LAND DEGRADATION & DEVELOPMENT

Land Degrad. Develop. (2010)

Published online in Wiley Online Library (wileyonlinelibrary.com) **DOI**: 10.1002/ldr.1037

AGRICULTURAL LAND CONVERSION DRIVERS: A COMPARISON BETWEEN LESS DEVELOPED, DEVELOPING AND DEVELOPED COUNTRIES

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Received 26 April 2010; Revised 7 June 2010; Accepted 13 July 2010

ABSTRACT

This study examines the level of intensity, trend and the main drivers of agricultural land conversion (ALC) worldwide. Considering the World Bank classification and using a stratified random sampling, 94 countries were selected in three different groups: less developing, developing and developed countries. Data were obtained from two databases; Nation Master and Earth Trends for the period of 1961–2003. The empirical results revealed some differences in the level of intensity and the trend of ALC among the groups. Agricultural land loss was more intensified in developing countries experiencing rapid economic growth and a transition in their economic structure. The results also showed that there is a positive correlation between ALC and productivity, capital–labour ratio and urban population. Urban population was identified as the main driver affecting ALC in all the countries. Furthermore, although urbanization process exists in all the groups, the developed countries are more successful in managing urban development and ALC. Considering the increasing trend of ALC in the future and its socio-economic and environmental impacts, this study concluded that governments' intervention in land policies is needed to preserve agricultural lands.

KEY WORDS: agricultural land conversion; industrialization; land policy; population growth; urbanization

INTRODUCTION

Background

Land conversion is a process by which land is changed from agricultural to urban uses. There is a debate on whether agricultural land fringing should be maintained or converted to other uses. This debate can be shown from both the pro-ruralist and the pro-urbanist perspectives. In the pro-ruralists view, land conversion has negative impacts: the loss of prime agricultural land, reduced agricultural jobs and wasted investment in irrigation infrastructure. Consequently, it could affect agricultural production and threaten the food security. Pro-ruralists conclude that agricultural land should be kept to maintain food production. On-the-other-hand, the pro-urbanists argue that land conversion is a logical consequence of urban growth. The decline of agricultural production, they argue, can be solved by intensification and technological production. Hence, land conversion is not considered as a threat in their view.

Land conversion is a phenomenon that is almost unavoidable during economic development and population growth periods (Tan *et al*., 2009). However, uncontrolled land conversion has great impacts on environment in general and agricultural products in particular. Subsequently, some countries such as China, Japan and the USA have tried to preserve agricultural land from being converted to other uses (Lichtenberg and Ding, 2008). In China, since 1980, the conversion of agricultural land to non-agricultural land has been widespread and intense (Ho and Lin, 2004). High population density, rapid economic growth and the urbanization process are believed to be the main factors causing agricultural land conversion (ALC) in China. In 1995, ALC accounted for more than two-third of the loss in cultivated land in several areas. During 1996–2000, the rate of ALC in The Netherlands was only 17 ha per day while in Germany in 2006 the rate was 114 ha per day. Such rates are much lower than in China and Indonesia which respectively experienced 802 (in 2004) (Tan *et al*., 2009) and 514 ha per day (2000–2002) (Agus and Irawan, 2006). The above description makes it clear that the rate of ALC is different in developed and developing countries. It is therefore important to explore the main drivers of ALC in different countries.

Agricultural Land Conversion Drivers

The phenomenon of ALC in different countries is varied in terms of intensity, trend and drivers. According to Setiawan and Purwanto (in Firman, 1997), there are two main drivers that contribute to ALC: internal and external. The former is

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related to the location and land potential (including land productivity), ownership pattern (including land size) and household size and income. The later includes urbanization, socio-economic conditions and government policies.

External drivers

Industrialization. Industrial development is widely seen as an engine for economic growth (Lichtenberg and Ding, 2008). China, for example, is known for its rapid economic growth. During the 1980s–1990s, Chinese growth was closely supported by the development of China's rural non-agricultural sector, particularly the spread of enterprises owned by rural communities, called township village enterprises (TVEs) (Ho and Lin, 2004). In China, rural industries are located in areas where agriculture is better developed and located close to urban centres. The 62% of TVEs were concentrated in coastal provinces; hence, the rural industries exerted significantly more pressure on rural communities to convert agricultural land to non-agricultural uses.

