Planning Interventions as a Major Driving Force for Transforming Unitary Habitats into Multi-habitats in the Ladkrabang District of Bangkok Metropolitan Area

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Abstract

Planning interventions may lead to both intended and unintended results. A change of focus in planning interventions over time may lead to non-symbiotic relationships among different elements in an urban area. This paper examines the outcomes of three decades of planning interventions in an outer district of the Bangkok Metropolitan area. To corroborate the overall transformation, the paper analyzes the effects of each planning intervention during the successive planning periods. The transformation is analyzed in relation to three major factors; (1) land-use changes, (2) occupational changes, and (3) residential development. The analysis confirms that the change in focus of successive planning and development interventions is a main driving force responsible for the transformation of unitary habitats to multi-habitats in the studied urban area. Although this outcome of the planning interventions is unanticipated, this study argues that progressive change in focus can be an effective strategy to build symbiotic and pluralistic societies.

Keywords: Habitat transformation, Homogeneous land-use, Heterogeneous land-use, Unitary habitat, Multi-habitat, Plural society

1. Introduction

Cities in developing countries usually grow in a radial pattern by converting vast areas of fringe land from rural agricultural uses to urban, non-agricultural uses. Urban sprawl, which this paper defines as unplanned and radial urban expansion towards the peripheries of a city, occurs due to a variety of reasons such as improvement of transportation system and infrastructure (Barcus, 2004) as well as the outward shift of industries (Pacione, 1990), is largely responsible for this process. When cities grow without being guided by clearly designed urban plans and regulatory planning techniques such as land-use zoning, haphazard developments often take place in the outer areas of cities (Daniel & Bowers, 1997; Mariola, 2005). On the other hand, some local land-use regulations, particularly land-use zoning, could also cause sprawl (Pendall, 1999). Usually, haphazard and mixed developments are seen as undesirable from a conventional urban planning perspective. However, there is a tendency to accept mixed land-uses in many cities as a way of reducing travel distance and thereby reducing pollution caused by excessive transport (Permana *et al.*, 2008; Litman, 2008). Mixed scenarios also seem acceptable from the perspective of integrating different economic functions and social activities in cities. Outer-city areas that are often subjected to less stringent regulations may allow mixed land-uses to proliferate.

Although outer-city areas in developing countries are not ready for guided urban development due to lack of necessary infrastructure, they offer opportunities for new enterprises to begin operating with relatively low capital expenditure (Dillman, 1979). They also offer opportunities for newly formed families and migrants to find footholds in the city at affordable prices (Rossi, 1955). In fast-growing cities, there are more employment opportunities in outer-city areas due to de-congestion policies implemented by the authorities (Duany *et al.,*

2000). This phenomenon is especially true in the case of cities that enforce regulations to relocate industries from inner-city areas to outer-city areas (Pacione, 1990). Although outer-city areas may lack the necessary infrastructural facilities and amenities to support an urban lifestyle, they continue to attract new settlers and investors. This process results in heterogeneous urban societies, which this paper calls as multi-habitats. A multi-habitat is defined as a socially and culturally plural society that exists in a functionally mixed physical environment (Fujii, 2004; Meseeri & Perera, 2004; Panitchpakdi, 2004). Under this definition, a multi-habitat is not solely associated with mixed land-use, although that is one of its characteristics. Whereas a multi-habitat is seen from a societal viewpoint, mixed land-use is more often viewed only within a functional context. Given this argument, our paper asserts that multi-habitats are different from mixed land-use zones that may also contain various communities.

Urban communities commonly include people from various social strata who engage in different activities. The new trends in housing developments, such as gated communities that are growing in number in outer city areas demonstrate that emerging urban communities can become socially homogeneous, a scenario that this paper terms unitary habitats. Our paper defines a unitary habitat as a socially and culturally uniform community that exists in a physical environment devoted to a single function. Under this definition, a unitary habitat differs from a single purpose land-use scenario. Planning interventions can alter the trend of unitary habitats proliferating in cities. For example, in Malaysia, real estate housing developers are required to build a mixture of different housing types in real estate projects for different income groups and allocate them to all ethnic groups and religious groups. It is mandatory to allocate at least thirty percent of the units for households with low income (Ezeanya, 2004). Similarly, Indonesia's 1:3:6 regulation requires real estate developers to build six housing units for low-income people and three housing units for middle-income people for every housing unit built for high-income people (Government of Indonesia, 1995). These planning interventions were intended to prohibit exclusive habitats that are dominated by particular ethnic groups, religious groups or socio-economic groups. They are also policy responses to the growing trend of gated communities built for high-income and upper middle-income people in the cities of Malaysia and Indonesia.

Although the transformation from unitary habitats to multi-habitats might be caused by different reasons such as spatial interaction and organic development (Braimoh and Onishi, 2007), economic integration of formal and informal sectors (Xie *et al.*, 2005), economic diversification (Firman, 2000), and gentrification (Firman, 2004); we argue that the causes of habitat changes are rooted in planning interventions within the context of a strongly governed urban area. Therefore, the paper raises the questions; (1) to what extent the planning interventions act as a driving force in habitat transformation? (2) what are the socio-economic and environmental impacts of the habitat transformation?

Answers to these questions are explored using three major indicators of habitat transformation viz. (1) land-use changes (functional changes), (2) occupational changes (diversification of the employments of inhabitants), (3) residential development (typological changes of the settlements of inhabitants). The paper aims to scrutinize the planning interventions introduced to a previously unintervened area and analyzes its transformation over the whole period of planning interventions, using the above indicators. In doing so, the paper aims to find the extent of habitat transformation taken place in that area and its socio-economic consequences.

For this purpose, a newly emerging sub-center in the outer area of Bangkok was selected. The paper reviews the planning strategies that have contributed to the transformation process of this sub-center in order to understand the relationship between interventions and their cumulative results. The next section presents the conceptual basis of study before presenting the empirical part of the paper.

2. Unitary Habitats and Multi-Habitats

The term "habitat" in the context of urban planning refers to the environment in which people live and work. Ettinger (1976) asserts that the human habitat is an environment where people flock to settle. In the past, human habitats easily blended with natural physical environments due to the fact that most people engaged in cultivating land for crops. Most of the inhabitants in such settlements lived in similar conditions and engaged in similar activities. Therefore, such places can be termed as unitary habitats. By contrast, multi-habitats are socially, culturally and functionally mixed areas that are usually located between the central business area and the periphery of a city (Fujii, 2004). This definition by Fujii (2004) implies that multi-habitats are living environments that do not conform to the characteristics of a specific functional zone. In other words, heterogeneity of function and society are hallmarks of a multi-habitat. Fujii (2004) argues that multi-habitats can be places where people of different ethnic, cultural and economic backgrounds live and work in harmony. Though difficult to accomplish in many instances, this perspective suggests that planned multi-habitats can

provide opportunities to form pluralistic and integrated societies that UN-Habitat (2009) envisions for "harmonious cities". In this paper, the term "pluralistic society" refers to the co-existence of groups with different ethnic, religious or social backgrounds and income levels within one society as explained by Gollnick and Chinn (2008).

