While capital-labor ratio is obtained by dividing agricultural machinery data (tractor uses) with labor uses. Data used is time series data from 1961 to 2003.

This study uses quantitative analysis with 123 countries as a unit of analysis. In order to answer the research question number 3 about factors influencing agricultural land conversion in those countries, some variables hypothesized as causing factors are determined and elaborated.

[2] www.nationmaster.com and www.earthtrends.wri.org

The three variables hypothesized as the causing factor of agricultural land conversion are productivity, capital-labor ratio, and urban population. This study will examine how these explanatory variables influence agricultural land conversion by using statistical tools, hypothesis testing, and concluding remark.

3.1.1. Study Population

This research uses secondary data collected from Nation Master and Earth Trends Data Base and including 123 countries as population. In these two sites, there are data of more than 200 countries, however only 123 countries had complete data of the variables studied in this research.

3.1.2. Study Sample

The decision about the size of sample is very important. If the sample is too large, it will waste the resources, but if it is too small, it will diminish the utility of the results. In this study, the sample size is calculated based on the Slovin formula, (Visco, 2006; Rivera, 2007).

$$n = \frac{N}{(1+N.e.e)}$$

Where **n** is sample size

N is population

e is percentage of imprecision of sampling that can be tolerated

If we use **e** = 5 %, and the population number is 123, so the sample size is :

$$n = \frac{123}{(1+123x0.05x0.05)}$$

$$n = \frac{123}{1.3075}$$

$$n = 94.07 = 94$$

3.1.3. Sampling Method

When the sample size is determined, the next step is deciding how to choose the samples. There are several methods of sampling that are generally used in researches, such as random sampling, stratified sampling, purposive sampling, cluster sampling, and systematic sampling. In this study, the stratified random sampling will be used to choose 94 cases out of population. In stratified random sampling, the population of N units is divided into sub population of N_1, N_2, N_3…, N_L. These sub populations are non overlapping, and together they comprise of the population (Cochran, 1977). The division of the sub population or strata is defined based on certain characteristics which are believed to be related to the variables of interest. For example, sex, race, geographic region, etc. Then the sample is selected from these strata randomly, so the sampling is known as stratified random sampling. The main objective of stratified random sampling is to ensure the proper representation of the stratification variables; this in turn, enhances the representation of each stratum that is included in sample (Babbie, 2007). There is also another sampling method or technique that almost similar with stratified sampling which is cluster sampling.

In cluster sampling, the population is also divided into non overlapping sub population, usually base on geographic location, or political boundaries. In the simple cluster, called single-stage cluster sampling, all of the units in selected clusters are included in the sample. So, the main difference between stratified sampling and cluster sampling is that in cluster sampling the cluster is treated as the sampling unit. So analysis is done on a population of clusters (at least in the first stage). In stratified sampling, the analysis is done on elements within strata. In stratified sampling, a random sample is drawn from each of the strata, whereas in cluster sampling only the selected clusters are studied. The main objective of cluster sampling is to reduce costs by increasing sampling efficiency. In contrary, the main objective of stratified sampling is increasing precision (Babbie, 2007).

3.1.4. Strata Determination

As discussed above, in stratified random sampling, the strata division is defined based on certain characteristic. Babbie (2007) discussed that the choice of

stratification variables generally depends on the availability of certain variables. In selecting stratification variables, the variable that is likely related to the explained variable should be considered. The main objective of this study is to understand the phenomenon of agricultural land conversion in different countries all over the world. Based on the discussion in Chapter 2, this phenomenon is closely related to economy size of a country. Therefore, the population will be divided into three strata; less developed, developing, and developed countries, based on the World Bank classification 2008.

According to World Bank, 2008, developed countries are high income countries, in which most people have a high standard of living. Sometimes are also defined as highly industrialized countries. While developing countries are countries with low or middle levels of GNP per capita and some of which have a transition in their economies.

Less developed countries generally have common characteristics such as low living standard (low real income per capita, poor health, high income inequality, inadequate education, and limited life expectancy), low level of productivity due to unskilled labor, limited resources, and backward technology. These countries also experience high population growth, large scale of unemployment, large scale but neglected agricultural and outward migration from rural to urban areas

In this study, the population is divided into 3 strata; less developed countries, developing countries, and developed countries. As mentioned above, the population number is 123 which have been divided into 3 strata which are 38 (less developed), 60 (developing), and 25 (developed) countries. The samples are chosen from each stratum proportionally. Therefore, sample size for each stratum is : $ns = \frac{Ps}{P} \; x \; n$

where, ns is sample for each stratum

Ps is population in each stratum

P is population

n is sample

Based on the formula, sample size are 29, 46, and 19 countries respectively.

3.2. Data Analysis

This study is focused on the collection and analysis of numerical data and statistics. Therefore, quantitative analysis is used. Statistical analysis is conducted to analyze (1) whether any difference in agricultural land conversion in different countries divided by 3 categories based on the World Bank classification, (2) the trend of agricultural land conversion in those different countries, (3) the relationship between agricultural land conversion and variables hypothesized as its causing factors.

Derived from research questions in Chapter 1 and discussion of some literature reviews in Chapter 2, hypotheses in this research can be determined as follows:

1. There is significant difference in agricultural land conversion among three strata.
2. It is hypothesized that there is positive trend in agricultural land conversion in every stratum.
3. It is assumed that there is positive correlation between agricultural land conversion and productivity; agricultural land conversion and technology intensity (capital-labor ratio); agricultural land conversion and urban population.
4. It is hypothesized that productivity, capital-labor ratio, and urban population contribute to agricultural land conversion.

There are two kinds of variables involved in this research, which are:

1. ***Endogenous variable***, denoted by Y, is variable explained by the model (dependent variable). In this study, agricultural land conversion is the dependent variable.

Agricultural land conversion is defined as a process by which agricultural land is changed to other uses particularly urban uses. In this research, the data of agricultural land conversion is obtained by deducting the number of current year agricultural land per capita with the number of previous year agricultural land per capita. So, it will be the change of agricultural land year by year per capita during 1961-2003.

2. ***Exogenous variable***, denoted by X, whose values are determined outside the confines of the present model (explanatory or independent variable). Productivity, capital – labor ratio, and urban population are the independent variables hypothesized as factors causing agricultural land conversion.

   a. *Productivity (X_1)*

      In this research, productivity is defined as the outcome that results from the using of inputs in agricultural production. The data of cereal productivity in kg/ha from 1961 to 2003 is considered to be used as the data for productivity in this research.

   b. *Capital-labor ratio or technology intensity (X_2)*

      Capital-labor ratio is hypothesized as the variable influencing agricultural land conversion positively; it means that if capital labor ratio increase, the agricultural land conversion might increase as well. The data for capital-labor ratio is the number of tractor uses divided by the number of labor use from 1961 to 2003.

   c. *Urban population (X_3)*

      In this research urban population is used as a measurement of urbanization in a country. Urban population is the population that lives in an area defined as urban and reported to the United Nation (UN) during 1961-2003. According to UN, due to national differences in the characteristics that distinguishing rural from urban areas, the distinction between the rural and urban population is not yet agreeable to a single definition that would be applicable for all countries. For that reason, they must establish their own definition in accordance with their needs. However, they should report this to the UN.

3.2.1. Compare Mean Analysis

Before conducting the time series analysis, we will examine whether the means of three strata/groups are all equal or different from each other. The One-Way of Variance (ANOVA) analysis is used to test this hypothesis.

3.2.2. Time Series Analysis

By Time series analysis, it is possible to raise questions concerning how variables behave in the past and how they are likely to behave in the future. The advantage is the analysis can explain the past and predict the future behavior of variable interest.

There are two main goals of time series analysis: (a) identifying the nature of the phenomenon represented by the sequence of observations, and (b) forecasting (predicting future values of the time series variable). There are three kinds of time series analysis that will be conducted in this study, which are:

3.2.2.1. Trend Analysis

This analysis is run to understand the trend or pattern of agricultural land conversion in each group or strata. Trends in time-series data were analyzed using simple linear regression.

3.2.2.2. Correlation Analysis

This analysis tries to understand the relationship between agricultural land conversion and three explanatory variables; productivity, capital labor ratio, and urban population.

Correlation analysis determines the extent to which changes in the value of an attribute are associated with changes in another attribute. The correlation coefficient ***r*** is a measure of the linear relationship between two attributes of data. The correlation coefficient is also known as the Pearson product-moment correlation coefficient (For further explanation about this analysis see Appendix. 1).

3.2.2.3. Regression analysis

Regression analysis is one of the most widely used techniques for analyzing multifactor data. It is a statistical tool for the investigation of relationships between variables. The application of regression analysis in this study is a statistical technique used to forecast and to analyze the factors that influence agricultural land conversion.

3.2.2.3.1. Hypothesize Testing in Regression Analysis

a. The F- test of Overall Significance

   The F-test is used to test the overall significance of a regression equation. It is also called global test of model adequacy.

b. The t-test of Individual Regression Coefficient

   The t-test is used to test the hypothesis of the significance of any individual regression coefficient. This test determines whether each independent variables significantly to the model.

3.2.2.3.2. Coefficient of Multiple Determination (R^2 and Adjusted R^2)

The coefficient of determination or R^2 measures the impact of all included all explanatory variables in explaining the variation in dependent variable. The high R^2_{Adj} close to 1) shows that there is a strong linear relationship between the agricultural land conversion and productivity, capital-labor ratio, and urban population.

3.2.2.3.3. Classic Assumption of Multiple Linear Regression

There are three classic assumptions required in multiple linear regression in order to make it reliable. These assumptions are:

a. No Heteroscedasticity (Homoscedasticity)

   Homoscedasticity is the assumption that all residuals have a common variance σ^2, and the violation of this assumption is known as heteroscedasticity (Maddala, 1977).

b. No Autocorrelation

   The third assumption in multiple linear regression is that the residuals μ_i are mutually independent (Maddala, 1977).

c. No Multicollinearity

   Multicollinearity refers to a situation where independent variables correlate with each other.

3.3. Discussion

In this part, the analysis is continued by interpreting the statistical analysis results. The interpretation is supported by some literature reviews explaining the agricultural land conversion phenomenon in different countries.

CHAPTER IV
RESULT AND DISCUSSION

This chapter consists of two parts; the first part describes the general overview of three groups of countries as study area; the second part discusses the result analysis of this research.