Firman (1999) found that industrial estates development, particularly in regions surrounding Jakarta, was the main factor causing extensive ALC in Indonesia. This land conversion was followed by other transformation. There are some regions (peripheral areas) that show a transition from agricultural economy to industrial and service-based activities. This transition is also reflected by employment structure. The employment structure transforms from a primary economy to secondary and tertiary industries. Additionally, the number of households involved in agricultural activities was declining. The strategy to attract foreign direct investments and to improve global competitiveness in Indonesia's industrial sector exacerbates rapid ALC in the urban periphery. This strategy stimulates the development of many light industries such as footwear, electronics and plastics manufacturing. The strategy has therefore made the ALC more severe.

Urbanization. The urbanization process and rural–urban migration are two major factors that influence ALC and have been widely studied. Han and He (1999) studied the distribution pattern of farmland loss in several cities in China and also examined the relationship between urbanization and farmland conversion in the cities. They found that there was a significant positive correlation between the urban population growth (as the main measurement of urbanization) and farmland conversion in coastal cities. Their results support Ho and Lin's (2004) study that showed industrialization also causes farmland conversion in coastal cities in China. They conclude that the industrialization process in China is often synchronized with urbanization and consequently causes farmland conversion.

Rapid population growth influences ALC because greater population means the expansion of built areas to provide more housing and employment opportunities. Fazal (2001) discusses how urbanization influences ALC in India. He argues that the urbanization pattern and high population growth in developing and underdeveloped countries lead to pressure on land. This urban expansion encroaches on fertile agricultural lands. India has experienced huge loss of agricultural land due to rapid urbanization and the expansion of urban areas combined with growing population.

Housing development is one of the main activities that has caused ALC in Indonesia, during the last 20 years. Housing development has taken place very intensively in the outskirts of Jakarta (Firman, 1997). Han and He (1999) also noted that the real estate speculation, which is a new phenomenon in China, is a cause for fast reduction of farmlands. They argue that another problem in real estate development that directly affects farmland conversion was ineffective use of the converted lands. Due to this, there was a large proportion of the land parcels flagged for industrial or residential development which was left vacant for a long time. According to the Chinese Ministry of Land and Natural Resources, in 1996, about 40 per cent of urban construction land was utilized ineffectively. There were 1160 km^2 of converted land parcels left idle after being acquired.

Metro Manila, is another city that has suffered from ALC due to the urbanization process (Malaque and Yokohari, 2007). There was a period of land development in the urban fringe of Metro Manila, between 1982 and 1997. This period was mostly influenced by a policy that encouraged the spreading industries in rural areas and made land conversion a common phenomenon in the City.

Road infrastructure development. Infrastructure development, such as road construction also contributes to ALC in most countries. China has faced such pressures (Lichtenberg and Ding, 2008) about two decades ago. As the industry grows rapidly, the agricultural sector becomes commercialized, the people's income grows, and the number of commuting people increases, China's inadequate road system becomes more congested. A reliable and efficient transport infrastructure is therefore needed for sustained economic growth.

According to Ho and Lin (2004), the various road projects in China demand a large amount of agricultural land. Many scholars believe the road construction that supports industrial development and links to highways, has caused encroachment on fertile agricultural lands. This view was supported by Landsat images of various regions in coastal China. For instance, of 12 682 hectares of construction land developed between 1987 and 1997 in the Jinan metropolitan region in Shandong, 54 per cent were converted from cultivated lands to industrial uses (Ho and Lin, 2004). By

using Landsat images of Dongguan (a county-level city in the Pearl River Delta in Guangdong) taken in 1988 and 1993, Ho and Lin (2004) constructed a land use conversion matrix for the region and found that nearly 94% of the construction sites in 1993 were agricultural lands in 1988.

Government policy. Most of economic development policies tend to foster industrial growth and indirectly stimulate intensive land conversion in many developing countries, like Indonesia, China, Vietnam, and the Philippines (Van den Berg *et al*., 2003; Malaque and Yokohari, 2007; Irawan, 2008; Lichtenberg and Ding, 2008). Furthermore, spatial development policy, which determines whether an area becomes industrial site or residential, boosts the conversion of agricultural land in that area. The policy of establishing industrial zones in the urban periphery of Jakarta, such as Tanggerang, Bekasi and Karawang caused extensive ALC in Indonesia (Firman, 1997). China's government decided to relocate industrial zones to suburban areas to solve the congestion problem and also caused huge farmland loss in coastal provinces (Ho and Lin, 2004).