Although it is not generally true that multi-habitats contain high population densities, Williams *et al.* (1996) argue that high population density and close proximity to urban living can lead to conflicts among residents, given the differences in socio-economic backgrounds and lifestyles. Residents of high-density areas with mixed populations are more susceptible to conflicts and segregation based on socio-economic, cultural, racial, ethnic, and religious backgrounds. They are even subject to segregation based on one's region of origin. Leisch (2002) observes that social polarization and segregation often emerge because economic growth creates income gaps that lead to poverty, discrimination and inequality within and among communities. However, Ardani (2006) points out that if adequate development control measures are enforced, endogenously grown multi-habitats can be properly managed and sustained to support a contemporary style of urban living. Therefore, if multi-habitats are perceived as favorable elements in a plural society, habitat formation in cities will require planning interventions that go beyond land-use zoning and building control. This paper is positioned neither as a proponent nor as an opponent of the multi-habitats debate. Rather, it tries to explore the transformation process of a sub-center in Bangkok in order to better understand the planning interventions that it has undergone in becoming a heterogeneous place.

To understand the relative advantages and disadvantages of unitary habitats and multi-habitats in the context of urban planning, a comparison of their characteristics was done with reference to the following six parameters: economic base, social structure, physical structure, way of life, eco-system, and community organization. The result of this comparison is presented in Table 1.

[approximate location of Table 1]

Table 1 implies that the transformation from a unitary habitat to a multi-habitat encompasses a complex process. It is debatable whether a simple social order as depicted in a unitary habitat is better for contemporary societies than the complex social order that is commonly considered to be the norm of a plural and inclusive society. In this context, the transformation of outer urban areas from traditional unitary habitats to other forms of habitats in Asian cities is worthy of investigation.

As shown in Table 1, there are a number of main indicators that signify the presence of unitary habitats and multi-habitats. However, the study focuses only on three indicators, viz., land-use changes, occupational changes and residential development, under two major parameters, viz., economic base and physical structure. These two major parameters were selected for the focus of this study because they are the most visible and observable factors among other factors in terms of indicating the presence of a transformation process in the study area. This selection therefore is a limitation of the study.

3. Methodology

As indicated above, an emerging sub-center of Bangkok, namely Ladkrabang was selected as the study area. At the outset, the study evaluated the planning documents of Bangkok Metropolitan Administration (BMA) from the period of 1976 until 2005 (three decades). The year 1976 was selected as the base year because it signifies the beginning of planning interventions by BMA. Interviews with the planning officers of BMA and Ladkrabang District were carried out regarding planning focuses and objectives during different planning periods. The different focuses of BMA's plans for Ladkrabang District as stated in the planning documents or explained by the planning officers were carefully noted and analyzed.

We assert that the results of planning interventions can be reflected in the physical environment of an area as well as social structure of a habitat. This is the perceived linkage between planning interventions and habitat transformation in the study area. Therefore, the study also employed a questionnaire that allowed us to explore the perceptions and attitudes of inhabitants who settled in the study area during different planning periods. The social survey was carried out by employing a structured questionnaire.

The year 2005 was selected as the end of the survey's time scale because it signifies the end of the implementation of 6th plan (the last completed plan). As recorded in 2005, there were 32,695 registered households in the study area, including both native people (original settlers) and migrants. Because the majority of them are working people and difficult to meet for face-to-face interviews during the day, a questionnaire was distributed in order to obtain their responses on economic activities, social relationships, socio-economic changes and other relevant information.

To avoid a low number of responses, a master sample of 1500 respondents was randomly drawn from the households registered at the Ladkrabang District Office. The required number of samples was calculated using a 90% confidence interval (z=1.645), an estimated 50% no responses (p=0.5), and a precision of 5% (D=0.05). These conditions resulted in a minimum sample size of 270 households. The questionnaires were distributed among the master sample of 1,500 households by visiting their premises in the evening. The heads of households were asked to duly complete the questionnaire. The respondents were asked to respond within 10 days. After this period was over, the researchers collected the filled questionnaires by visiting respondents' homes. From 1,500 prospective respondents, 602 returned the completed questionnaire after repeated reminders by phone and an extension of the time period allotted for response. This number was obviously larger than the minimum required responses. Many respondents' access to mobile telephones made it possible to persuade them to respond, which resulted in the higher than expected return. The returned questionnaires were stratified into three different groups according to the date of household registration.

The respondents who settled in the area before BMA introduced the 1st Bangkok Development Plan in 1976 were considered to be **original settlers** or native people, and 154 (25.6% of total responses) of them responded. The respondents who settled in the area during the 1st to 5th Bangkok Development Plan periods, i.e., 1977-2000 (during the phase of intense transformation) were identified as **old migrants**, and 343 (57%) of them responded. The households that settled in the area since 2001, during the period of 6th Bangkok Development Plan (2001-2005), were identified as **new settlers** to the area, and 105 (17.4%) of them responded (see Table 2). As explained above, household that have settled during the current plan (7th Bangkok Development Plan, 2006-2010) were not included in the sample due to their limited history of residence in the study area.

[approximate location of Table 2]

We presumed that the three groups of respondents adequately represent their respective groups. The statistical properties of; $^2_{0.05} = 5.991 > 0.335$, shows that the presumption is correct. Before further analyzing the data obtained from the social survey, the following section outlines the BMA's development plans for the Ladkrabang District and explains their major consequences in terms of transformation.

4. Development Plans of the BMA for the Ladkrabang District and the Corresponding Transformation Processes and Output results

The Ladkrabang District is located in the outer part of BMA. A part of the district is located in the green belt demarcated by the BMA. The main purpose of this zone is to conserve an agricultural zone in the periphery of the city and to protect inner-city areas from floods by acting like a sponge to retain excess storm water (DCP, 2000). In addition, the green belt zone is intended to control the city from sprawling into the surrounding provinces.

Development of new infrastructure, particularly transportation networks in the outer-city areas, contributed to the rapid urbanization of the Ladkrabang District. Many new infrastructure developments were followed by land conversions from agricultural uses to real estate developments. Land conversion in the Ladkrabang District has continued unabated under successive development plans of the BMA. The general land-use composition of the sub-districst of Ladkrabang District is shown in Figure 1.

[approximate location of Figure 1]

The Ladkrabang District is comprised of six sub-districts: *Klong-song Tonnun, Klong-sam Prawet, Lumplateaw, Kumtong, Ladkrabang* and *Tapyaew*. The present composition of these sub-districts varies from predominantly agricultural activities to predominantly non-agricultural activities. This variation is presumably a direct result of three decades of planning interventions. The major functions of the whole district according to the successive development plans of the BMA are listed in Table 3. The table identifies the major development initiatives under each plan in terms of physical and socio-economic attributes that demonstrate the habitat transformation in the district.

[approximate location of Table 3]

The plans, as summarized in Table 3, portray the transformation of the Ladkrabang District as a result of planning interventions by BMA. The table indicates that the BMA's development plans have contributed to the present mixed characteristics. In the subsequent sections, the discussion attempts to observe and substantiate the effects of the development plans of the BMA in Ladkrabang by analyzing according to the three selected attributes of transformation, viz., land-use changes, occupational changes and housing development trends.

Due to BMA's plans for Ladkrabang District, the district has experienced many changes. However, if the observations are made at the sub-district level, the changes may not be so visible (see Figure 1). An analysis at the

sub-district level seems too diminutive to sufficiently portray the habitat changes, and therefore sub-district as the unit of analysis is not pursued hereafter. Instead, the analysis was focused on the major facets and indicators of the transformation as explained above.