4.1. General Overview of Study Area

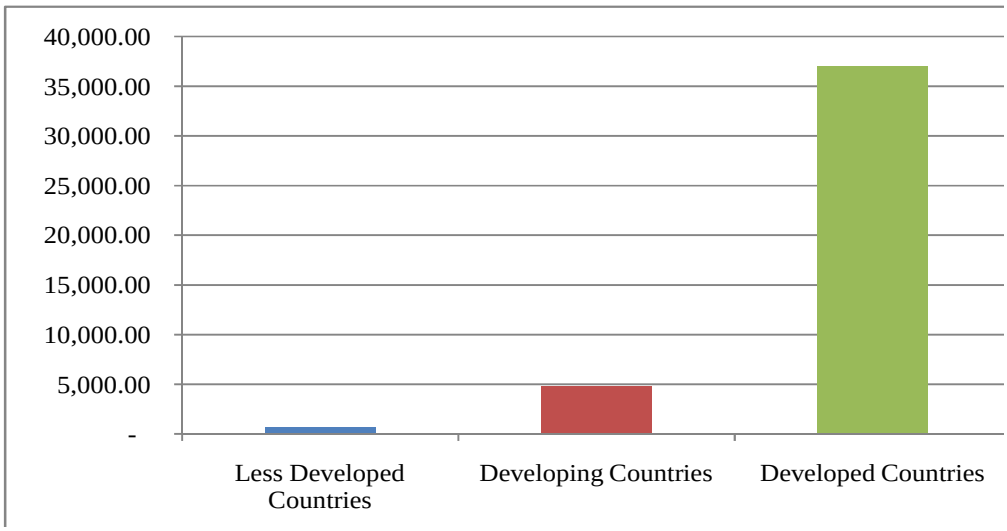
4.1.1. Economic Aspect

The research analyzes agricultural land conversion in 94 countries from all over the world. These countries are classified by World Bank, 2008, as developed, developing, and less developed countries. There are 29 less developed countries, 46 developing countries, and 19 developed countries (see Appendix 4). It is not arguable that national income is one of indicators of a country's development. Gross Domestic Product or GDP is broadest and most widely used measure of national income. GDP is also commonly used as an indicator of economic health of a country. GDP is defined as the value of the expenditures on final goods and services at market prices produced by domestic factor of production (labor, capital, materials) during a given year (Library of Economics and Liberty, 2009). Obviously, GDP of developed countries is the highest among these three groups (see Appendix 5).

Furthermore, the growth of GDP also indicates a country's development. The GDP growth generally represents economic growth of one country. As mentioned in chapter II, economic growth is one of factors influencing agricultural land conversion. Economic growth requires sectors that generate high productivity. Non-agricultural sector is believed as sector that creates higher productivity rather than agricultural sector, because this sector is more elastic to income changing. In contrast, agricultural sector relatively inelastic to income changing. It means that the changing in people's income will not affect the demand for agricultural products significantly.

Finally, the economic growth also can be indicated by income per capita. The rise of income increases the need for better housing, recreation opportunities, cars, vacation trips (lead to demand of improved road infrastructure). These demands had direct impact on the demand for land and its product, particularly land for non agricultural uses. Therefore, higher income per capita would lead to higher agricultural land conversion. However, there is a hypothesis called Environmental Kuznet Curves (EKC) argued that agricultural land conversion will go up with the growth of income per capita at the beginning, after reaching to its peak value, then turn to go down with further economic growth (Liu, et al., 2007).This hypothesize would be discussed elaborately in the next section.

Figure 4. 1. GDP per capita per strata in 2007



Source : Nation Master

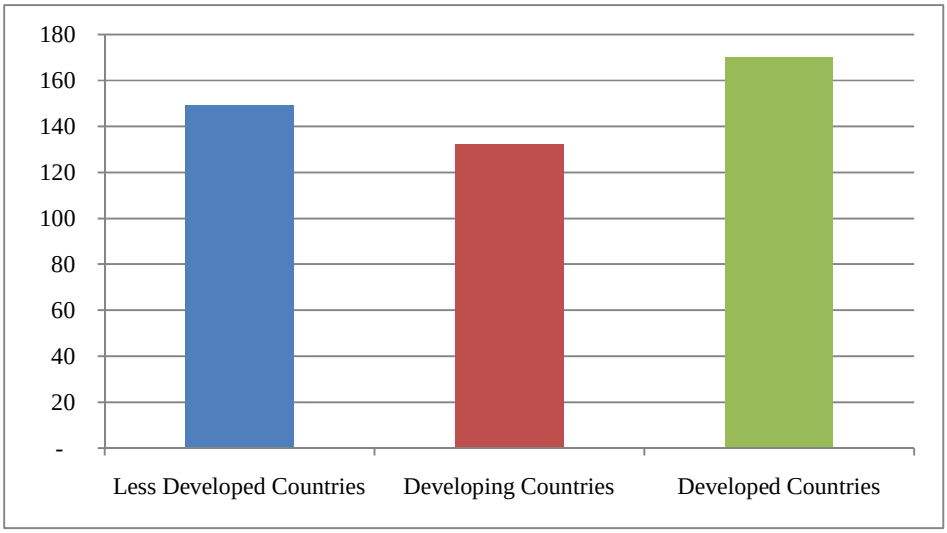
4.1.2. Demographic Aspect

Population is very closely related to land conversion. Population together with economy largely determines demand for land and its products. One of dimensions of population and economy is spatial distribution (Kaiser,1995). This dimension explains about how population distributed spatially. It relates population and space (land resources) and also stated as population density. Population density is the number of persons per square mile or other area unit. In some populous area, competition between land uses occurs between uses and users for the utilization of land. Competition between uses may lead to the uses

that generate highest return. Under completely free market condition, land would be utilized for highest and best use.

Figure 4.2. shows differences exist in average population density reported for various countries . Some populous areas like Japan, and The Netherlands have densities of more than 350.55 people and 481.7 people per square meter, while other such as Canada and USA have averages of 3.55 and 32.55 persons per square kilometers, respectively.

Figure 4. 2. Population Density of 3 Strata in 2007



Source : Nation Master

While population number provides an important index of the demand for land and its products, the feature of the demand for certain types of land often reflects the makeup of the population and changes from one period to another in population characteristics (Barlowe, 1986).The significance changing in population characteristics is indicated by people life style or behavior. People are more urban oriented on their work and thinking now. Moreover, in 1790 in USA, only about one person in twenty lived in urban area, but by 1980, 3 out 4 Americans lived in urban places (Barlowe, 1986).

Urban people's direct interests are expressed more in the demand for housing, commercial and industrial development, parking space, and recreation areas, while agricultural land is only their indirect demand. Urbanization and the

increasing of urban population also brought new demand for highway, airport facilities, and other services area. Therefore, the increase in urban population affects the increase of conversion of agricultural land to urban uses.

4.1.3. Agricultural Sector

In the early stage of development, agriculture sector becomes economic base of almost all countries in the world. In most developing countries, agricultural sector plays important role in their development due to its large contribution to national income and the large numbers of participants in this sector. However, this role has been replaced by other productive sector. Todaro (1999) argued that many developing countries experienced high rates of national income growth, and the greatest proportionate share of this growth came from manufacturing and commerce sectors. In contrast, agricultural output growth was much less robust, and the share of this sector to national income declined. This situation was contrast to the historical experience of developed countries, where agricultural sector in the early stage of their development always contributed at least as much to total output as the share of labor force involved in these activities.

During the economic transition, economic growth has become the main target of development. This growth is needed to move further to the next stage of development. The development of sector created high productivity is necessary in this transition periods. Manufacturing or industry and commercial sector are believed have higher productivity and income elasticity rather than agricultural activities.

The unique feature of agricultural sector is its ability to absorb many participants in its activities, particularly in less developed and developing countries. However, in line with development process, its role declined, and replaced by other sectors such as industrial and commercial activities. As seen in Appendix 10 the larger the economic size (the higher the stage of development), the lesser the labor used in agricultural production. The role of labor in the process is substituted by machine. As we know that, agricultural production involves three kinds of inputs or factors of production; (1) labor or human resources, (2) capital, and (3) land or natural resources (Salvatore, 1986). Capital in this research refers to machinery uses, such as tractor uses in production process. Capital and labor

are classified as variable inputs. It means that during the short time they can be varied easily. Moreover, capital and labor are substitutes to each other. The combination of these inputs in production process is called technological progress (Salvatore, 1986).

There are three kinds of technological progress; neutral, capital using, and labor using. Capital using (K-using) technological progress refers to production process where the proportion of capital uses is larger than labor uses. In other words, it shows a higher K/L ratio. In developed countries, farmers use more capital (more tractors) than labor in their agricultural production (see Appendix 9 and 10); it means that they have higher K/L ratio rather than those of developing and less developed countries.

In developing countries, where population growth is rapid, this situation creates labor surplus in agricultural sector. In the end this surplus might migrate to urban area, expected to be accommodated by non agricultural activities in urban area.

4.2. Data Analysis

4.2.1. Agricultural Land Conversion in Different Strata

Compare mean analysis is used to find out whether there is any significant difference in farmland conversion among the strata. Therefore, H_0 and H_1 could be defined as follow:

H_0 : no significant difference in farmland conversion between the strata

H_1 : there is significant difference in farmland conversion between the strata

Table 4. 1. Means Comparison of Agricultural Land Conversion Among Strata

(ANOVA)

F = 105.65; Sig. = 0.00

Strata	Agricultural Land Conversion Mean
Less Developed Countries	- 0.557
Developing Countries	- 0.712
Developed Countries	- 0.102

An ANOVA estimation was run to find the mean difference of agricultural land conversion in the countries. Table 4.1. shows that all strata have minus mean indicating that they are all faced agricultural land conversion. However, there are some differences among the strata that show different conversion intensities, where developing countries experience the highest conversion (-0.712) and developed countries are faced the least (-0.102).

Based on the World Bank definition, developing countries are countries with low or middle levels of GNP per capita and some of which have a transition in their economies. As discussed in Chapter 2, developing countries are in the phase of transition from a low income, agrarian rural economy to an industrial urban economy. In this transition process, there is a transformation of composition of economic activity and a shift of allocation of production factor (land). The land which previously allocated for low productive sector such as agriculture is converted to high productive sector such as industry, commerce, services, etc. The urban uses encroaching fertile agricultural land is also stimulated by rapid population growth in these developing countries. The development of industrial estate and commercial areas attract people particularly from rural area to move to the city to find new job and new life. (The explanation on how the increase of urban population and city growth affect agricultural land conversion will be discussed in the next section). Therefore, in order to understand the phenomenon and factors related to agricultural land conversion in each stratum, the analysis could be continued to trend analysis, correlation, and regression analysis.