Current housing regulations in China support local government to provide housing for the growing population by expanding into rural areas rather than intensifying the density within urban areas. Local government considers that redevelopment of existing municipal land requires it to pay compensation to current tenants and to cover resettlement expenses. The compensation payment to current residents is much higher than the payments to the rural inhabitants. Furthermore, it is more expensive to provide new infrastructures in high dense population areas. For those reasons, it is more profitable for local governments to fulfil the need for housing by converting farmland to residential areas rather than increasing density within urban boundaries.

Internal drivers

Land productivity. Levia and Page (2000) examined the driving forces of ALC to residential uses. Farm size, farm slope and distance to nearest cities and highways are the variables hypothesized as factors fostering farmland conversion in Massachusetts. They found that all those variables are the primary determinants of the ALC. Farm size is an important variable which should be considered due to the scale of economy and land value. From the housing developers' point of view, it is more feasible and profitable to choose large farms rather than small farms due to the scale economy. Therefore, the land value increases alongside the farm size. The vast majority of farmland conversion is of those farms which have little slope. Farms with slopes greater than 15 degrees are less profitable for residential development due to high cost of landscape levelling. Construction costs (e.g. road construction, foundations and wells) on flat lands are almost always less than on uneven lands (Nelson, 1990).

In addition, according to Firman (1997), lands with better qualities (flat and well drained) are more attractive for housing development. Farms close to a city and major highways are prone to be converted to urban uses. This is due to the prime location of the farm relative to employment, shopping centres and entertainment opportunities. Such prime locations attract housing development and developers bid high prices for the farms. Those farms which have such characteristics are generally productive farmlands. Productive farmlands are often located on flat (not uneven) areas, are closer to water sources, urban areas and are well-drained. More productive farmlands are at the risk of being converted as housing developers find them more profitable due to the low construction costs. This means, farmlands' owners will earn much from selling the farm due to the high land value.

Technology intensity. When using improved and modern technologies in agriculture, demand for labour will decrease. The technologies will create labour surplus in the agricultural sector. Such labourers will look for jobs in urban areas and therefore require more lands for more services for the growing economy and population. Therefore, the more cities expand to fringe areas, the more the possibility of ALC can be expected.

Objectives

As thus far discussed, many studies have focused on land conversion and its drivers. However, the phenomenon of ALC has not been systematically explored as a comparative study between South and North. The main objective of this paper is therefore to draw a picture on the main drivers of ALC in less developed, developing and developed countries. More specifically, our study aims: (i) to analyse the phenomenon of ALC in the three groups of countries; (ii) to identify the main drivers of ALC in the countries; and (iii) to understand how ALC happens in different stages of development.

METHODOLOGY

Study Population

This study is conducted as a quantitative time-series analysis for the period of 1961–2003 when the data could be obtained on land conversion drivers in less developed, developing and developed countries from two online databases: Nation Master and Earth Trends Data Base (the most comprehensive available data sets on ALC and its drivers). From a total of 200 countries reported in the databases, 123 countries adequately reported the status of their agricultural lands and were considered as the population of this study.

Study Sample

In this study, the sample size is calculated based on Slovin's formula (Visco, 2006; Rivera, 2007):

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

Where n is sample size, N is population and e is percentage of imprecision of sampling that can be tolerated (5%). The sample was therefore estimated as below:

$$n = \frac{123}{(1 + 123 \times 0.05 \times 0.05)} = 94.07 \simeq 94$$

Considering the World Bank classification (2008) and using a stratified random sampling, the sample was divided into three strata which are: less developed, developing and developed countries[1]. The sample size was proportionally calculated from each stratum and accounted respectively for 29, 46 and 19 countries.

RESULTS AND DISCUSSION

Agricultural Land Conversion in Different Countries

An ANOVA estimation was run to find the mean difference of the ALC among the countries. Table I shows that all the strata have negative means which indicate that they are all affected by the ALC. However, there are some differences among the strata that show different conversion intensities, where developing countries experience the highest land conversion (−0·712) and developed countries face the least (−0·102).

