

# 論文の内容の要旨

## Dissertation Abstract

論文題目  
Dissertation  
Title  
氏名  
Name

**Interactions between Irrigation Canal Deteriorations and  
Agricultural Land Transformations in Bangkok Metropolitan Region**  
(バンコク大都市圏における灌漑用水路の潰廃と農地変容の関係性)

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### Introduction

Bangkok, the capital city of Thailand, had undergone a rapid urbanization during the late twentieth century. According to the fast economic growth and population increase since the 1980s, urbanization has spread out into the surrounding provinces and formed one of the largest mega-urban regions in Southeast Asia, the “Bangkok Metropolitan Region” (BMR).

Along with this rapid urbanization of the BMR, a large amount of agricultural lands located in the peri-urban area have been transformed into urbanized areas. On one hand, many peri-urban agricultural lands were intentionally transformed for urban development in order to facilitate the population increase. This type of agricultural land transformations is considered an unavoidable development to support the economic growth in regional and national levels. On the other hand, other agricultural lands were unintentionally transformed by the spillover from former urban developments. (Fig. 1) This type of transformations is resulted from deteriorations of the environment, i.e. water, soil and air, which makes the existing agricultural lands no longer suitable for farming. Since these agricultural lands were not intended to transform for urbanites, developments occurred there were frequently unplanned and appeared in unfavorable, disorganized and low-quality forms, not to mention the loss of green areas around the city to make way for the constructions. Therefore, it is necessary to prevent this type of development to occur and expand.

Problematic issues regarding canal deteriorations have been raised among local farmers, especially the consequential effects on unintentional transformations of agricultural lands. The deterioration of the existing irrigation canals has provoked conflicts between local farmers and new proprietors, especially real estate developers. Such deteriorations could reduce the canals’ capability to convey water supply to feed agricultural lands, consequently leading to discontinuation of land use for agriculture and eventual transformations for urban developments.

Earlier researches pointed out several influential factors of the urbanization process of peri-urban agricultural lands, including access from road networks, land price and agricultural product price. Most of them mainly focused on the intentional transformations of agricultural lands. However, none has studied irrigation canals which are speculated here as another significant factor that affects the unintentional transformations of agricultural lands in BMR.

Merits of agricultural lands to urbanites are not only for food production but environmental mitigation and recreation also included. In order to provide suggestions on how to maintain peri-urban agricultural lands, unintentional transformations of agricultural lands due to irrigation canal deteriorations should be investigated and examined, especially on some certain characteristics that may affect the vulnerability of agricultural lands.

Canal ownership and canal distribution are hypothesized as important characters that effect to the vulnerability of agricultural lands. Agricultural lands supplied by canals which are highly susceptible to deteriorations hypothetically have a high chance of unintentional transformations due to their private ownership and minor distribution. In contrast, agricultural lands served by lowly susceptible canals are hypothesized to have a lower chance of transformations.

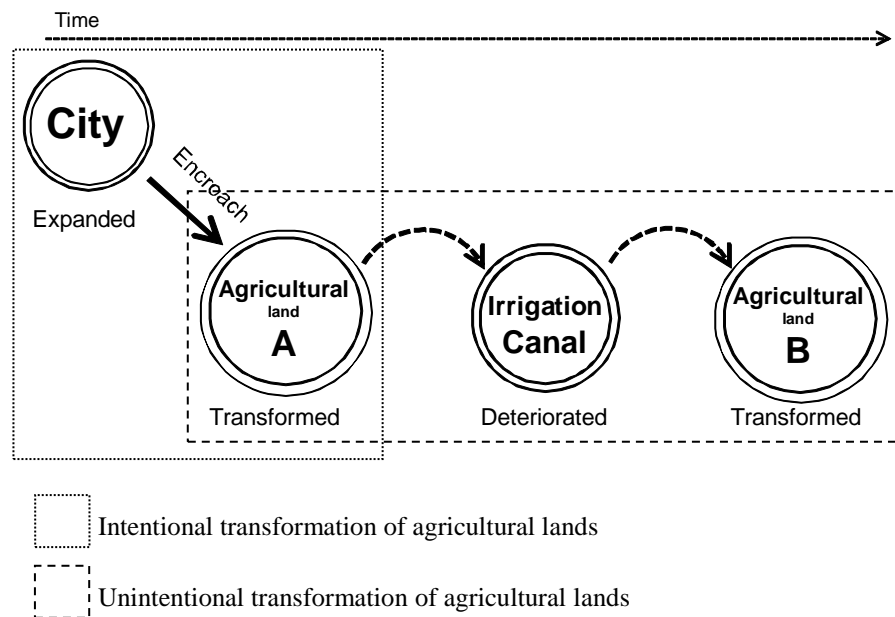


Fig. 1 Diagram of Intentional and Unintentional Transformations of Agricultural Lands

### Objectives

In order to find a suitable solution for planning strategies to maintain agricultural lands in BMR, the main objective of this study is to provide key information to prevent unintentional transformations of agricultural lands in the BMR. There are two sub-objectives to be investigated and examined. 1) To understand actual situations of the unintentional transformations of agricultural lands. 2) To determine agricultural lands under potential risk of unintentional transformations.