4.2.2. Agricultural Land Conversion Trend

Trend analysis is conducted to understand the trend of land conversion in each stratum. Simple regression analysis is used to see this trend. The result of regression for less developed, developing, and developed countries are shown as follow:

Table 4. 2. Summary for the Trend Analysis for All Strata during 1961-2003

Strata	R	R^2	Adjusted R^2	Standard Error of the Estimate	F
Less Developed	0.537[a]	0.289	0.271	0.211749	6.561
Developing	0.980[b]	0.960	0.959	0.047994	995.940
Developed	0.407[c]	0.166	0.145	0.051389	7.952

[a] Predictors : (Constant), Time
[b] Predictors : (Constant), Time
[c] Predictors : (Constant), Time

Table 4. 3. Coefficients for the Trend Analysis in Less Developed Countries during 1961-2003

	Unstandardized Coefficient		Standardized Coefficient	T	Sig
	B	Standard Error	Beta		
(Constant)	-0.791	0.067		-11.883	0.000
Time	0.011	0.003	0.537	4.028	0.000

[a] Dependent Variable : Agricultural Land Conversion

Table 4. 4. Coefficients of the Trend Analysis in Developing Countries during 1961-2003

	Unstandardized Coefficient		Standardized Coefficient	t	Sig
	B	Standard Error	Beta		
(Constant)	-1.119	0.015		-11.883	0.000
Time	0.019	0.001	0.980	30.918	0.000

[a] Dependent Variable : Agricultural Land Conversion

Table 4. 5. Coefficients of the Trend Analysis in Developed Countries during 1961-2003

	Unstandardized Coefficient		Standardized Coefficient	t	Sig
	B	Standard Error	Beta		
(Constant)	-0.142	0.016		-8.800	0.000
Urban Population	0.002	0.001	0.407	2.820	0.007

[a] Dependent Variable : Agricultural Land Conversion

Base on the result shown above the model of agricultural land conversion trend in less developed countries can be considered as follow:

$$y1 = 0.537x_1 + \varepsilon$$
$$y2 = 0.980x2 + \varepsilon$$
$$y1 = 0.407x_3 + \varepsilon$$

y is agricultural land conversion

x is time

ε is random disturbance term

As seen in the tables above, it can be concluded that p value (sig) is less than 0.05; it means that there are trends in agricultural land conversion variable in all strata. The trends are positive (the sign of coefficients); it means that the trends are increasing.

In less developed countries, the standardized β [3]for time is 0.537; it means that as time increase by one standard deviation (12.268 year), agricultural land conversion increase by 0.537 standard deviation. The standard deviation of agricultural land conversion is 0.247969, so the time constitutes a change of agricultural land conversion, 0.133159 km^2 per capita (0.537 x 0.247969). Therefore, for every 12.3 year, farmers would lose 0.1332 km^2 of their agricultural land converted to urban uses.

For developing countries, the standardized β for urban population is 0.980; it indicates that as time increase by one standard deviation (12.268), agricultural land conversion would increase by 0.980 standard deviation. While the standard deviation of agricultural land conversion is 0.236544, so the time constitutes a change of agricultural land conversion 0.231813 km^2 per capita (0.980 x

[3] The standardized *b* or β (beta) value is used because it is easier to interpret than unstandardized *b* or B (Field, 2005). The β indicates the number of standard deviations of the dependent variable will change as a result of one standard deviation change in independent variable. The standardized β values are all measured in standard deviation units, and so are directly comparable. Therefore β provides better insight into the contribution of predictor in the model.

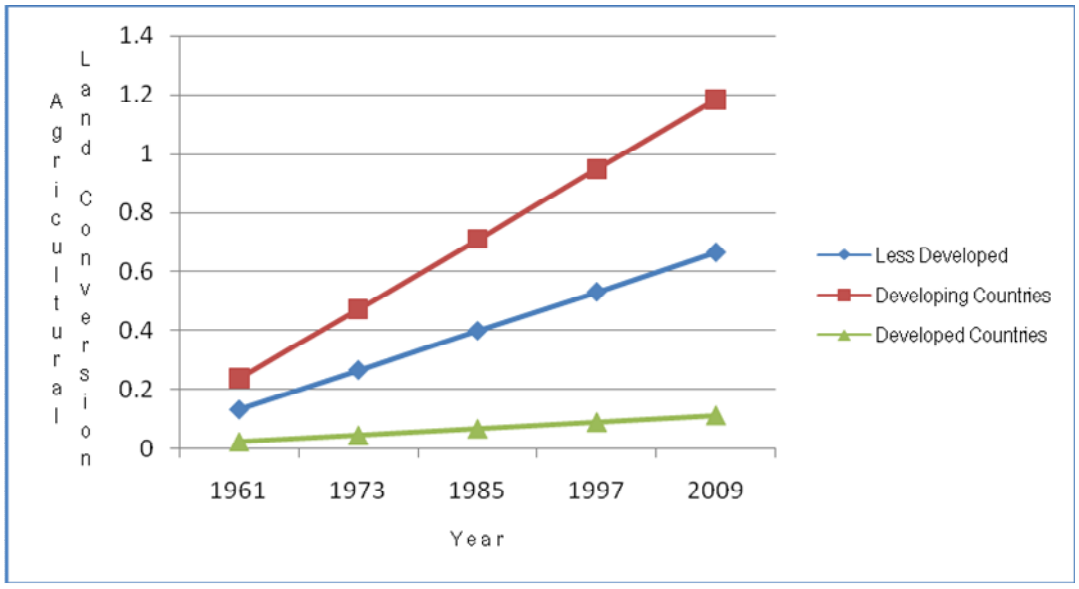
0.236544). Hence, for every 12.3 years, farmers would lose 0.23318 km^2 of their agricultural land converted to urban uses.

The similar calculation is also applied to developed countries. For every 12.3 years, farmers will lose 0.0226 km^2 of their agricultural land converted to other uses.

The findings of trend analysis support the results of previous analysis. For every 12.3 years, developing countries have experienced the highest average of agricultural land conversion among these groups, followed by less developed and developed countries.

As shown in Figure 4.3, in line with the increasing time the agricultural land conversion will increase as well. In developing countries this conversion will keep increasing in highest rate due to economic growth, rapid population growth and high level of urbanization.

Figure 4. 3. Agricultural Land Conversion Trend



Source : Analysis Result

4.2.3. Correlation Analysis

The hypothesis of whether there is correlation between agricultural land conversion and productivity, ratio of capital-labor, and urban population is tested by correlation analysis. The test is done respectively for each stratum.

Table 4. 6. Pearson Correlation between Variables in All Countries

Variables	Agricultural Land Conversion	Productivity	Capital – Labor Ratio	Urban Population
Agricultural Land Conversion	1.00			
Productivity	0.881**	1.00		
Capital-Labor ratio	0.874**	0.988**	1.00	
Urban Population	0.875**	0.987**	0.998**	1.00

** correlation is significant at $P \leq 0.01$

Based on statistical result all correlations (showed by Pearson Correlation) for all countries are significant at the level of confidence 90 %. It implies that there are relationship between agricultural land conversion and productivity, capital-labor ratio and urban population. The positive sign of Pearson correlation coefficient implies that an increase in the value of productivity, capital-labor ratio, and urban population indicates a likely increase in the value of agricultural land conversion.

4.2.3.1. Level of Productivity

Land owners will not undertake resources developments unless they anticipate a benefit or economic returns more than expected cost (Barlowe, 1986). In their decision, they have strong economic incentives for maximizing their monetary return. They also aware of the opportunity cost - the income that could have been obtained by utilizing their resources inputs in their most productive alternative uses. Cereal productivity is a kind of return creating from agricultural sector. The higher the productivity the better the land is.

Land productivity and agricultural land conversion have parallel correlation. The positive sign of standardized coefficient (β) implies that the increase of land productivity will lead to the increase of agricultural land conversion. Generally, land with high productivity is fertile, close to water power site (irrigation, river). The development of industrial site, commercial site usually associated with natural or manmade advantages, such as soil fertility or location close to water source, along rail road, or close to a good market area (residential site). Location, accessibility, and topography play important role in determining location for housing/residential development. Construction costs on level land are almost always less than those in hilly land. The cost of roads, foundations, wells constructions are typically less than on flat than on hilly land (Nelson, 1990). Due to high productivity, land owner considering splitting their land into acreage and sell it to the market and offer high prices. So they can get benefit not only from farmland but also from selling acreage tracts (Drozd and Johnson, 2004).

According to Edrijani in Firman (1999), In Indonesia, the conversion is not only squeezed the agricultural land but has also reduced the productivity of remaining paddy field from 4.5 to 3.4 ton/ha. It indicates that the conversion also happen in productive agricultural land. Many development of investment in housing and industrial business has greatly transformed urban fringes from prime and irrigated agricultural land to new residential and industrial areas. The possibility of the productive land to be converted to other uses is bigger than the less productive land because of some reasons; (1) the development of non agricultural activities such as housing, commercial, office and industrial estate on a flat and productive land is much easier than on hilly land; (2) The main objective of national development was focused on the increasing of paddy production, therefore the development of infrastructure such as road was more concentrated in productive agricultural land, particularly paddy field; (3) generally, the productive agricultural land is located close to urban area (consumers), so it is more profitable for developer to purchase the productive land due to the low transportation cost. In addition, Sumaryanto in Irawan (2005) discussed that land owners' motivation to sell their land to be converted to other uses was not the low productivity. In his research, 50 % of farmers in Bandung,

Indonesia stated that the high land price is the main reason for them to sell their land. The more productive the land, the higher the value or price is.

4.2.3.2. Capital-Labor Ratio (K/L ratio)

A high K/L ratio is often called K-deepening or L-saving technological progress (Salvatore, 1986). It means that farmers improve their production technology. With improved technology, farming requires fewer operators/workers so displaced workers seek other works in cities. Cities create more jobs to serve economy that is going in complexity and diversity. These job opportunities absorb the labor surplus in agricultural sector. Consequently, the creation of more jobs in non-agricultural sectors needs more lands and as cities grow, they expand to the outskirts and compete for land uses. This phenomenon also indicated by the decrease of workers that work in agricultural sectors, particularly in developed countries due to technology use in agricultural production. The dynamic of urban development result in the conversion of agricultural land to urban uses at urban fringe area. In this research, this variable has a parallel correlation with agricultural land conversion; it means that the increasing of capital-labor ratio indicates a possible increase of agricultural land conversion. Furthermore, in developed countries such as USA, over the last several generations, agricultural producers' demographic profile has been steadily changing. The percentage of the workforce in agricultural sector has declined from about 20% at the start of World War II to less than 2 % in 2004 (Drozd and Bruce Johnson, 2004).