As previously discussed, 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 in composition of economic activities and a shift of allocation in the main production factor (land). The land which was previously allocated to a low productivity sector such as agriculture will be converted to high productivity sector such as industry, commerce, services, etc. The urban uses that encroach on fertile agricultural lands are also stimulated by rapid population growth in developing countries. The development of industrial estate and commercial areas attract people particularly from rural areas to migrate to urban areas in order to look mainly for better social services and new job opportunities.

[1]Based on the World Bank (2008) definition, developing countries are those with low or middle levels of GNP per capita, some of which have experienced a transition in their economies.

Table I. Mean comparison of ALC among the strata (ANOVA)

Strata	ALC Mean[a]
Less developed countries	−0·557 a
Developing countries	−0·712 a
Developed countries	−0·102 b

F = 105·65; Sig. = 0·00.
[a]Common letters show non-significant mean (estimated by LSD, $p \leq 0{\cdot}05$).

Agricultural Land Conversion Trend

A trend analysis was conducted to understand the tendency of land conversion in each stratum. A regression analysis was used to explain this trend. The regression results for less developed, developing and developed countries are shown in Tables II and III.

As shown in the tables, all the groups have positive trend in ALC. This means that the ALC is increasing in all the strata. Based on the results in less developed countries, the beta coefficient for time is estimated at 0·537. It means that if 'time' increases by one standard deviation (12·268 year), the standard deviation of ALC will increase 0·537 and the time makes a change in the ALC equal to 0·133 km^2 per capita (0·537 × 0·247). Therefore, for almost every 12-year period, farmers loose 0·133 km^2 of their agricultural land (converted to urban uses). This loss, given in the tables, for farmers in developing and developed countries is respectively 0·233 and 0·022 km^2. This finding shows that the ALC in developing countries, compared to the two other groups, stands at the highest rate.

The results of trend analysis in Figure 1 support this finding. As shown in the figure, almost for every 12-year period, developing countries have experienced the highest average of the ALC compared to less developed and developed countries.

Association Between the Main Drivers

The hypothesis of whether there is any association between ALC, productivity, ratio of capital–labour and urban population was tested by Pearson correlation analysis. The results of this analysis are shown in Table IV.

Based on the table, there are some significant ($p \leq 0{\cdot}01$) positive associations between ALC, productivity, capital–labour ratio and urban population. The positive sign of the correlation coefficient implies that when the productivity, capital–labour ratio and urban population increase, one may predict an increase in ALC.

Land productivity and ALC have direct correlation ($r = 0{\cdot}88$) which implies that the increase in land productivity is associated with the increase of ALC. Generally, land with high productivity is fertile and often close to water sources. The development of industrial or commercial sites usually associates with natural or human made advantages,

Table II. Agricultural land conversion trend: summary of regression models in different strata

Strata	R	R^2	Adjusted R^2	Standard error	F
Less developed	0·537[a]	0·289	0·271	0·211	6·561
Developing	0·980[a]	0·960	0·959	0·047	995·940
Developed	0·407[a]	0·166	0·145	0·051	7·952

[a]Predictor: (Constant), time.

such as soil fertility, access to water, market or roads. Such accessibilities play an important role in determining the location for housing and residential development. The construction cost on flat lands is always much less than rough lands (Nelson, 1990). Due to high productivity, land owners are often willing in fragmenting their lands and sell it to the market which offers high prices (Drozd and Johnson, 2004). As concluded by Irawan (2008), the more productive land is, the higher its price is. According to him, during the period 2000–2002 in Indonesia, the ALC mainly accounted for residential development (48·96%), industrial (36·50%) and administrative sites (14·55%) while in Hanoi (Vietnam) during the period 1991–1993, an average of 15% decline in ALC was reported by Van den Berg *et al.* (2003).

According to Firman (1999), in Indonesia, ALC has not only squeezed the farmlands but has also diminished the productivity of remaining paddy fields from 4·5 to 3·4 t ha^{-1}. It indicates that the conversion also happens in productive agricultural lands. The development of housing and industrial sites has therefore greatly transformed urban fringes from prime and irrigated farmlands to new residential and industrial areas.