### Study area

BMR comprises Bangkok Metropolis and five surrounded provinces. The study areas focus on the rural-urban areas of BMR where agricultural lands are transforming along with urban developments. Deterioration of irrigation canals in the indigenous irrigation system was another selection criterion. Bangraknoi Sub-district in Nonthaburi Province located in the west rural-urban area of BMR was selected as the study area. Agricultural lands here are represented by orchards and paddy fields served by the indigenous irrigation system.

### Methods

In order to study agricultural land transformations, physical and social analyses were conducted to identify interactions between irrigation canal deteriorations and agricultural land transformations.

#### *Social Analysis to Understand the Actual Situation of Unintentional Transformations of Agricultural Lands*

In order to understand actual situations of unintentional transformations of agricultural lands, the social analysis was used as a key method to clarify two objectives as follows: 1) to investigate actual situations of unintentional transformations of agricultural lands and 2) to understand processes of unintentional transformations of agricultural lands caused by irrigation canal deteriorations. Interviews, questionnaire surveys and literature reviews were study methods used to confirm the existence and understand processes of unintentional transformations of agricultural lands. Key stakeholders, i.e. local farmers, local administrative officers and real estate developers were the focus groups of this research.

### *Physical Analysis to Determine Agricultural Lands under Potential Risk of Unintentional Transformations*

In order to determine agricultural lands under potential risks of unintentional transformations, the physical analysis was used as a key method to clarify two objectives as follows: 1) to examine transformation of agricultural lands caused by irrigation canal deteriorations due to (1.1) canal ownership and (1.2) canal distribution, and 2) to identify agricultural lands under potential risk of unintentional transformations. Data were collected via field survey and aerial photograph interpretation. The analysis of the transformation of agricultural lands from 1987-2010 was made through ArcGIS. Proportions and percentage of transformed area were used as the indexes for the comparison of vulnerability of agricultural lands.

## **Results and Discussions**

### *Social Analysis to Understand Actual Situations of Unintentional Transformations of Agricultural Lands*

Results from case studies confirmed the existence of unintentional transformation of agricultural land in Bangraknoi Sub-district which represents the rural-urban area of BMR. Irrigation canal deteriorations revealed an influence on local farmers' decisions on the abandonment of farming and the selling of agricultural lands. There were two processes involved in the unintentional transformations of agricultural lands. In the first process, agricultural land transformations induce irrigation canal deteriorations. As a consequence, irrigation canal deteriorations induce transformations of other agricultural lands.

The results based on data from local farmers and local administrative officers confirmed that agricultural land transformations induced irrigation canal deteriorations. Housing estate development is the major cause of irrigation canal deteriorations, i.e. polluted, narrowed & shallow, and filled canals. These irrigation canal deteriorations also induced transformations of other agricultural lands. Irrigation canal deterioration is one of the important factors which affect local farmers' decisions to abandon farming and sell their lands, especially on the unintentional transformations. The results from real estate developers focused mainly on land acquisition strategies which indicated preferred types of lands for development, i.e. large size of land, close distance to main roads and government offices, and good infrastructures. While the concerns of real estate developers mainly involve the intentional transformations of agricultural lands for urban development, local farmers have been receiving the effects of former developments as unintentional transformations of agricultural lands. Conflicts of policies, a lack of a comprehensive system to resolve conflicts, and a lack of necessary data as supportive materials in the decision making process of building permit approvals were among problematic issues raised by the local administrative officers.

### *Physical Analysis to Determine Agricultural Lands under Potential Risk of Unintentional Transformations*

Results from the physical analysis revealed significant effects of canal ownerships on agricultural land transformations. Based on the statistics, the amount of transformations of agricultural lands served by private canals was higher than by public canals. Agricultural lands served by both public and private canals had the lowest transformation rate. Results from physical analysis on the transformation of agricultural lands revealed the significance of distribution types of supplying canals. Agricultural land served by ditches had the highest transformations rate. Agricultural lands served by single canals were less transformed, while those supplied by multiple canals had the lowest transformation rate. Transformations of agricultural lands served by primary, secondary and tertiary canals in the single canal type were also compared to study a relationship of transformations with types of canal distribution. The results revealed that transformations of agricultural lands served by tertiary canal showed the highest rate. Rates of transformations of agricultural lands served by secondary canals and primary canals were lower and the lowest among the three groups, respectively.

Regarding the effects of ownership and distribution types of irrigation canals on agricultural land transformations, agricultural lands under potential risk of unintentional transformations were identified. Agricultural lands served by ditches had the highest level of potential risks of unintentional transformations. Agricultural lands served by single-tertiary-private canal also showed a high level of potential risks of unintentional transformations. These two types of vulnerable agricultural lands were illustrated on the map of agricultural lands under potential risk in order to provide key information to prevent future unintentional transformations.

### **Conclusions**

This study provided key information to prevent unintentional transformations of agricultural lands in the BMR. The existence of unintentional transformations of agricultural lands was confirmed through the social analysis. Irrigation canal deteriorations appeared as an influential factor. Agricultural lands under potential risk of unintentional transformations were determined through the physical analysis. Ownership and distribution characters of irrigation canals were also examined to explain their relation to agricultural lands' vulnerability to transform. It is found that agricultural lands served by ditches have the highest potential risk of unintentional transformations while the high level goes to agricultural lands served by single-tertiary-private canal. The map of agricultural lands under potential risk of unintentional transformations was created based on the study data and proposed as a tool to use in the development of planning strategies to prevent unintentional transformations of agricultural lands.