4.2.3.3. Urban Population

Urban population also has parallel correlation with agricultural land conversion. The increasing in urban population will lead to the increasing of agricultural land conversion. The increase of economic growth encourages the change of economic structure from agricultural sector to non agricultural sector. This shift triggers the increase of demand for non-agricultural sectors. The development of commercial and industrial sites attracts more people to find job and new life close to those places. This situation creates another demand for housing site, recreation site and other facilities supporting people's activities. Moreover, due to high land price in city centre many firms relocate their plants to

sub urban location in order to reduce production cost. This reason also fosters people to move to sub urban area and decide to be a commuter.

Due to urbanization process, during 1988-1998 Saharanpur India has suffered the loss of about 1683 of fertile agricultural land, of which 592 transformed to residential, commercial, and industrial areas (Fazal, 2000). According to Irawan (2008), in Indonesia during 2000-2002, agricultural land conversion mainly allocated for residential development (48.96 %), industrial area 36.50 %, and for office area 14.55 %.

Furthermore, urbanization process in Hanoi, Vietnam has various important effects on the agricultural sector (Van den Berg, LM, et.al 2003). First, urban growth decreases the amount of land available for agricultural causing an increase in land price and forcing farmers to intensify their land use. The data showed that there was an average decline of 15% in the area of agricultural land per household between 1991 and 1999. Second, the demand for food products increases.

4.2.4. Factors Causing Agricultural Land Conversion

Times series regression analysis is used to understand the relationship between agricultural land conversion as dependent variable and productivity, capital-labor ratio, and urban population as independent variables (explanatory variables). By using regression analysis it can be understood how agricultural land conversion is affected by productivity, capital-labor ratio, and urban population.

Table 4. 7. Summary for Regression Models for All Strata during 1961-2003

Strata	R	R^2	Adjusted R^2	Standard Error of the Estimate	F	DW Stat
Less Developed	0.537[a]	0.289	0.233	0.217201	5.146	2.057
Developing	0.989[b]	0.977	0.976	0.036922	548.258	1.079
Developed	0.584[c]	0.341	0.289	0.046854	6.561	1.473

[a] Predictors : (Constant), Productivity, Capital-Labor Ratio, Urban Population
[b] Predictors : (Constant), Productivity, Capital-Labor Ratio, Urban Population
[c] Predictors : (Constant), Productivity, Capital-Labor Ratio, Urban Population

Table 4. 8. Coefficients for the Regression Model for Less Developed Countries during 1961-2003[a]

	Unstandardized Coefficient		Standardized Coefficient	T	Sig
	B	Standard Error	Beta		
(Constant)	0.055	0.679		0.080	0.936
Productivity	-0.001	0.001	-0.907	-1.1850	0.243
Capital-Labor Ratio	-2.671	3.375	0.413	-0.791	0.434
Urban Population	0.000000993	0.000	1.790	1.998	0.053

[a] Dependent Variable : Agricultural Land Conversion

Table 4. 9. Coefficients for the Regression Model for Developing Countries during 1961-2003[a]

	Unstandardized Coefficient		Standardized Coefficient	T	Sig
	B	Standard Error	Beta		
(Constant)	- 1.390	0.052		-26.504	0.000
Productivity	0.000	0.000	0.260	2.237	0.031
Capital-Labor Ratio	-0.089	0.000	- 0.260	-1.281	0.208
Urban Population	0.0000000367	0.070	0.998	7.450	0.000

[a] Dependent Variable : Agricultural Land Conversion

Table 4. 10. Coefficients for the Regression Model for Developed Countries during 1961-2003[a]

	Unstandardized Coefficient		Standardized Coefficient	T	Sig
	B	Standard Error	Beta		
(Constant)	-0.934	0.234		-3.989	0.000
Productivity	-0.00004	0.000	-0.629	-0.681	0.500
Capital-Labor Ratio	-0.007	0.003	-2.139	0.024	0.021
Urban Population	0.0000000434	0.000	3.165	0.003	0.018

[a] Dependent Variable : Agricultural Land Conversion

Based on the statistical results, the models for agricultural land conversion in less developed, developing, and developed countries are:

$$y1 = -0.907x_1 - 0.413x_2 + 1.790x_3 + \varepsilon$$

$$y2 = 0.260x_1 - 0.260x_2 + 0.998x_3 + \varepsilon$$

$$y3 = -0.629x_1 - 2.139x_2 + 3.210x_3 + \varepsilon$$ [4]

where

y = agricultural land conversion

x_1 = productivity

x_2 = capital-labor ratio

x_3 = urban population

ε = random disturbance term

4.2.4.1. Hypothesis Testing in Regression Analysis

As explained in Chapter 3, there are 3 tests used to test hypothesizing in regression analysis. Firstly, F-test; it is used to test the overall significance of a regression equation. As shown in the table 4.7 above, the F statistic for all models are larger than F table, (at the level of confidence of 5 % F table is 3,23), so it can be concluded H_0 is rejected and H_1 is accepted. It means that at least one of explanatory variables influence agricultural land conversion.

To understand which variable affect the agricultural land conversion as dependent variable, the second test will be run. The t-test is needed to examine the significance of each individual regression coefficient. At the level of confidence of 95 % and 90 % with 2 tail test; it is found that in less developed countries, of three independent variables, there is only one

[4] The inconsistency of coefficient signs of productivity (in less developed and developed countries) and capital labor ratio (in all countries) in regression analysis is due to multicollinearity problem. The coefficient signs of all independent variables are positive in correlation analysis, but in regression analysis some of which turn to be negative. Furthermore, these signs are also different with the hypotheses mentioned in Chapter 3. According to Maddala (1977), the wrong sign in coefficient sign is one of indicators that a serious muticollinearity problem found in a regression model.

independent variable which influences agricultural land conversion significantly, which is urban population, while other variables do not influence agricultural land conversion significantly. In developing countries, of three independent variables, there are two variables influencing agricultural land conversion, which are productivity and urban population. The capital-labor ratio and urban population affect agricultural land conversion significantly in developed countries.

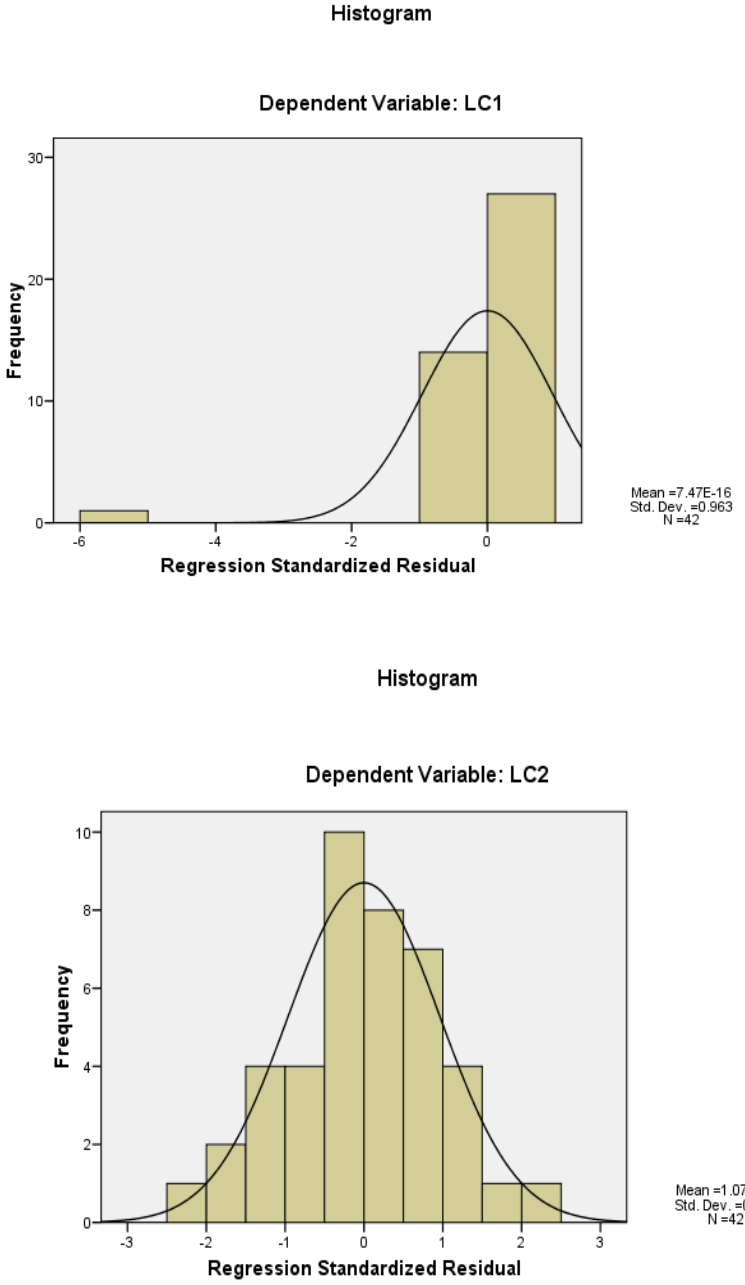
Furthermore, the test to examine the strength of relationship between agricultural land conversion and its hypothesized causing factors will be run. Test of Goodness Fit or the determinant coefficient (R^2) shows the percentage of variation of dependent variable that can be explained by independent variable. As shown in the table 4.7, R^2 for less developed countries, developing countries, and developed countries are 0.289, 0.977, and 0.341; it means that 28.9 % of variation in agricultural land conversion in less developed countries1 is explained by productivity, capital-labor ratio, and urban population, while the rest of it (71.1%) is explained by other variables outside the model. While in developing and developed counties, 97.7 % and 34,1 % of the variation in agricultural land conversion are explained productivity, ratio of capital-labor, and urban population.