In short, the potential of such productive lands to be converted to other uses is greater than less productive lands due to the following reasons: (i) the development of non-agricultural activities (such as housing, commercial and industrial sectors) on a flat and productive land is much easier and more attractive for land grabbers than on rough lands; (ii) higher productivities ask also for the development of infrastructures (e.g. road construction in quality agricultural lands where the higher productivities can faster be reached); (iii) the productive agricultural land is often located close to urban areas where the products can reach the market faster and with lower costs.

Nevertheless, a high K/L ratio (often called K-deepening or L-saving technological progress) which shows that farmers improve their production technologies should also be addressed. When using the improved technologies, farming requires fewer operators/workers. The dismissed workers will consequently look for job opportunities often in cities where new jobs are generated by the growing economy. Consequently, the creation of more jobs in non-agricultural sectors needs more land and as a result, cities will expand their outskirts and compete for land uses. This phenomenon is also characterised by the decrease of workers who work in the agricultural sector, particularly in developed countries due to the increased use of technology in the agricultural sector. In our study, this variable shows a direct correlation with the ALC ($r = 0{\cdot}87$). It means that an increase in capital–labour ratio is associated with an increase in the ALC.

As shown in Table IV, urban population has also a direct correlation with the ALC ($r = 0{\cdot}87$). Hence, an increase in urban population is also associated with an increase in the ALC. The increase of economic growth encourages the change of economic structure from agricultural sector to non-agricultural sectors. This shift triggers an increasing growth in non-agricultural sectors. The development of commercial and industrial sites attracts more people to find a job and new life close to those sites. This situation creates another demand for housing and other facilities for the workers' settlement. Moreover, due to a usual high land

Table III. Agricultural land conversion trend: summary of in different strata[a]

	B	Standard error	Beta	T	Sig.
Less developed countries					
(Constant)	−0·791	0·067	—	−11·883	0·000
Time	0·011	0·003	0·537	4·028	0·000
Developing countries					
(Constant)	−1·119	0·015	—	−11·883	0·000
Time	0·019	0·001	0·980	30·918	0·000
Developed countries					
(Constant)	−0·142	0·016	—	−8·800	0·000
Time	0·002	0·001	0·407	2·820	0·007

[a]Dependent variable: ALC.

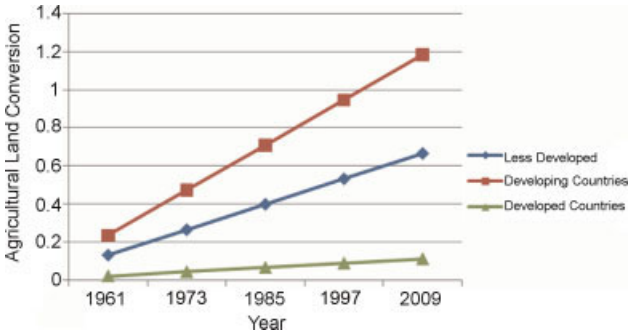

Figure 1. The ALC trend in less developed, developing and developed countries. This figure is available in colour online at wileyonlinelibrary.com

price in city centres, many firms would go to suburban areas and consequently many workers will become commuters.

Agricultural Land Conversion Drivers

A time-series regression analysis was used to understand the relationship between the ALC as dependent variable and productivity, capital–labour ratio and urban population as independent (explanatory) variables. The results of this analysis are presented in Tables V and VI.

Based on the results, the following models for the ALC and its drivers can be formulated:

$$y1 = -0.907x_1 - 0.413x_2 + 1.790x_3 + \varepsilon$$
$$y2 = 0.260x_1 - 0.260x_2 + 0.998x_3 + \varepsilon$$
$$y3 = -0.629x_1 - 2.139x_2 + 3.210x_3 + \varepsilon$$

where $y1$, $y2$, $y3$ are the ALC in less developed, developing and developed countries, respectively; x_1 is the productivity; x_2 is the capital–labour ratio; x_3 is the urban population and ε is the random disturbance term.

Using 'stepwise method', the only variable which was selected as the main explanatory variable, was urban population, and the ALC's model should therefore be corrected as follows:

$$y1 = 0.499x_1 + \varepsilon$$
$$y2 = 0.987x_1 + \varepsilon$$
$$y3 = 0.433x_1 + \varepsilon$$

In the estimated model, only 'urban population' significantly influences the ALC in all the strata. 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 the variables is calculated in Table VII.