5. Major Facets of Transformation

Habitats often evolve through a dynamic transformation process over a long period of time. This transformation may involve a change from a unitary habitat to a multi-habitat. This section presents evidence from the survey conducted in the Ladkrabang District of Bangkok in order to examine its transformation during the 1st to 6th development plans of the BMA (1975-2006). Land-use change was analyzed as one of the key indicators of the transformation.

5.1 Land-use Changes

After 30 years of planning interventions, the Ladkrabang District has experienced different kinds of development that have physically transformed it from a pristine agricultural area to a partly built-up area. As a result of the changed focuses of successive plans, the Ladkrabang District presently features a mixture of agricultural, residential, commercial, and industrial land, as well as other lands used for transportation, warehousing, and water conservation. Non-agricultural and agricultural areas co-exist in an uneasy relationship due to the changed focuses of successive development plans. The extent of changes during each development plan is shown in Table 4.

[approximate location of Table 4]

As shown in Table 3, before the first planning intervention (as recorded in 1970 and 1975), farmland including other green fields were the predominant land-uses. There were changes in land-use even during the period of 1970-1975 due to the onset of urbanization in the area. When the respective figures for 1970 and 1975 are compared, it can be noted that green fields have been primarily converted to residential and industrial uses. At the baseline year of 1970, the green fields accounted for 94.26 percent in comparison to other land-use categories. The propensity of land-use change towards more heterogeneous uses has prevailed since then. At the end of the 7th Development Plan (in 2010), the remaining farmland and greenery was estimated as 54.92 percent. By contrast, residential areas are expected to increase from 3.06 percent in 1970, to 13.41 percent by 2010, which is a four-fold increase. For the same period, the extent of industrial areas increased eight-fold, and commercial areas increased fourteen-fold. These facts show that the district has been undergoing a steady transformation in terms of land-use. Planning interventions are seen as the driving force of this transformation from homogeneous land-use to heterogeneous land-use and thus from a unitary habitat to a multi-habitat. Without the planning interventions, the extent of land-use changes could have been even more due to the onslaught of urbanization in the area.

The major recommendation for the Ladkrabang District in the 7th development plan was for this district to function as a transport logistics hub to support the Suvarnabhumi International Airport. The airport is located in the adjoining province, yet in the vicinity of the Ladkrabang District of Bangkok. Lands, which could be developed, but presently used primarily for agricultural purposes, surround the airport. Land conversions in this area are occurring at an alarming rate to meet the needs of transportation, service, industrial and residential activities. Local and foreign investments are being made in close proximity to the airport. A concept called 'Airtropolis' was promoted by the pro-development lobby to establish a special administrative area comprising the Ladkrabang District and the Nong-Ngu Haow District of the Samut Prakarn province (The Nation, 2005). If this idea is implemented, it could potentially further accelerate the transformation of the Ladkrabang District. In other words, the conversion of agriculture areas would be faster.

According to the Land Law of Thailand, conversion of agricultural land for non-agricultural purposes without permission is illegal. The conversion, according to the law, should be clearly spelled in the government's land-use planning. On the other hand, it was observed that some land speculators accelerate land conversion by purchasing agricultural land and turning them into fallow land by abandoning farming activities for a period of time. Then, they sell or develop the land for non-agricultural activities. Turning productive land into fallow land also adds another dimension to the land transformation process because the land can be converted for different purposes later on (Tian, 2005). However, this situation is not so prevailing in Ladkrabang District as reported by the District Office. That means the planning interventions are effective in driving the transformation of the area as envisaged.

The 1st development plan of the BMA (1976-1980) triggered the alteration of the landscape of Ladkrabang district. This alternation was signified by the proliferation of residential and industrial areas during the plan

period. In fact, industries spearheaded this urban development. Once industries developed in the area, various other developments followed because workers need housing, food and other services. This fact is easily observable in any urbanizing area including Ladkrabang.

Transformation from a homogeneous land-use to heterogeneous land-uses can be observed by referring to the quantitative changes of homogeneous and heterogeneous land-uses. Figure 2 shows the rate of change of land-use for non-agricultural (heterogeneous) activities as indicated by the gradient of the graph.

[approximate location of Figure 2]

Figure 2 shows three different patterns of gradients that indicate the different rates of transformation of agricultural land-use to non-agricultural land-uses resulting from the implementation of plans. The development focus in the Ladkrabang District during the period of 1970-1995 was on industrial development and a higher education center along with the conservation of agricultural areas and the designation of the eastern greenbelt of Bangkok. These strategies were limited to designated sites and locations. Therefore, during this period, a slower increase in non-agricultural uses was observed, as illustrated by an average change of 22.04 hectares/year (see segment 1 in Figure 2). During the period of 1995-2000, a transportation network was the focus of the development. This network triggered other developments, particularly residential developments, to flourish. This trend can be observed from a high rate of change of 60.07 hectares/year (see segment 2 in Figure 2), which means a fast rate of land-use conversion. Despite the carried-over effects of the development of the transportation network that was present during the period of 2005-2009 (see segment 3 in Figure 2), the rate of conversion of land-use has slowed down due to the focus change of the plan. The previous focus of the development plan (1995-2000) was a "transportation network", whereas during the subsequent period, the focus was on "sub-center development to support Suvarnabhumi Airport". The inauguration of the Suvarnabhumi Airport in 2006 has contributed to the declining rate of some residential development in the area because of the issue of noise pollution. Numerous protests by neighboring communities of the airport against excessive noise pollution led not only to the relocation of some communities but also to a reduction in demand for housing in the nearby areas (The Nation, 2009).

Along with this preliminary discussion, the increase of the gradient of non-agricultural land-use (Figure 2) is also used to further substantiate the claim that planning interventions functioned as a major driving force of the transformation. This claim can also be examined through the rate of development of major sectors such as industries and housing as illustrated in Table 5. These two major sectors significantly contributed to the development of build-up areas in Ladkrabang.

[approximate location of Table 5]

This analysis refers to the period of pre-planning intervention (1970) as the baseline situation. During the period of the 1st and 2nd plans, the residential and industrial areas increased, and consequently, the farming lands decreased. In fact, as shown in Table 5, the 1st plan stimulated a faster increase in industrial development in Ladkrabang in comparison to later periods, which is demonstrated by the highest rate of increase in industrial development (45.58 hectare/year). As an apparent response to this development, new residential areas developed during the 2nd development plan. These outcomes show that the focus of development in the 1st and 2nd plans (industrial development and the higher education center) have significantly influenced the habitat transformation in the Ladkrabang District. During the 3rd and 4th plans, the BMA declared the conservation of agricultural areas in Ladkrabang. In these planning periods, the conversion of agriculture areas significantly slowed down to almost negligible levels. According to the district office of the BMA, this condition was a direct result of the change in focus of the plans and effective enforcement of land-use regulations.

During the 5th development plan (1996-2000), the focus was on the development of a transportation network from Bangkok to the Eastern Seaboard (ESB). The ESB area is located in the eastern and southeastern regions of Bangkok. In 1996, the ESB was designated as the major industrial development area of Thailand. In order to facilitate this development, an expressway leading to the ESB from Bangkok was developed, and its initial segment was constructed through the Ladkrabang District during the 5th Plan period of the BMA. The development of this expressway triggered the proliferation of real estate development in the vicinity of the expressway. The rate of residential development during this period in Ladkrabang District, which is the gateway district to the ESB, was 95.37 hectare/year. This rate indicates that the BMA relaxed its land-use regulations to enable residential development in the Ladkrabang District. The result was a ten-fold increase in the rate of land-use conversion for residential purposes during the period of the 5th plan.