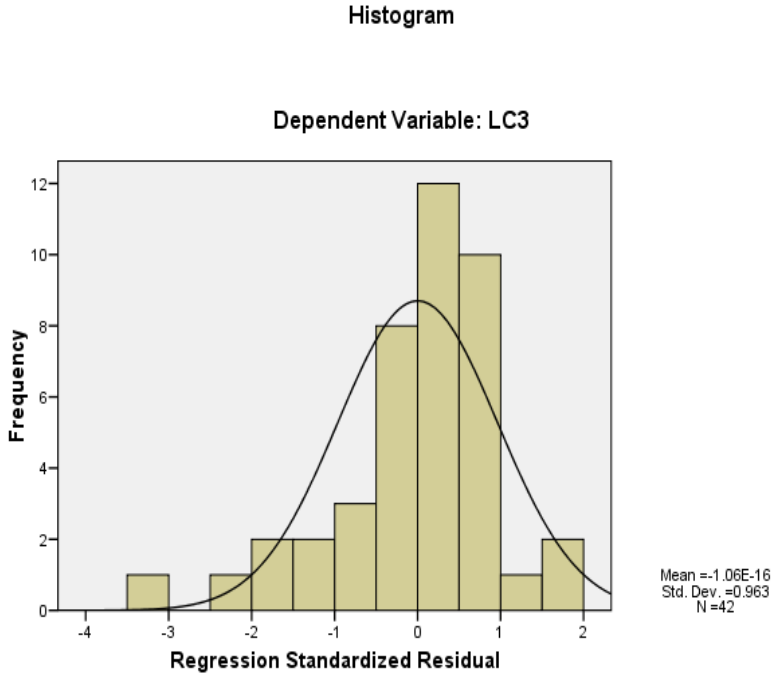
4.2.4.2. Test of Classic Assumption of Multiple Regression

a. No Heteroscedasticity (Homoscedasticity) test

   One of assumption of regression model is that errors in the equation have a common variance. If the error does not have a constant variance, we say that there is heteroscedasticity.

Figure 4. 4. Residual Distribution of Three Agricultural Land Conversion Models





Scatter plot of the standardized residuals on the standardized predicted values (Z residual as the dependent variable and the Z predicted as the independent variable) is used to detect heteroscedasticity in the model (Pryce, 2002). As seen in the graphs above, it can be concluded that heteroscedasticity symptom has not been found in all models, because the residuals follow the curve pattern.

b. No Autocorrelation test

The linear regression model assumes that there is no autocorrelation between errors in the model. The Durbin Watson test is used to examine this symptom. From the table above we found that Durbin Watson statistic (DW stat) for strata 1,2 and 3 are 2.079, 1.079, and 1.473, while DW table are $d_{L\,=}$ 1.15 and d_U = 1.46, it means that the DW statistic meets the requirement of 1.15 < DW stat < 4 – 1.46. Therefore we can conclude that the autocorrelation symptom is not happened in strata1 and 3 models.

c. No Multicollinearity test

Multicollinearity symptom happened when there is correlation among explanatory variables; productivity, capital-labor ratio, and urban population

To avoid misspecification and biased estimation; it is needed to consider the possible present of multicollinearity. Table 4.16, 4.17, and 4.18 shows the relationship of these explanatory variables to each other in all models. It seems that the variable urban population is highly correlated with productivity (r1 = 0.985, r2 = 0.945, r3 = 0985) and capital-labor ratio variables (r1 = 0.968, r2 = 0.978, r3 = 0.988) in every group, respectively. On the other hand, productivity also correlated with capital-labor ratio (r1= 0.956, r2 = 0.974, r3 = 0.984). Obviously, it can be concluded that the multicollinaerity is a problem here. In these models, the coefficient productivity and capital-labor ratio have 'the wrong sign'. According to Maddala (1997), to some cases, what might happen with multicollinearity is that some of the coefficients have wrong signs.

Multicollinearity can cause a problem for the estimation of the regression; not a problem for prediction, because multicollinearity is a problem with the sample not with a population. It causes difficulty in explaining which variable contributes the most of variance explained individually.

One of the solutions to solve the multicollinarity problem suggested by Maddala (1977) is dropping variables. Some variables hypothesized have high correlation coefficient are dropped from the model. As explained above, it is obvious that the incorporation of productivity variable and capital-labor ratio variable into the model with the existence of urban population might cause the multicollinearity problem. Furthermore, by using Stepwise method[5], it can be

[5] Stepwise method is a common approach to select variable from a multivariate model. The variable which less contribute to the variance explained would be excluded from the model.

determined which variable should be chosen as a regressor of agricultural land conversion.

4.2.4.3. Model of Agricultural Land Conversion

After solving the problem of multicollinearity the model for agricultural land conversion in different countries becomes:

$$y = \beta_0 + \beta_1 x_1 + \varepsilon$$

where

y = agricultural land conversion

x_1 = urban population

β_0 = intercept of the regression plane

β_i = urban population coefficients

ε = random disturbance term

Table 4. 11. Summary for the Stepwise Regression Models for All Strata during 1961-2003

Strata	R	R^2	Adjusted R^2	Standard Error of the Estimate	F
Less Developed	0.499[a]	0.249	0.230	0.217547	13.269
Developing	0.987[b]	0.974	0.973	0.038554	1,503.336
Developed	0.433[c]	0.188	0.167	0.050716	9.233

[a] Predictors : (Constant), Urban Population
[b] Predictors : (Constant), Urban Population
[c] Predictors : (Constant), Urban Population

Table 4. 12. Coefficients for the Stepwise Regression for Less Developed Countries during 1961-2003[a]

	Unstandardized Coefficient		Standardized Coefficient	T	Sig
	B	Standard Error	Beta		
(Constant)	-0.839	0.084		-9.948	0.000
Urban Population	0.0000000277	0.000	0.499	3.643	0.001

[a] Dependent Variable : Agricultural Land Conversion

Table 4. 13. Coefficients for the Stepwise Regression for Developing Countries during 1961-2003[a]

	Unstandardized Coefficient		Standardized Coefficient	t	Sig
	B	Standard Error	Beta		
(Constant)	-1.271	0.016		-81.554	0.000
Urban Population	0.0000000363	0.000	0.987	38.773	0.000

[a] Dependent Variable : Agricultural Land Conversion

Table 4. 14. Coefficients for the Stepwise Regression for Developed Countries during 1961-2003[a]

	Unstandardized Coefficient		Standardized Coefficient	t	Sig
	B	Standard Error	Beta		
(Constant)	-0.272	0.056		-4.829	0.000
Urban Population	0.00000000594	0.000	0.433	3.039	0.004

[a] Dependent Variable : Agricultural Land Conversion

Based on the results as shown above, the models for agricultural land conversion in less developed countries, developing countries, and developed countries can be considered as follows:

$$y1 = 0.499x_1 + \varepsilon$$

$$y2 = 0.987x_1 + \varepsilon$$

$$y3 = 0.433x_1 + \varepsilon$$

where,

$y1$, $y2$, $y3$ = agricultural land conversion in less developed, developing and developed countries

x_1 = urban population

4.3. Agricultural Land Conversion and Stages of Development

As discussed in chapter 3, development is seen as an interrelated set of long-run process of structural transformation accompanying growth (Syrquin, 1988). The transformation means the transition from agrarian rural economy to industrial urban economy. Due to its long-run process, the transition involves

some changes in production, resources use as well as changes in socio-economic element such as urbanization, and population growth.

The urbanization process brought changes in the cities. The spread of economic development to sub urban area make the city become bigger in size in line with the increasing of its population number. Urban population variable influences agricultural land conversion significantly in all strata. Based on statistical result in less developed, developing, and developed countries, it can be concluded that urban population influences agricultural land conversion significantly. In this model, beta, β (standardized coefficient) is used to indicate the number of standard deviations that the outcome would change as a result of one standard deviation change in the predictor. The standardized beta value for urban population in less developed, developing, and developed countries are 0.499, 0.987, and 0.433 respectively. To interpret these values, the standard deviation of all variables would be needed.

Table 4. 15. Standard Deviation of All Variables

Variables	Standard Deviation		
	Less Developed	Developing	Developed
Agricultural Land Conversion (Y)	0.247969	0.236544	0.055576
Urban Population (x)	4,980,358.537	7,129,843.526	4,319,967.138

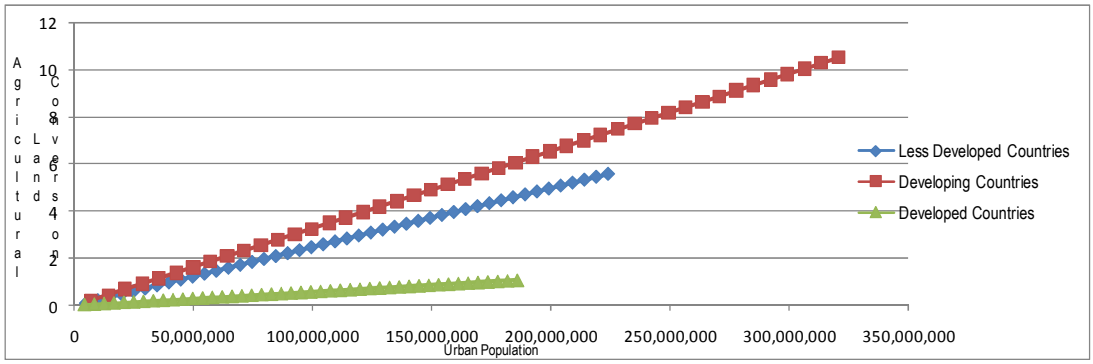
Source: Result Analysis

In less developed countries, the standardized β for urban population is 0.499; it means that as urban population increase by one standard deviation (4,980,358.537 people), agricultural land conversion increase by 0.499 standard deviation. The standard deviation of agricultural land conversion is 0.247969, so the urban population constitutes a change of agricultural land conversion, 0.123737 km^2 per capita (0.499 x 0.247969). Therefore, when urban population increases as many as 4,980,358.54 people, farmers would lose 0.123737 km^2 of their agricultural land converted to urban uses.

For developing countries, the standardized β for urban population is 0.987; it indicates that as urban population increase by one standard deviation (7,129.843.526), agricultural land conversion would increase by 0.987 standard deviation. While the standard deviation of agricultural land conversion is 0.236544, so the urban population constitutes a change of agricultural land conversion 0.2335 km^2 per capita (0.987 x 0.236544). Hence, when urban population increases as many as 7,129,843.526 people, farmers would lose 0.2335 km^2 of their agricultural land converted to urban uses.

This calculation is also applied to developed countries. As urban population increase by 4,139,967.138, farmers lose 0.024064 km^2 of their agricultural land converted to other uses.