As estimated in the corrected $y1$, in less developed countries, the standardized β for urban population is 0·499. It means, if urban population increases by one standard deviation (4 980 358 people), the ALC will increase by 0·499 of its standard deviation (0·247). Therefore, a change of 0·123 km^2 per capita in the ALC can be expected (0·499 × 0·247). As a result, when urban population increases one standard deviation (4 980 358 people), farmers will loose 0·123 km^2 per capita of their agricultural land. Based on the same estimations, the loss of 0·233 and 0·024 km^2 in farmlands can respectively be predicted for developing and developed countries, when their urban populations increase to 7 129 843 and 4 139 967 as shown in Figure 2.

The empirical evidence confirms these results. In developing countries, the increase of urban population causes intensive ALC. The increase of urban population to more than 7 million would lead to a loss in agricultural land around 0·233 km^2 per capita. People's migration to urban areas needs more land. The increase need for job, housing,

Table IV. Pearson correlation between the main drivers

Drivers	ALC	Productivity	Capital–Labour ratio	Urban population
ALC	1·00			
Productivity	0·881**	1·00		
Capital–labour ratio	0·874**	0·988**	1·00	
Urban population	0·875**	0·987**	0·998**	1·00

**$p \leq 0{\cdot}01$.

Table V. Agricultural land conversion drivers: summary of regression models in different strata

Strata	R	R^2	Adjusted R^2	Standard error	F	D.W.[b]
Less developed	0·537[a]	0·289	0·233	0·217	5·146	2·057
Developing	0·989[a]	0·977	0·976	0·036	548·258	1·079
Developed	0·584[a]	0·341	0·289	0·046	6·561	1·473

[a]Predictors: (constant), productivity, capital–labour ratio, urban population.
[b]The Durbin–Watson statistic ranges from 0 to 4. A value near 2 (1·80 to 2·20) indicates non-autocorrelation; a value towards 0 indicates positive autocorrelation; a value towards 4 indicates negative autocorrelation (see Savin and White, 1977).

Table VI. Agricultural land conversion drivers: summary of analysis in different strata[a]

	B	Standard error	Beta	*T*	Sig.
Less developed countries					
(Constant)	−0·791	0·067	—	−11·883	0.·000
Productivity	−0·001	0·001	−0·907	−1·185	0·243
Capital–labour ratio	−2·671	3·375	0·413	−0·791	0·434
Urban population	0·000	0·000	1·790	1·998	0·053
Developing countries					
(Constant)	−1·390	0·052	—	−26·504	0·000
Productivity	0·000	0·000	0·260	2·237	0·031
Capital–labour ratio	−0·089	0·000	−0·260	−1·281	0·208
Urban population	0·000	0·070	0·998	7·450	0·000
Developed countries					
(Constant)	−0·934	0·234	—	−3·989	0·000
Productivity	−0·000	0·000	−0·629	−0·681	0·500
Capital–labour ratio	−0·007	0·003	−2·139	0·024	0·021
Urban population	0·000	0·000	3·165	0·003	0·018

[a]Dependent variable: ALC.

Table VII. Standard deviation of urban population and ALC

Variables	Standard deviation		
	Less developed	Developing	Developed
ALC (Y)	0·247	0·236	0·055
Urban Population (x)	4 980 358	7 129 843	4 319 967

Source: the study results.

recreation, commercial area, parking sites, road infrastructure, educational and other facilities that create social welfare, increases demand for land. On-the-other-hand, land in urban areas becomes scarce and expensive, so the development sprawls to fringe areas and grabs fertile agricultural lands. Consequently, the possibility of agricultural lands to be converted to urban uses is getting higher and higher. On the contrary, in developed countries, the increase of urban population to more than 4 million, would lead only to a small loss in agricultural land around 0·024 km^2 per capita. The possible reason for this phenomenon is that the developed countries had already passed the stage of 'take-off' to 'self sustaining growth' of Rostow's stages in economic growth, and they are now driving to 'maturity' stage (Todaro and Smith, 2009). These stages are indicated by mainly low number of population and low economic growth in developed countries. According to Liu *et al.* (2008), there is a relation between economic growth and ALC. It is needless to say that the ALC can fulfil the growing demand for land induced by economic growth. In the early stage of development, ALC keeps stepping forward with economic growth. However, when economy reaches higher levels, economic growth has a negative impact on the ALC. The structure of economy shifts from high land-intensive to low land-intensive industries, such as services and technological industries. As a result, the ALC begins to slow down.