During the 6th plan, the Suvarnabhumi International Airport was the focus of development in Ladkrabang and several adjoining districts. The residential development in this area decreased to only one-fifth in comparison to

the previous period, i.e., the 5th plan. This decrease was possibly due to the residents' displeasure with the noise pollution created by the operation of the airport. Although no hard proof is available, this decrease could also be a reflection of housing developers' apprehension of losing their market, as Pornchokchai (2003) forecasted.

By observing the land-use changes as discussed above, it can be preliminarily concluded that three decades of planning interventions have transformed the major portions of the Ladkrabang District from predominantly agricultural area to an urban area that is comprised of different functions. However, this transformation has changed in a sustainable manner as indicated by the very small area of land that changed function from agricultural use to residential or industrial use during the entire 30-year period of planning interventions. Table 4, Table 5, Figure 2 and the discussion above demonstrate that planning interventions have driven the transformation of the Ladkrabang District. This substantiation will be further supported by the examination of demographic change in the study area.

5.2 Occupational Change

Land-use change has been the major force behind population growth in the outer metropolitan areas. The social survey revealed that some respondents have migrated from other provinces while others have moved from other areas of Bangkok. The urbanization in the study area is characterized by a high proportion of inhabitants engaged in non-agricultural activities. Table 5 shows the gradual transformation of Ladkrabang District in terms of the major source of income of households at the end of each plan and the 30-year period of planning interventions. Whereas the number of households engaged in agricultural activities has steadily declined in parallel to reductions in agricultural land area, the number of households engaged in non-agricultural activities has tripled. It remains unclear whether agricultural households shifted to other areas or to non-agricultural occupations.

[approximate location of Table 6]

Table 6 illustrates a consistent decrease in agricultural occupations along with a consistent increase in non-agricultural occupations. The increase of non-agricultural occupations was due to two reasons: (1) the engagement of new migrant settlers in non-agricultural occupations and (2) the shift of original settlers from agricultural occupations. This fact was further corroborated by other proof that agricultural area per household continuously decreased in parallel with the continuous increase of non-agricultural area per household. The indicator, area per household, was used to show the number of households engaged in agricultural activities and the coverage of agricultural areas. A similar indicator was also used for non-agricultural areas. By examining these indicators, it could be found that the average size of agricultural area per household steadily declined, while the average size of non-agricultural area per household steadily increased with the increase of population.

The survey carried out in 2009 found that people who engage in non-agricultural activities constitute the overwhelming majority (more than 75%) of the sample. However, it is interesting to note that the single largest occupation type in Ladkrabang is still farming (23.7%), followed by industrial jobs (21.9%). These findings demonstrate that the planned interventions in Ladkrabang have either resulted in a change of occupation of the original settlers or encouraged migrants to settle in the Ladkrabang District and engage in non-agricultural activities.

No single occupation type dominates in our sample. Therefore, it is argued that planning interventions in the Ladkrabang District have created a pluralistic society in terms of variety of occupations. Although the data provide no conclusive answer, we assume that migrants have not displaced original settlers. Instead, a significant number of farmers appear to have changed their occupations in response to the various urbanization and industrialization forces in the area, as happening in China and Vietnam (Leaf, 2002). This assumption is based on the fact that there was no single predominant occupation in the area, as occurring in Beijing and some other cities in China (Yan & Ding, 2007). Similarly, we assume that the original residents have continued to live in their original homes despite changing jobs. In order to identify the location and housing characteristics of both the original settlers and the migrants, a physical survey was conducted in addition to the questionnaire-based social survey.

5.3 Housing development trends

The field survey undertaken by the authors reveals a clear distinction between original settlers and migrants in terms of housing locations. The original settlers mostly live along canals in a dense and organic pattern, whereas migrants seem to have settled along roads and in housing estates in a dense but geometrical pattern. Original settlers and migrants are not separated in terms of location. This condition is due to the strict planning interventions that have permitted new development only in areas prescribed in the land-use plan. The areas that

are designated for agricultural conservation have seen few developments, though some of these developments take place without permission. The planning interventions have helped to avoid segregation of communities along social and occupational lines. In other words, planning interventions have contributed to the construction of socially mixed communities of different social strata. This situation was also found in Vietnam, as studied by Thanh (2002).

Given the urbanization trend in Ladkrabang and its vicinity, especially after the establishment of the new international airport in the adjoining district, the BMA strictly regulates the expansion of new settlements in Ladkrabang District. Such a measure is required for the long-term sustainability of this part of the city because it is an ecologically sensitive area. The conservation of agricultural land as well as other wetlands in the three easternmost districts of Bangkok (Nongjok, Klong-Samwa and Ladkrabang) is very crucial in order to maintain these lands as flood retention areas. The Ladkrabang District has resisted pressure from real estate developers who wish to speculate on urban development stimulated by new industries and other developments such as the establishment of educational institutes.

The development of the King Mongkut Institute of Technology in Ladkrabang (KMITL) commenced in 1960, and the full implementation of the original development plan was achieved in 1981. KMITL is a premier educational institution in Thailand and its mandate is to produce graduates with technological skills to support the industrialization and urbanization of the country. The development of this institute has triggered the development of commercial and service areas as well as residential areas in the vicinity of KMITL (Figure 3). The survey also found that about 17% of the residents in these places are students, lecturers or staff of the institute. Other residents are engaged in various occupations. This evidence shows that the development of the university stimulated the land-use conversion in the vicinity for mixed development, utilizing an area previously occupied by unitary habitats of agricultural communities.

[approximate location of Figure 3]

Figure 3 shows that these new settlements co-exist with the original community that remains engaged in agricultural activities.

6. Impacts of habitat transformation on socio-economic and environmental conditions

The previous section discussed the outcome of habitat transformation from unitary habitats to multi-habitats referring to three major determinants of transformation, viz., land-use change, demographic change and housing development. This section presents an discussion on the perception of the respondents regarding the impacts of that habitat transformation.

During the social survey, the original settlers and old migrants were asked about two issues pertaining to the effects of habitat change. These issues are; (1) changes in economic opportunities and, (2) changes in social cohesion, during the period when agricultural activities were predominant and the period afterwards. New settlers were excluded from this survey because they were not present during the period of 1970s, when agricultural activities were predominant. The survey, therefore, attempted to compare the conditions in the 1970s and 2000s based on the respondents' perceptions. The survey found that the transformation from homogeneous land-use to heterogeneous land-use has led to improved economic opportunities. The statistical data leading to this finding are presented in Table 7.

[approximate location of Table 7]

Table 7 shows that economic opportunities were perceived to be better in 2000s than in the 1970s by original settlers and the old migrants. This perception is substantiated by the statistical indicator - Pearson's coefficient (r). The 'r' values that show the association between income earning opportunities and the groups of settlers in 1970s and 2000s are 0.693 and 0.695 respectively. An 'r' value higher than 0.6 was considered as showing high correlation. Therefore, the above 'r' values mean that both original settlers and old migrants perceive of having better income earning opportunities in 2000s than in 1970s. The opinion about having better income earning opportunities in 2000s is more or less same among the two groups.