Figure 4. 5. Model of Agricultural Land Conversion Model in Three Strata



Source : Result Analysis

This empirical result emphasizes the result of the other three analyses. In developing countries, the increase of urbanization measured by urban population causes severe problem of agricultural land conversion (the increase of urban population by more than 7 million would lead to the decline in agricultural land by 0.233 km^2 per capita) . The people's migration to urban area need more land. The increase need for job, housing, recreation, commercial area, parking sites, road infrastructure, educational facilities, and other facilities supporting people activities increases demand for land. In the other hand, lands in urban area become scarce and expensive, so the development sprawls to fringe area encroaching

fertile agricultural land. Consequently, the possibility of agricultural land to be converted to urban uses is very high.

On the contrary, in developed countries the increase of urban population by more than 4 millions only results in small decline of agricultural land per capita (0.024 km^2). The possibility reasons for this phenomenon are that these developed countries had already passed the stage of "take –off into self sustaining growth" of Rostow's stages of economic growth, and they are now in the "take-off or the drive to maturity" stage (Todaro, 1999). These stages are indicated by low number of population and low economic growth in developed countries (as seen in Appendix. 6 and 7). In addition, Liu, et.al (2008), studied that there is a relationship between economic growth and agricultural land conversion. It is needless to say that agricultural land conversion can fulfill the increment of demand for land induced by economic growth. In the early stage of development agricultural land conversion keeps step up with economic growth. However, when economy reaches higher level, economic growth has a negative impact on agricultural land conversion. The structure of economy shifts from land-intensive industries to less land-intensive industries, such as services and technology-intensive industries, as a result agricultural land conversion begins to slow down.

Moreover, during period 1961-2003, most of developed countries, such as USA began to concern that economic growth, urbanization, and population decentralization accelerate the conversion of farmland in rural area to urban uses (Nelson, 1990). Therefore, in the late of 1960, the idea to control urban development to preserve the farmland started to emerge. In the other hand, during those period most of developing countries had experienced great leap forward, cultural revolution, economic structure transformation, and reorientation from agricultural to manufacturing investment (O'Hara, 2006). Hence, the amazing conversion of agricultural land to urban uses occurred in this period.

Furthermore, as income grows, people are keen to achieve higher living standard and care more for environment quality. In 2007, the average GDP per capita of developed countries was $ 36,983.53, while in developing countries and less developed countries were $ 4,767.39 and $ 586.17. This fact supports the empirical result that the agricultural land conversion in developed countries with

highest income is the least among three strata. According to income elasticity of environmental demand, people will increase their willingness to pay for the preservation for farmland in line with the increase of their income. The purpose of farmland preservation is not only about protecting the food sustainability but also protecting the environment amenity. Therefore, the government intervention through planning instrument is needed to slow agricultural land conversion.

Agricultural land conversion has become an increasing concern in many countries in the world, particularly in developing countries, such as China, Indonesia, Philippines, Vietnam, including some developed countries, such as United State and European Countries. Whether it is for food security reason or environmental reasons, the issue arises concerning the main factor causing agricultural land conversion in this study, which is urbanization. Lesson can be learned from developed countries, on how to govern urbanization, so it affects the conversion of agricultural land at minimum level.

Under the free market mechanism, supply and demand for land tends to follow the perfect market, so agricultural land conversion would keep happening. However, the presence of state (land use planning) separates the market of different uses, such as housing, industry, office, commerce, or agriculture (Evan, 2004). Consequently, the availability of land resources becomes limited for urban uses, and the conversion would be hampered.

4.4. Lesson Learned

Developed countries particularly European Countries are very well known of their policies to preserve agricultural lands. Learning from other countries, which succeed in dealing with agricultural land conversion can be useful for the countries which have similar problem. Recently, there have been some comparative of some countries studies intended to get lesson learned or policy transfer in coping with agricultural land conversion (Tan, R, et.al., 2009, Mori, 1998).

According to Dolowitz and Marsh (2001), there are some knowledge that can be learned or transferred, which are policies, administrative arrangements, and institutions. Policy is one of means of government interventions in land market. The policy options to encourage the prevention of land in agricultural use can be

categorized into direct and direct method (Forkenbrock and Fisher, 1982). Direct methods include land use plan or spatial plan, zoning regulation, land banking, and Transferable Development Rights (TDRs). Indirect method particularly tax incentive programs are the most common mechanism for slowing agricultural land conversion at urban fringe area. Parallel with Forkenbrock and Fisher, Pearce and Turner in Iqbal and Sumaryanto (2001) discussed that there are 3 approaches to control agricultural land conversion in fringe area, which are: 1) regulation; government as a decision maker should establish some regulation related to land use, such as land use plan (spatial plan), and zoning regulation. The regulation also has to arrange about public participation in land conversion process. It should be transparent and involve related stakeholders as many as possible. 2) Acquisition management; this approach related to rules and regulation of land transaction and land tenure system. 3) Incentives and charges; the implementation of low tax for the farmers can prevent agricultural land from being converted to urban uses.

There are two methods of policy in developed countries which succeed in coping with agricultural land conversion; direct and indirect method. These methods can be learned and adapted by less developed and developing countries. A European country, such as the Netherlands, is known for its well-developed spatial planning to manage urban development and agricultural land conversion (Tan, R, et al., 2009). It is showed by its performance of agricultural land conversion which is only 17 ha per day during 1996-2000 (Tan, R, et al., 2009). In the other hand, Indonesia like other developing countries has been experienced rapid agricultural land conversion. Although there are some land policies issued to control agricultural land conversion, the government had been failed to control this phenomenon, showed by the high rate of conversion which is 514 ha per day during 2000-2002 (Irawan, 2008).

4.4.1. Direct Method - Land Use Plan

In The Netherlands, there are some acts related to land development, such as Housing Act, Water Management Act, etc. The main legal basis for land development is Spatial Planning Act. Land use planning or often called spatial planning is one of means to control agricultural land conversion. It is run and

organized by three levels of governments: national, provincial, and municipal. National government issues broad guidelines for land uses which provide an outline for strategy, policy and purpose of land development based on ecological and environment for the entire nation. Provincial government issues broad plans for regional development aimed at ecological protection, urban as well as green area development and reconstruction of basis public infrastructure. Municipal government responsibles for the actual extension of towns and villages based on specialized investigation of soils, terrain, biodiversity, and so on.

There is one of principles of Dutch Spatial Planning that arrange urbanization which is concentration of urbanization (Needham, 2007). It means that urban development should take place in or around existing urban area. It is meant to preserve open country side and agricultural land. In other words, the objective of this principle is to prevent urban sprawl. The Dutch land use plan is known for indicative system (Ludyanto, 2006). In an indicative system, the land use planning is more detailed and the control on land use is very strict. The indicative system provides certainty on the land use. The Dutch land use plan shows their effectiveness in controlling the opportunity to convert agricultural land to urban uses due to its strict regulation. The detailed land use plans have already constrained the land use of every plot, and no agricultural lands conversion can take place if it violates the plan (Tan, R, et.al. 2009).

Coordination among three levels of governments is the essential key in the success of spatial planning implementation in The Netherlands. Municipal land use plans must follow the regional plan and national plan, so the provincial and national government must approve the plan so it can be implemented. However, land policies in The Netherlands tend to be authorized in local levels (decentralized). It is showed by the dominant role of municipal government in land policies implementation. Some national projects have to conform to detailed land use plan made by municipal government (Tan, R, et.al., 2009).

Public support is very important in the implementation of land policies. In The Netherlands land policies are highly supported by public, because land use planning in all levels involves public participation. Land use plans that consist of a detailed land use recommendation within the planned area and a detailed

financial budget should be presented for public discussion. Financial budget of the plan and public opinion expressed during the planning stage are the main consideration for provincial government in approving the plan (Tan, R, et.al., 2009).

In contrast land use plans in some developing countries, such as Indonesia, China, and Philippines, are mostly in favor of built-up land uses rather than preservation of agricultural land purposes (Firman, 1997, Malaque and Yokohari, 2007, Han and He, 2000). Theoretically, the land use plan is intended to control agricultural land conversion. However, in practice it doesn't seem work so effectively. Illegal conversion of agricultural to urban uses was intensified by weak control and lack of supervision on land use in sub urban and rural areas. The weak control over this conversion is largely a reflection of poor legal system, weak law enforcement, inconsistencies, and the administrative inadequacies of local governments.

Actually, Indonesian government has been issued many policies to slow agricultural land conversion in urban fringe area. Besides spatial plan (RTRW) as the main land use policy, there are some policies especially targeted on hampering land conversion, such as some President Decrees regulating that industrial areas activities must not invade agricultural land (Kepres 53/1989 and Kepres 33/1990), Land Ministry Regulations that directly prohibit industrial activities encroach agricultural land (SE MNA/KBPN No. 410-1851/1994, No. 410-2262/1994, No. 5335/MK/1994, No. 5417/MK/10/1994, No. 460-1594/1994) (Irawan, 2008).

Firman (1999) discussed that many violations on spatial plan in Indonesia has resulted in the extensive land conversion of prime agricultural land to non-agricultural land. These violations such as development of housing, tourist resort, hotel, and restaurant in conservation area in Puncak Strip (Bogor and Cianjur area) are mainly caused by:

- Inconsistencies between plan and implementation and also weak enforcement so there is false impression that plan is negotiable.
- Local government capacity to implement and manage the land use plan, particularly in controlling and monitoring land conversion has been inadequate, while the private interests to change zoning are very strong.

- Local government regards the issuing of land permits more as a means of collecting fee than as a means of controlling urban and regional development.
- Land use plans are prepared without enough consideration about future socio economic condition.

Finally, it can be concluded that the success key of hampering agricultural land conversion is not about the number of land policies that one country have, but more about how effective the policy control the land conversion. Netherlands has spatial planning as a main land policy to control land conversion, but it exhibits good performance in coping with agricultural land conversion. In contrast, Indonesia like other developing countries, such as China, issues many land policies, even some of which targeted on controlling agricultural land conversion has been failed to deal with this problem. Therefore, strong commitment of government, strong law enforcement (clear sanction on violation), coordination among levels of government, adequate human resources, and policy transparency (including public participation) are factors contribute to success of the land policy implementation.