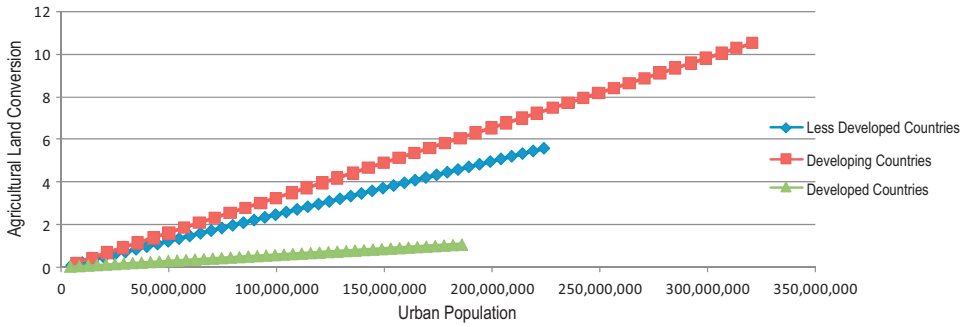

Figure 2. Estimated farmlands' loss in the three strata based on the model. This figure is available in colour online at wileyonlinelibrary.com

Moreover, during the studied period (1961–2003), most of developed countries gradually began to concern that economic growth, urbanization and population decentralization accelerate the conversion of farmlands to urban uses. Therefore, in the late-1960s, the idea of controlling urban development to preserve the farmlands started to emerge (Nelson, 1990). On-the-other-hand, during that period, most of developing countries experienced a great leap forward: a cultural revolution, economic structure transformation and reorientation from agricultural to manufacturing investment (O'Hara, 2006). Hence, the amazing conversion of agricultural lands to urban uses occurred in that period.

CONCLUSION

As discussed in this paper, ALC is widely seen as a consequence of industrialization. The growing population and its needs, particularly in urban areas demands more land that is fixed in supply. Therefore, land in urban areas becomes scarcer and more expensive. In order to meet the growing demand for land, city development expands to fringe areas where prime and fertile agricultural lands are located. This development causes intensive ALC in urban fringe areas. ALC is therefore argued as a logical result of population growth and economic development and it has been neglected as an unavoidable consequence in the development process. However, for a long period, ALC will lead to many negative impacts, such as loss of prime farmlands, production, jobs and infrastructure. Urbanization is therefore often considered as a threat to agricultural land in many countries. In developing countries with rapid economic growth, the economic structure tends to shift from an agricultural-based to a non-agricultural-based economy. The development of the industrial sector that is believed to be the engine of economic growth accelerates the conversion of agricultural lands. Furthermore, some governmental industrialization policies encourage the development of industrial zones to grab agricultural lands in urban fringe areas. The development of these zones not only attracts industrial investments but also encourages people to migrate and look for new job opportunities. This situation could be exacerbated by higher rates of land conversion resulting in residential and recreation areas, and from development of infrastructure and services.

This study showed that ALC in different countries is intensifying. While developing countries show the highest, developed countries show the lowest rate of land loss. Additionally, the ALC's trend for all the three groups is increasing. Whereas the developing and developed countries have respectively experienced the highest and lowest average of ALC. Obviously, this result leads to the conclusion that ALC will be continuing in the future if there is no government intervention to halt it.

The results also showed that urbanization could (significantly) be considered as the main cause of the ALC, especially in developing countries where the urbanization has the fastest growth while developed countries have been successful in managing their urbanization process and therefore receive the least impacts. Therefore, proper management and planning may restrict ALC. Planning directs urban expansion to desired ways that protect fertile agricultural lands (e.g. the Dutch Government not only has strong comprehensive spatial planning, but also keeps a serious commitment at all governmental levels, and maintains inter-governmental coordination, a financial mechanism and public support in order to prevent the conversion of their farmlands). Therefore, a stricter implementation of land use and spatial planning or even land conversion laws are needed. Furthermore, the legal approach (law and regulation) must be accompanied by other approaches (such as economic controls including tax incentives and agricultural subsidies) not only to encourage farmers to remain, but also to improve their farming activities.

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