In contrast, the statistical analysis of survey data revealed that the transformation has created less cohesive social relationships. For example, more original settlers opined that a better cohesive society existed in the 1970s (57.1%) in comparison to the 2000s (42.8%). However, it is noted that only 35.6% of the respondent thought that a cohesive society existed even in 1970s. That means, the majority of the respondents of this group has not felt integrated with the society existed at that time when they settled in Ladkrbang.. This perception has become even more negative by 2000s as indicated by only 21.8% of respondents reporting about the existence of a cohesive society in 2000s. Among the old migrants too a similarly declining trend of opinion was noted. Pearson

coefficient value of 0.712 for 1970s and 0.743 for 2000s indicate that the correlation between the cohesiveness of the society and the groups of settlers as high.. This finding illustrates that the transformation from a unitary habitat to a multi-habitat has created two asynchronous outcomes in terms of economic and social conditions. Therefore, this finding is contradictory to Fujii's argument that multi-habitats can be places where different ethnic, cultural and economic backgrounds live and work in harmony. Ideally, development should promote both economic and social well being (Muñuzuri, 2005), but according to the survey findings, mixed communities that resulted from planning-driven interventions are not apparently having strong social relationship and cohesiveness.

Impacts of habitat transformation on the environmental condition were also inquired from the original settlers and old migrants. Their perceptions on the impacts were obtained in terms of four environmental issues viz., (1) flooding (2) air pollution, (3) noise pollution, and, (4) solid waste. The respondents were asked for their opinions on the comparison of environmental conditions between 1970s and 2000s, in terms of those four environmental issues. The findings of the survey are shown in Table 8.

[approximate location of Table 8]

According to Table 8, both original settlers and old migrants perceived that the environmental conditions worsened from 1970s to 2000s. This trend is indicated by higher percentage of respondents reporting worsened conditions in 2000s, regarding all four environmental issues. The Pearson's coefficients of more than 0.60 for all the four issues indicate strong correlations between the groups of respondents and environmental variables. The comparison of 'r' values indicates that the old migrants suffered more than the original settlers from the flooding problem, air pollution and noise pollution. This may be due to the location of the settlements of original settlers near more urbanized areas of the district and highways. These areas experience poor drainage, more air emissions and higher noise levels being located closer to urban functions. The lower 'r' value for old migrants in relation to waste problem could be due to better solid waste management provided by the local authority to their areas. However, it is reiterated here that both respondent groups are in agreement in their perception of worsened environmental quality from 1970s to 2000s. The difference of 'r' values between the two groups is not indicating a significant difference of opinion between the two groups.

Based on the perceptions of the respondents on socio-economic and environmental issues, it was realized that the habitat transformation has had positive impacts on economic opportunities, but at the same time it created negative impacts on the social cohesion and overall environmental condition of the multi-habitats.

7. Conclusions

The above analysis reveals that the change in planning focus by successive BMA development plans for the Ladkrabang District is the cause of present outcomes. Our results are not unique to the Ladkrabang District. Perhaps similar results may be observed in some other peri-urban districts of the Bangkok Metropolitan Area as well. Our results suggest that urban development in the Bangkok Metropolitan Area does not follow a single path. This statement conforms to that of Marcotullio (2001), who argues that globalization-driven growth has not translated into a single path of development, but that localities have instead followed contextually specific paths. The Ladkrabang District has witnessed such a change and a shift towards a mixed society that reflects some attributes of a multi-habitat as explained in Table 1. The ideology of sustainable development aims to achieve a proper balance between social, economic and environmental change. We argue that the transformation in Ladkrabang, driven by planning interventions of the BMA, has led to an improvement of economic conditions without drastically affecting environmental resources such as land. Despite the fact that environmental conclusion has worsened in 30 years as perceived by the respondents Ladkrabang District still maintains over 50% of its land as green fields. This is a direct result of strict implementation of the strategies of the development plan.

Can industrial, educational, commercial and service activities be compatible with agricultural activities? By examining the current trend of urbanization in most cities in developing countries, we note that such developments are inevitable, at least during the initial process of transformation. Heterogeneous land-use with multi-habitats will always develop along the implementation path of development plans, particularly when the focus of the successive plans is periodically shifted from one to another. The BMA's planning interventions in the Ladkrabang District have enabled somewhat sustainable transformation to take place. Based on this experience, it can be concluded that the change in focus of successive plans do lead to sustainable and guided urbanization and transformation. Therefore, the change of focus in plans of BMA can be seen in a positive light. As our study has demonstrated, this change has enabled a more sustainable development pattern in which unitary habitats of agricultural communities and multi-habitats of urban communities may co-exist in harmony.

However it is questionable whether planed interventions for forming multi-habitats can create truly plural societies, if the settlers perceive social cohesiveness has deteriorated over time.

References

Ardani, A. (2006). *Revitalization of environmental infrastructure systems for sustaining endogenous multi habitats in historic cities: A case study of Maliobro area in Yogyakata, Indonesia.* Master thesis study, Asian Institute of Technology, Thailand.

Barcus, H.R. (2004). Urban-rural migration in the USA: an analysis of residential satisfaction. *Regional Studies*, 38:643-657.

Braimoh, A.K and T. Onishi. (2007). Spatial determinants of urban land-use change in Lagos, Nigeria. *Land Use Policy* 24:502-515.

Daniel, T. and D. Bowers. (1997). *Holding our ground: protecting America's farm and farmland*. Island Press, Washington DC.

Department of City Planning. (2000). *The greater Bangkok plan (Litchfield Plan)*. Bangkok: Bangkok Metropolitan Authority.

Dillman, D.A. (1979). Residential preferences, quality of life, and the population turnaround. *American Journal of Agricultural Economics*, 61:960-966.

Duany A., E. Plater-Zyberk, and J. Speck. (2000). *Suburban Nation.* North Point Press, New York.

Ettinger, J. (1976). *Habitat before and after*. Hague: Ministry of Housing and Physical Planning.

Ezeanya, A.C. (2004). Malaysian Housing Policy: Prospects and Obstacles of Nation Vision 2020. International Conference on Adequate and Affordable Housing for All, Center for Urban and Community Studies, University of Toronto.

Firman, T. (2000). Rural to urban land conversion in Indonesia during boom and bust periods. *Land Use Policy*, 17:13-20.

Firman, T. (2004). Major issues in Indonesia's urban land development. *Land Use Policy*, 21:347-355.

Fujii, T. (2004). Sustainable multi-habitats: an introduction. In R. Perera, P. Pradhan, T. Fujii and K. Takahashi (Eds.), *Endogenous development for sustainable multi-habitations in Asian cities: Proceedings*. Pathumthani, Thailand: Urban Environmental Management Field of Study, Asian Institute of Technology.

Gollnick, D.M. and P.C. Chinn. (2008). *Multicultural Education in a Pluralistic Society*. Allyn & Bacon, 8th edition.

Government of Indonesia. (1995). Joint Policy of the Ministry of Home Affairs, Ministry of Public Works, and Ministry of Housing, No. 04/KPTS/BKP4N/1995.

Leaf, M. (2002). A Tale of Two Villages Globalization and Peri-Urban Change in China and Vietnam. *Cities,* 19(1): 23-31.