4.4.2. Indirect method - Tax Incentives and Subsidies

Farmers in USA particularly those who live at urban fringe area paid excessive taxes on their land, creating inequity and encourage them to sell their land (Fockenbrock and Fisher, 1982). Therefore, the free tax incentive programs aimed at slowing agricultural land conversion has been introduced intensively. The two main objectives of tax incentives are: 1) to relieve the tax burden experienced by farmers, 2) to preserve enough agricultural land to ensure food supply in the future. However, there was a debate about tax incentives in USA. The debate took place between the tax burden perspective and the equity perspective. Tax burden argued that market values of agricultural land that close to urban fringe is increasing rapidly. As the value of agricultural land acquired for other uses increases, its property tax based on this value should increase as well at a rate far in excess of farm income. The equity advocates urged that farmers' property tax too large compare to their income. Their property tax burdens are proportionally far greater than the services got from government.

In The Netherlands, farmland is a tax-exempt object (Ludyanto, 2006). It means that farmers are excused from not paying the property tax. By exempting the tax for agricultural uses, this can encourage farmers to remain in agricultural activities. Furthermore, the government has strong commitment to preserve agricultural land, to keep the agricultural land from development. The provincial planning director had stipulated that satellite towns were not be located in the agricultural land. There is also planning policy requiring housing to be built in expensive location to spare the agricultural land, and the central government will subsidize the extra cost paid for those housing. This policy called the 'location subsidy' (Faludi, 1994). Therefore, there were massive subsidies targeted to expanding town as long as those towns located outside the agricultural land.

On the other hand, tax incentives policy in Indonesia is not intended to control agricultural land conversion. Agricultural land is not free from tax property; farmers oblige to pay some taxes to the government. However, there are some fiscal policies that might indirectly influence the land conversion, such as the policy of fertilizer subsidy (Ministry of Finance Regulation No. 150/PMK.02/2008). Fertilizer subsidy is aimed at decreasing farmers' production cost. By subsidizing fertilizer price, the intensity of fertilizer uses would increase. Farmers would obtain more profit in their production, and hopefully they would maintain their land for agricultural uses. Nevertheless, it seems that this incentive is not strong enough to influence agricultural land conversion.

Lesson learned is beneficial for countries that face agricultural land conversion problem. Indonesia as one of developing countries can learn from The Netherlands as one of developed countries how to govern agricultural land conversion. The direct method such as land use plan or spatial plan is one of method that can be learned by most of developing countries, because every country has such a plan. The most important lesson that should be learned is how to make the land use plan work effectively to manage agricultural land conversion.

CHAPTER V
DISCUSSION AND RECOMMENDATION

This last chapter discusses some concluding remarks from the previous chapters and suggests some recommendations in dealing with agricultural land conversion related to urbanization.

5.1. Conclusion

Agricultural land conversion is widely seen as a phenomenon that taken place as a consequence of development. The growing population and their activities particularly in urban area need more land for live. In the other hand, land is fixed in supply. Therefore, land in urban area becomes scarce and expensive. In order to meet the demand for land for urban uses, city expands the development to fringe area, where prime and fertile agricultural lands are located. This development causes extensive agricultural land conversion in urban fringe area. Agricultural land conversion is argued as the logical consequences of population growth and economic growth. Therefore, it is unavoidable in development process. However, for the long period, agricultural land conversion will lead to many negative impacts, such as loss of prime agricultural land, loss of agricultural production, loss of agricultural jobs, loss of investment in irrigation infrastructure. In addition agricultural land conversion is worsening the environmental quality. It decreases agricultural land's multifunction such as environmental purification, open space, aesthetic landscape, excursion destination, and culture preservation.

There are many causes influencing agricultural land conversion in urban fringe area. These causes can be categorized as internal and external factors. The former would be related to farm size, pattern of ownership, land characteristics, land productivity, etc. Meanwhile, the later would be related to economic growth, population growth, urbanization, transformation of economic structure, and government policies. These two kinds of factors influence supply of and demand for land for non-agricultural uses. Under perfect competition market operation, this conversion would keep continued, because market allocates land for uses that generate highest return for the owner or the operator.

Urbanization which is measured by urban population, land productivity, and technology uses in agricultural production are criteria used to measure agricultural land conversion in different countries. Urbanization is often considered as a threat to agricultural land in many countries, even in developed countries such as US. In developing countries with rapid economic growth, the economic structure tends to shift from agricultural-based economy to non-agricultural based economy. The development of industrial sector that is believed as engine of economic growth accelerates the conversion of agricultural land. Furthermore, many government policies related to industrialization encourage the development of industrial zones encroaching agricultural land in urban fringe area. The development of these zones not only attract industrial investment but also people to migrate to find new jobs and new life. This situation would be followed by another land conversion that is allocated for residential area, recreation area, road infrastructure, and other facilities supporting human activities.

Through the compare mean analysis, it is found that the hypothesis of difference scale (intensity) of agricultural land conversion in different countries is tenable. Based on empirical result, the intensity of land conversion in developing countries is the highest among these groups, which is 0.712 km^2 per year. In the other hand developed countries face this conversion at the lowest rate, 0,102 km^2 per year. World Bank defines developing countries as countries with low medium income and some of which have a transition in their economies. So, most of developing countries have been faced an economic transformation from traditional agricultural to industrial sector. . Industrial sector that has higher income elasticity than agricultural sector is believed can accelerate economic growth. High economic growth is needed for developing countries to move further to the next stage of development. This finding is strongly supported by some land conversion cases in Indonesia, China, and India.

By means of trend analysis, the trend of agricultural land conversion in less developed, developing, and developed countries can be examined. This trend for all different countries is increased. The empirical result of trend analysis also showed that developing countries has experienced highest average of agricultural

land conversion compare to that of other groups. Obviously, this result leads to conclusion that agricultural land conversion would keep happening in the future if there is no government intervention to control it. Furthermore, based on empirical result, agricultural land conversion developed countries with high income is much lesser than in developing countries; it indicates that as income grows (economic growth) the land conversion would be decline. Since environmental quality is high luxury commodity, so in the high-income economies countries the income elasticity of environmental amenity is high. In the other hand, in the low-income economies, the income elasticity of environmental amenity is very low.

Urbanization, land productivity, and technology uses in agricultural production are strongly correlated with agricultural land conversion in less developed, developing, and developed countries. The increase in urbanization that is measured by urban population, land productivity, and technology uses would be followed by the increase in agricultural land conversion. However, by correlation analysis we couldn't understand the way how these three variables affect agricultural land conversion. Therefore the regression analysis is run. Through the analysis, it is found that only urbanization influence agricultural land conversion significantly. The result of this analysis support previous findings. In developing countries, the increase in urban population would be followed by the increase in agricultural land conversion per capita by high number (when the urban population increase as many as 7,129,843.526 people, the agricultural land will lose for 0.2335 km^2 per capita), while in developed countries the increase of urban population by 4,139,967.138 will be followed by the loss of agricultural land by 0.024064 km^2 per capita. Based on this empirical result, it can be concluded that urbanization is presence in less developed, developing, and developed countries, and the presence becomes a threat to agricultural land loss. However, developed countries are success in managing urbanization process, so the effect is much lesser than that of developing and less developed countries.

Agricultural land conversion has been blamed for several negative impacts on social, economic, and environment. Socially, it causes the transfer of land ownership from indigenous people to new people that move to fringe area. In addition, it also changes people's life style and behavior due to the loss of

indigenous culture. Economically, agricultural land conversion has been blamed for loss of fertile and productive farmland, threat for food security, and loss of investment on irrigation. Environmentally, some scholars urged that in some extent agricultural land conversion causes the decrease of environmental quality. As a parcel of agricultural land converted into urban uses, the quality of environmental amenity in the neighborhood turns into worse. For that reason, it is necessary to preserve agricultural land, whether for economic reason or environmental reason.

Furthermore, up till now the amazing agricultural land conversion is undergoing in the world particularly in many developing countries. Subsequently, based on empirical results the trend of agricultural land conversion will increase year by year, so the government intervention is really needed. Additionally, since urbanization is proved to be the key determinant of agricultural land in less developed, developing, and developed countries, it is essential to manage urbanization in order to control the progress of agricultural land conversion.

Developed countries such as The Netherlands, is very well known for its well-developed spatial planning to manage urbanization. There is no special farmland preservation policy exists in The Netherlands and neither do any quantity targets nor limits on farmland conversion. However, spatial planning act or land use planning plays a dominant role in farmland conversion process. This planning restricts the urban development around existing towns and cities. The success of implementing land policies depend on many aspects. The strong commitment of every level of government on farmland preservation, intergovernmental coordination, financial mechanism, and public support are elements required to succeed the implementation of land policies to control the progress of agricultural land conversion.

Finally, land use is not static, but rather a dynamic interacting system. Urbanization that causes agricultural land loss cannot be avoided. However with a proper management and planning, it can be restricted. Planning directs urban expansion in desired and suitable way, protecting fertile and productive agricultural land. The stricter implementation of land use plans/spatial plan or even land conversion laws is needed. Furthermore, the farmers should be provided

by some incentives to remain in farming activities, such as tax incentives. They should be encouraged to go back to farming activity. This is one of ways to control rural urban migration, and prevent the conversion from agricultural land to other uses as well.

5.2. Recommendation

Agricultural land loss is a problem typical of the development of transition economy. It is broadly accepted as common phenomenon and part of daily life. However, the negative consequences emerged from this phenomenon in the long term period, force countries in the world to develop their awareness of agricultural land conversion. By understanding the behavior of agricultural land conversion in different countries, it can be explored which countries experience severe agricultural land conversion, what factors causing it, and what should be done to deal with this phenomenon.

Obviously, the conversion of agricultural land to urban uses would keep continuing in the future. Therefore, government should interfere to slow the progress of this conversion. It is widely seen that developed countries are success in keeping their farmland loss at minimum scale. They have been experienced urbanization process as well; however they can manage the urban development and agricultural land conversion very well.

The developing countries have the potency to be success in controlling agricultural land conversion. They have been aware of the problems caused by agricultural land conversion. It is indicated by some laws and regulation that issued by the governments to protect agricultural land. Recently, the Indonesian government's awareness will be realized by the issue of Sustainable Agricultural Land Preservation Act. This act is aimed at preserving agricultural land in rural area to support food security for future generation. Agricultural land preservation should become the main concern of local and central government; the act would be treated as a means of preventing illegal conversion of agricultural land to urban uses. It authorizes the local and central government to impose a sanction on illegal agricultural land conversion. However, the implementation must be accompanied

by strict law enforcement; otherwise it would be violated just like previous laws, and regulation prohibiting agricultural land conversion.

Some economists argue that this law will not effective enough to hamper agricultural land conversion without public participation and economic incentives (Maksum, 2009). The local government has no right to forbid people to sell their land and change the uses. Therefore, people should be involved in every policy that is decided by government. Public participation is needed in order to spread the knowledge about the importance of agricultural land and the impact of its conversion. Furthermore, this legal approach (law and regulation) must be accompanied by other approaches, such as economic approach (tax incentives, agricultural subsidy such as fertilizer, seed, agricultural technology) to encourage farmers to remain in farming activities.

Law enforcement, public participation, and strong commitment of government on preserving prime and productive farmland in urban fringe largely seem as factors contribute to failure of controlling land conversion in many developing countries. Learning from other successful developed countries in dealing with agricultural land conversion is one of many efforts that can be done by less developed and developing countries to solve the same problem. However, there is no guarantee that learning the successful method from others can result in success for our country due to different institutional, planning system, and economic and social condition. Nevertheless, it is important to learn how governments in developed countries perform their land policies, and how consistent they are in implementing the land policies.

References

Aryal, Shivakoti Shabnam, 2002, "Women in Land Management and Conservation : A Case Study from The Middle Hills of Nepal", MSc Thesis, Asian Institute of Technology, Bangkok, Thailand

Babbie, Earl, 11th edition, *The Practice of Social Research*, (Thomson Learning, Inc., 2007).

Barlowe, Raleigh, (4th edition), *Land Resource Economics The Economics of Real Estate*, (New Jersey, Prentice-Hall, 1986).

Berke, Philip R, et.al, *Urban Land Use Planning*, (Urbana and Chicago : University of Illinois Press, , 2006)

Cochran, William G., *Sampling Techniques*, 3rd edition, (Willey, 1977)

Dolowitz, David and David Marsh, 1996, "Who Learns What from Whom: a Review of the Policy Transfer Literature", *Political Studies*, Vol. XLIV, pp. 343-357.

Drozd, David J and Bruce B. Johnson, 2004 "Dynamics of Rural Land Market Experiencing Farmland Conversion to Acreages: The Case of Saunders County, Nebraska", *Land Economics*, Vol. 80 No.2, pp. 294-311,.

Evans, Alan W, (1st edition), *Economics, Real Estate and The Supply of Land*, (Oxford, Blackwell Publishing, 2004).

Fahmudin, Agus and Irawan, 2006, "Agricultural Land Conversion as A Threat to Food Security and Environmental Quality", *Jurnal Litbang Pertanian*, 25 (3) pp.90-98.

Faludi, Andreas, 1994, "Coalition Building and Planning For Dutch Growth Management : The Role of The Randstad Concept", *Urban Studies*, Vol.31, Issue. 3, pp. 485-508.

Fazal, Shahab, 2001, "The Need for Preserving Farmland A Case Study from A Predominantly Agrarian Economy (India)", *Landscape and Urban Planning* 55, pp. 1-13.

Field, Andy, (2nd edition), *Discovering Statistics Using SPSS*, (Sage Publication, 2005).

Firman, Tommy, 1997, "Land Conversion and Urban Development in the Northern Region of West Java, Indonesia", *Urban Studies*, Vol. 34, No.7, pp. 1027-1046.

Firman, Tommy, 1999, "Rural to Urban Land Conversion in Indonesia during Boom and Bust Periods", *Land Use Policy*, Vo. 17, pp.13-20,.

Forkenbrock, David J and Peter S. Fisher, 1982, "Tax Incentives to Slow Farmland Conversion", *Policy Studies Journal*, 11:1 , pp. 25-36.

Furuseth, Owen J, 1982, "Agricultural Land Conversion: Background and Issues", *Journal of Geography*, 81:3, pp.84-93.

Han, Sun Sheng and Chun Xing He, 1999, "Diminishing Farmland and Urban Development in China:1993-1996", *Geo Journal* 49, pp.257-267.

Harvey, Jack, (2nd edition), *Urban Land Economics The Economics of Real Property*, (London: Macmillan Press Ltd, 1987).

Ho, Samuel, P.S and George C.S Lin, 2004, "Converting Land to Non Agricultural Use in China's Coastal Provinces : Evidence from Jiangsu", *Modern China*, Vol.10, No.1, pp. 81-112.

Ilham, Nyak, et.al, "Perkembangan dan Faktor-Faktor Yang Mempengaruhi Konversi Lahan Sawah Serta Dampak Ekonominya", Pusat Penelitian dan Pengembangan Sosial Ekonomi Pertanian Bogor. (no date)

Irawan, Bambang, 2008, "Meningkatkan Effektifitas Kebijakan Konversi Lahan", *Forum Penelitian Agro Ekonomi*, Vol. 26 No. 02, pp. 116-131.

Kaiser, J Edward, et al., *Urban Land Use Planning* , (University of Illinois Press, 1995).

Kivell, Philip, *Land and The City, Patterns and Process of Urban Change*, (Routledge, 1993).

Lichtenberg, Erik and Chengri Ding, 2008, "Assessing Farmland Protection Policy in China", *Land Use Policy*, Vol.25, pp.59-68.

Liu, Li-Jun, et al., 2008 "Exploring The Environmental Kuznets Curve Hypothesis between Economic Growth and Farmland Conversion in China", *J.Fac.Agr., Kyushu Univ.*, 53(1), pp. 321-327.

Levia Jr, Delphis F and Daniel R. Page, 2000, "The Use of Cluster Analysis in Distinguishing Farmland Prone to Residential Development : A Case Study of Sterling, Massachusetts", *Environmental Management*, Vol.25 No.5., pp.541-548.

Ludiyanta, 2006, *Coping With Farmland Conversion in Urban Fringe Areas (Case Study Randstaat, The Netherlands and Yogyakarta, Indonesia)*, Thesis ITB and RUG.

Maddala, G.S, *Econometrics*, (McGraw – Hill Inc., 1977).

Malaque III, Isodoro R. and Makoto Yokohari, 2007, "Urbanization Process and The Changing Agricultural Landscape Pattern in The Urban Fringe of Metro Manila, Philippines", *Environment and Urbanization* Vol. 19(1), pp. 191-206.

Mori, Hiroshi, 1998, " Land Conversion at Urban Fringe Area : A Comparative Study of Japan, Britain, and The Netherlands, , *Urban Studies*, Vol.35, No.9, pp. 1541-1558.

Needham, Barrie, *Dutch Land Use Planning, Planning and managing land use in the Netherlands, the principles and the practice*, (Sdu Uitgevers bv Den Haag, 2007).

Nelson, Arthur C, 1990, "Critique of U.S. Prime Farmland Preservation Policies Towards State Policies that Influence Productive, Consumptive, and Speculative Value Components of the Farmland Market to Prevent Urban Sprawl and Foster Agricultural Production in the United States", *Journal of Rural Studies*, Vol. 6 No.2, pp. 119-142,

O' Hara, Philip Anthony, 2006,"A Chinese of Soacial Structure of Accumulation for Capitalist Long Wave Upswing?", available at http://pohara.homestead.com/files/ChineseSSA.doc (visited August, 5, 2009).

Pryce, Gwilym, 2002, "Heteroscedasticity: Testing and Correcting in SPSS", available at

www.geocities.com/.../SPSS/HeteroscedasticityTestingAndCorrectingInSPSS1.pdf -(visited at July, 12, 2009)

Rahmanto, Bambang, et al., (no date,) "Persepsi Mengenai Multifungsi Lahan Sawah dan Implikasinya Terhadap Alih Fungsi Ke Penggunaan Non Pertanian", *Pusat Analisis Sosial Ekonomi dan Kebijakan Pertanian, Litbang Pertanian.*

Rivera, Maximiano M, and Roela Victoria Rivera, Revised Edition, *Practical and Guide to Thesis and Dissertation Writing*, (Quezon City: Katha Pubishing Inc., 2007)

Sumaryanto and Muhammad Iqbal, 2007, "Strategi Pengendalian Alih Fungsi Lahan Pertanian Bertumpu pada Partisipasi Masyarakat", *Analisis Kebijakan Pertanian* Vol. 5, No.2, pp. 167-182.

Sykes, Alan O, An Introduction to Regression Analysis, no date, available at www.law.uchicago.edu/files/files/20.Sykes_.Regression.pdf (visited at August, 2, 2009)

Syrquin, Moshe and Hollis B. Chenery, *Patterns of Development 1950-1983*, (World Bank, 1989)

Tan, R., et al.,2009, "Governing farmland conversion: Comparing China with the Netherlands and Germany", *Land Use Policy* doi:10.1016/j.landusepol.2008.11.009.

Todaro, P Michael, *Reflections on Economic Development*, (Edward Elgar Publishing Ltd, 1995).

Todaro, P Michael, 7th edition, *Economic Development*, (Addison Wesley, Longman, Inc, 1999).

Van den Berg, LM, et al., 2003, "The transformation of Agriculture and Rural Life Downstream of Hanoi", *Environmental and Urbanization*, Vol. 15, No. 3, pp. 35-52.

Viglizo, E.F., et al., 2004, "Scale-dependent Controls on Ecological Functions in Agroecosystems of Argentina", *Agriculture, Ecosystem, and Environment* 101, pp. 39-51.

Visco, Emilia S, 2006, "Dynamics of Conflict of Cooperation of Group Stability among Selected Government-Assisted Cooperatives I Region IV, Philippines", *International Journal of Social Sciences*, 1;4, pp. 222-232.

Xie, Yichun, et al., 2005, "Socio-Economic Driving Forces of Arable land Conversion: A Case Study of Wuxian City, China", *Global Environmental Change*, 15, pp.238-252.

Yafee, Robert, Common Correlation and Reliability Analysis with SPSS for Windows, no date, available at : www.nyu.edu/its/statistics/Docs/correlate.html (visited at August, 2, 2009)

www.nationmaster.com

www.earthtrends.wri.org

http://tutor2u.net/economics/content/topics/development/development.ldcs.htm

Multi-Collinearity, Variance Inflation, and Orthogonalization in Regression, available at http://www.creative-wisdom/computer/sas/collinear stepwise.html (visited at 10 August 2009)

http://www.statemaster.com

http://www.worldbank.org

Bupati Pemberi Ijin Alih Lahan Pertanian Akan Dipidana, Kompas 19 August 2009, available at www.Kompas.com (visited at 19 August 2009).