Leisch, H. (2002). Gated communities in Indonesia. *Cities*, 19(5): 341-350.

Litman, T. (2008). Evaluating Transportation Land Use Impacts. Victoria Transport Policy Institute. [Online] Available: http://www.vtpi.org/landuse.pdf (3 March 2009).

Marcotullio, P. (2001). Asian urban sustainability in the era of globalization. *Habitat International,* 25(4) 577-598.

Mariola, M.J. (2005). Losing ground: farmland preservation, economic utilitarianism and the erosion of the agrarian ideal. *Agriculture and Human Values*, 22:209-223.

Meesiri, P. and R. Perera. (2004). Community Development with multi-habitation in new city areas: a case of Ladkrabang District, Bangkok. In R. Perera, P. Pradhan, T. Fujii and K. Takahashi (Eds.), *Endogenous development for sustainable multi-habitations in Asian cities: Proceedings*. Pathumthani, Thailand: Urban Environmental Management Field of Study, Asian Institute of Technology.

Muñuzuri, J. (2005). Solutions applicable by local administrations for urban logistics improvement. *Cities*, 22 (1): 15-28.

Pacione, M. (1990). *Urban problem: an applied urban analysis.* Routledge, London.

Panitchpakdi, K. (2004). Exploring Multi-habitations along the eastern corridor of Bangkok Metropolitan, In R. Perera, P. Pradhan, T. Fujii and K. Takahashi (Eds.), *Endogenous development for sustainable multi-habitations in Asian cities: Proceedings*. Pathumthani, Thailand: Urban Environmental Management Field of Study, Asian Institute of Technology.

Pendall R. (1999). Do land-use controls cause sprawl? *Environment and Planning B: Planning and Design,* 26(4):555–571.

Permana, A.S., R. Perera, and S. Kumar. (2008). Understanding energy consumption pattern of households in different urban development forms: A comparative study in Bandung City, Indonesia. *Energy Policy*, 36:4287-4397.

Pornchokchai, S. (2003). Lessons Learnt from Housing Speculation in Bangkok. Pacific Rim Real Estate Society (PRRES). The Ninth Confeence: January 19-22, 2003, Brisbane, Australia.

Princeton University website. [Online] Available: http://wordnetweb.princeton.edu/perl/webwn (28 November 2009).

Rossi, P.H. (1955). *Why families move?*. Mcmillan, Aldershot, UK.

Thanh, L.V. (2002). Population and urbanization in Ho Chi Minh City (Vietnam) towards new policies on migration and urban development. Poster paper prepared for the IUSSP Regional Population Conference, Siam City Hotel, Bangkok, Thailand, 10-13 Jun 2002.

The Nation. (2005). Suvarnabhumi Airport set to be 77th Province. *The Nation Newspaper*, 18 October 2005.

The Nation. (2009). Noise compensation by Surayud govt endorsed. *The Nation Newspaper*, 25 June 2009.

Tian, G. (2005). Analysis of spatio-temporal dynamic pattern and driving forces of urban land in China in 1990s using TM images and GIS. *Cities*, 22 (6): 400-410.

UN Habitat. (2009). Activities of the United Nations Human Settlements Programme, Report of the Executive Director.

Williams, K. (1996). Achieving the compact city through intensification, In M. Jenks., et al. (Eds.). *The compact city; a sustainable urban form?* New York: E & FN Spon.

Xie, Y., Mei, Y., Guangjin, T. and Xuerong, X. (2005). Socio-economic driving forces of arable land conversion: A case study of Wuxian City, China. *Global Environmental Change*, 15:238-252.

Yan, S. and C. Ding eds. (2007). *Urbanization in China: Critical Issues in an Era of Rapid Growth*. Lincoln Institute of Land Policy.

Table 1. The characteristics of unitary habitats and multi-habitats

Parameter	Main Indicators	Unitary Habitats	Multi-habitats
Economic base	• Economic activities • Occupations	People engage in mostly homogeneous livelihoods such as farming	People engage in heterogeneous economic activities
Social structure	• Social hierarchy • Dependency on others in society	No predominant social hierarchy in terms of socio-economic status except in recognized leadership and mutual cooperation	Interdependent economic activities create a hierarchical socio-economic status
Physical structure	• Use of land • Residential development	Simple physical organization of living and working space with unclear boundaries, modesty in dwellings	Complex physical organization with overlapping boundaries of living and working spaces, variety of house form
Way of life	• Social life of citizens	Same lifestyle exhibited by all of the residents	Different lifestyles of residents
Ecosystem	• Ecosystem components • Relationship among ecosystem components	Simpler relationship between inhabitants and the surrounding environment	More complex relationships between inhabitants and the surrounding environment
Community organization	• Relationship among people • Leader and community relationship	Simple network of people and households with less pronounced hierarchical order	Complex network and hierarchical organization characterized by the interdependence of socio-economic activities

Sources: Based on Mekvichai *et al.* (1990), Thavisin & Suwarnarat (1995), Thomas and Cousin (1996), Fujii (2004), and Ardani (2006)

Table 2. Sample frame of respondents

Group	Registered No. of households	Frequency of respondents (household heads)	Expected Value	Residual	Statistical Properties
Original Settlers (n_1)	8,144 (24.9%)	154 (25.6%)	150	4	x^2=4.212
Old Migrants (n_2)	23,857 (73.0%)	343 (57.0%)	439	-96	Df=2
New Settlers (n_3)	694 (2.1%)	105 (17.4%)	13	92	x^2(0.05)=5.991
TOTAL	32,695 (100.0%)	602 (100.0%)			

NOTE: x^2(0.05)= 5.991 > 0.335

Table 3. The major initiatives planned and implemented in the Ladkrabang District since 1976 under the 1st to 7th development plans of the BMA

BMA development plan	Major function for the Ladkrabang District	Major development initiatives that affected change	Observable effects of the Development Plan according to physical and non-physical attributes
1st plan (1976-1980)	Industrial development area spearheaded by a planned industrial estate	Development of the Ladkrabang Industrial Estate (2,345 Ha) and Romklao Housing Estate (5,367 Ha)	**1st and 2nd Plans lead to the following changes:** • Change of land-use towards the increase of non-agricultural activities
2nd plan (1981-1985)	Higher education center	Establishment of the King Mongkut's Institute of Technology Ladkrabang (1,890 Ha) and Chang Silpa College (560 Ha)	• Change in demographic structure due to the increase of non-agricultural occupations • More residential areas developed due to the increase of housing needs
3rd plan (1986-1990)	Agricultural conservation area as part of the Eastern green-belt of Bangkok	Conservation of agricultural land, particularly in Klong-Sam Prawet sub-District	**The results of 3rd and 4th Plans are manifested in the following:** • Land conversion from agricultural land lessens but does not cease completely
4th plan (1991-1995)	Water retention area to protect the city from flooding	Conservation of agricultural areas in the three sub-districts of Klong-Sam Prawet, Kum-tong and Tapyaew for water retention (643,000 Ha)	• Socially mixed communities developed
5th plan (1996-2000)	Transportation network extension to connect the city of Bangkok with the Eastern Seaboard (ESB) Development Area	Development of National Highway No. 4 (Bangkok-Chonburi Freeway, which passes through the entire length of the Ladkrabang District for 32.5 km) and development of container yard	**5th and 6th Plans resulting in the followings:** • Acceleration of the development of non-agricultural areas (particularly residential areas) • Conversion of agricultural lands to non-agricultural land continued and more significant
6th plan (2001-2005)	Eastern sub-center of the BMA (one of five sub-centers proposed for the metropolitan city)	Real estate development mainly for residential and commercial purposes (approximate total of 555 Ha)	• Development of industrial area continued • Development of residential areas accelerated
7th plan (2006-2010)	Transport logistics hub to support the Suwarnabhumi International Airport	Expansion of container yard and construction of airport rail link through the Ladkrabang District (7 km.)	**Current Development Plan :** • Development of residential areas continued • Conversion of agricultural land to non-agricultural land continued and more significant • Development of industrial area continued and accelerated

Data Source: Bangkok Metropolitan Administration

Table 4. Land-use change in Ladkrabang District, 1970-2010

Category	Percentage of land-use in each category (% of the total area of 12,386 hectares) at the end of each plan period								
	Base-line data	End of non-intervention period	End of 1st Plan	End of 2nd Plan	End of 3rd Plan	End of 4th Plan	End of 5th Plan	End of 6th Plan	End of 7th Plan*
	1970	1975	1980	1985	1990	1995	2000	2005	2010
Commercial Areas	0.11	0.17	0.21	0.26	0.53	0.71	0.87	0.95	1.57
Residential Areas	3.06	5.64	6.02	6.95	7.05	7.41	11.26	12.02	13.41
Industrial Areas	0.62	1.28	3.12	3.50	3.67	3.96	4.31	4.58	4.98
Roads	0.56	0.72	0.98	1.03	2.58	3.66	6.16	8.92	9.62
Waterways	0.56	0.56	0.54	0.54	0.53	0.53	0.52	0.5	0.50
Green Fields**	94.26	91.04	88.02	86.4	83.52	80.05	62.16	59.31	54.92
Others	0.83	0.59	1.11	1.32	2.12	3.68	14.72	13.72	15.00
TOTAL	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Source: Ladkrabang District Office (2009)

*Projected figures

**Green Fields include both farm land and un-built areas

Table 5. The Rate of Increase of Residential and Industrial Land-uses in Ladkrabang

Changes in Residential and Industrial		Average value of the rate of increase at the end of each development plan						
		1st Plan 1976-80	2nd Plan 1981-85	3rd Plan 1986-90	4th Plan 1991-95	5th Plan 1996-00	6th Plan 2001-05	7th Plan* 2006-10
The increase of Residential Area	Total area changed during the plan period (ha)	72.81	197.53	63.15	89.25	598.64	142.28	243.74
	The rate of change (hectare per year)	9.41	23.04	2.48	8.92	95.37	18.83	34.43
The increase of Industrial Area	Total area changed during plan period (ha)	311.46	87.35	56.29	76.54	83.61	74.61	88.92
	The rate of change (hectare per year)	45.58	9.41	4.21	7.18	8.67	6.69	9.91
Average rate of increase of Non-agriculture land-use	Total area changed during plan period (ha)	63.51				152.63	75.84	
	The rate of changed (hectare per year)	5.51				20.81	6.96	

Source: Ladkrabang District office of the BMA

*As estimated by the Ladkrabang District Office

Table 6. Change of occupations of households during the 1st-6th BMA development plans

Households and Their Occupations		Corresponding Development Plans of the BMA					
		1st plan (1976-1980)	2nd plan (1981-1985)	3rd plan (1986-1990)	4th plan (1991-1995)	5th plan (1996-2000)	6th plan (2006-2010)
Registered households	Agricultural occupations	14,120	13,400	11,872	10,125	9,240	8,920
	Non-agricultural occupations	14,280	15,745	16,910	18,541	20,650	23,775
Non-registered households*	Agricultural occupations	600	500	420	340	310	270
	Non-agricultural occupations	5,675	6,760	7,560	9,440	10,500	17,270
Total agricultural occupations		14,120	13,400	11,872	10,125	9,240	8,920
Agricultural area per households that engaged in agricultural activities (ha/household)		58.85	50.41	44.83	38.62	31.23	21.30
Total non-agricultural occupations		19,955	22,505	24,470	27,881	31,150	41,046
Non-agricultural area per household that engaged in non-agricultural activities (ha)		3.22	4.62	5.79	5.80	8.53	8.88
Total number of occupations (agricultural and non-agricultural)		34,075	35,905	36,342	38,106	40,390	49,965

Source: Ladkrabang District office of the BMA

*Note: As estimated by the Ladkrabang District Office

Table 7. Respondent's Perception of the Transformation in Terms of Social and Economic Conditions (frequency and % of 'Yes' responses)

Indicators of Transformation	Original Settlers (n_1=154)		Old Migrants (n_2=343)	
	1970s	2000s (at the time of survey in 2009)	1970s	2000s (at the time of survey in 2009)
Better income earning opportunities	60(38.9%)	111(72.1%)	109(31.7%)	245(71.4%)
More cohesive society	88(57.1%)	66(42.8%)	122(35.6%)	75(21.8%)
Statistical Analysis on "income earning opportunities" (Indicated by Pearson's Coefficient - r)*				
Variables	Group of Settlers	Income Earning Opportunities in 1970s	Income Earning Opportunities in 2000s	
Group of Settlers	1	0.693**	0.695**	
Income Earning Opportunities in 1970s	0.693**	1	0.835**	
Income Earning Opportunities in 2000s	0.695**	0.835**	1	
Statistical Analysis on "more cohesive society" (Indicated by Pearson's Coefficient - r)*				
Variables	Group of Settlers	Society in 1970s	Society in 2000s	
Group of Settlers	1	0.712**	0.743	
Society in 1970s	0.712**	1	0.685**	
Society in 2000s	0.749**	0.685**	1	

* We considered that Pearson's coefficient r >0.6 as indicating high correlation between the variables (1) group of settler and income earning opportunities, and (2) groups of settles and more cohesive society.

**Correlation is significant at the 0.01 level (2-tailed)

Table 8. Respondent's perception on environmental issues

Environmental Issues	Original Settlers (n₁=154)			Old Migrants (n₂=343)		
	Better	Worse	Neutral or No Opinion	Better	Worse	Neutral or No Opinion
Flooding problem	15(9.7%)	74(48.1%)	65(42.2%)	21(6.1%)	187(54.5%)	135(39.4%)
Air Pollution	12(7.8%)	80(51.9%)	62(40.2%)	30(8.7%)	165(48.2%)	148(43.1%)
Noise Pollution	10(6.5%)	81(52.6%)	63(40.9%)	18(5.3%)	186(54.2%)	139(40.5%)
Waste problem	12(7.8%)	83(53.9)	59(38.3%)	13(3.8%)	204(59.5%)	126(36.7%)
Overall environmental condition (%)	13(8.0%)	79(51.6%)	62(40.4%)	20(6.0%)	185(54.1%)	137(39.9%)
Summary of the Statistical Analysis (Indicated by Pearson's Coefficient - r)*						
Variables	Original Settlers			Old Migrants		
Flooding Problem	0.754**			0.789**		
Air Pollution	0.612**			0.696**		
Noise Pollution	0.625**			0.632**		
Waste Problem	0.794**			0.731**		

* We considered that Pearson's coefficient r >0.6 as indicating high correlation between the individed variables and the settler groups.

**Correlation is significant at the 0.01 level (2-tailed)
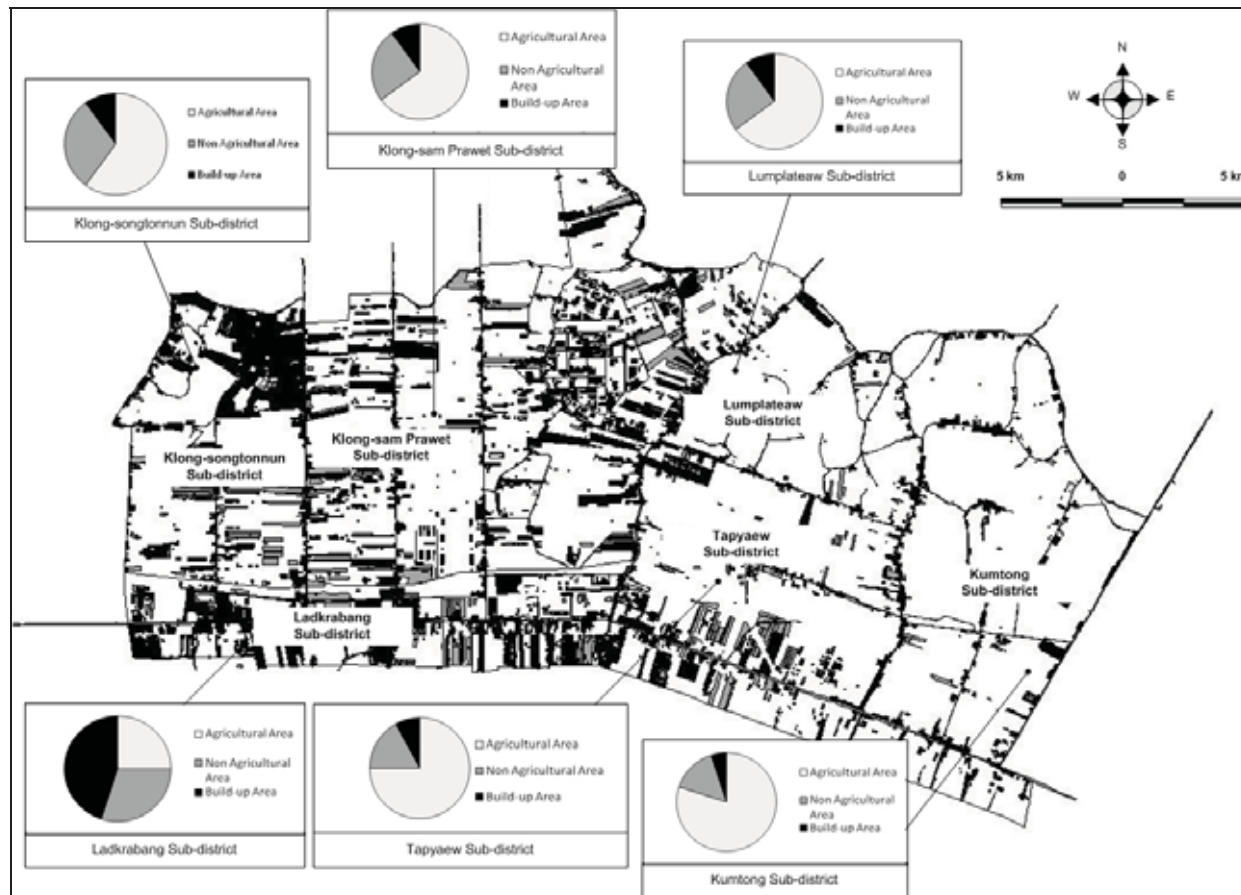
Source: Ladkrabang District Office 2009.

Figure 1. General Land-use Composition of the Sub-districts of Ladkrabang District
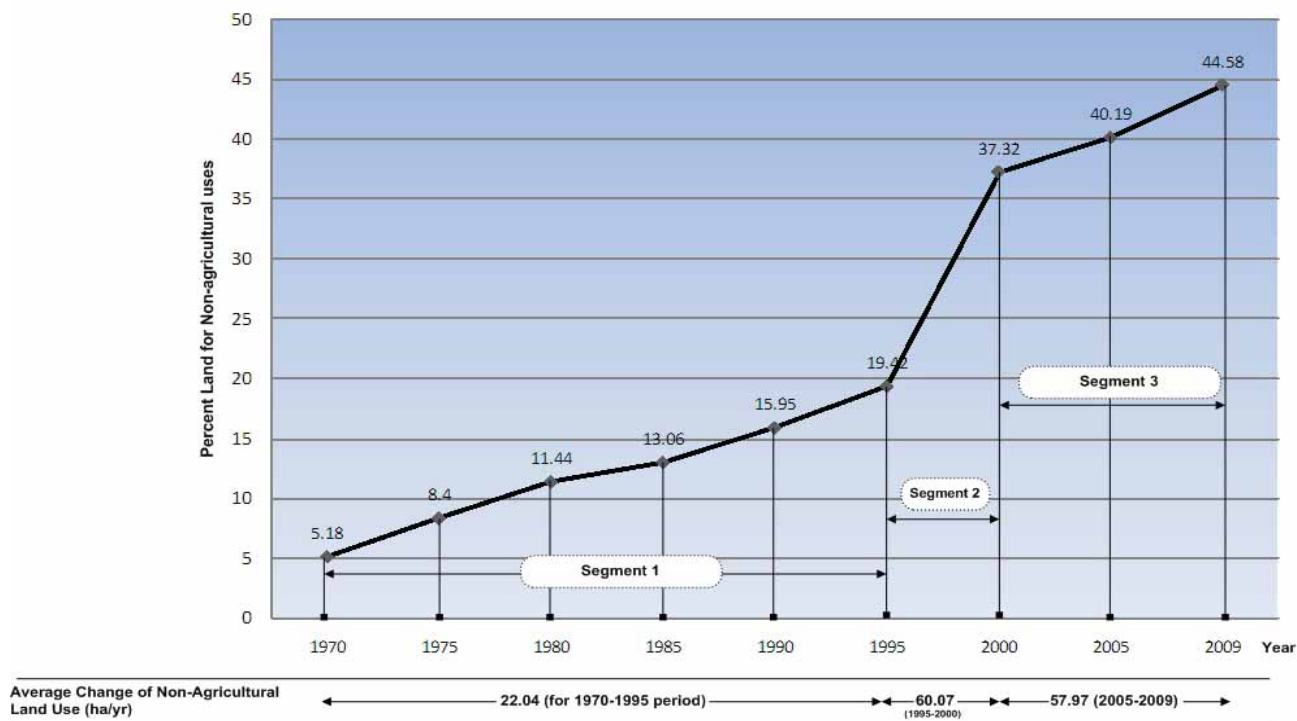
Figure 2. Land-uses of the Ladkrabang District

Note: A (Wat Bumrungruen Community), B (Wat Sam Community), C (Huatakay Community), D (Banchonlada Community), E (Wat Pluk Sutha Community), and F (Talad Huatakay) are six residential areas, which have emerged following the establishment of KMITL (Source:Googleearth)
Base Map: Courtesy of Google Maps

Figure 3. Location of KMITL and the commercial, service and residential areas in the vicinity