

INVESTIGATION ON THE REALLOCATION OF THE TOWN CORE IN THE CHANGJIANG DELTA USING SATELLITE IMAGES

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ABSTRACT: We analyzed the expansion process of town centers in the rural area of Changjiang delta since middle of 1980s and its mechanism using satellite images. The local industries played the most important role in urbanization of rural areas through investing their profits and paying their taxes to the town finance. Therefore, expansion of the town center was regulated by the growth of local industries and their ups and downs were reflected directly in the increase and the decrease in the town area. On the other hand, accompanying the accumulation of local industries to the town center, the employees (village population) moved into the town center and a chain reaction started; the increase in the permanent population accelerated development of residential land, accumulated commercial, transport, communication, financial and service businesses and resulted in a further expansion of the town center.

INTRODUCTION

In the Changjiang delta in China, urbanization has been driven by industrialization since 1980. There are two types of urbanization in this area. One is expansion of the city area in the existing cities such as Wuxi and Suzhou (abbreviated as expansion of the existing cities hereinafter) and the other is expansion of town centers scattering in rural areas (abbreviated as town center hereinafter). The former is induced by the external power, and the latter is induced by the internal power. That is, expansion of the existing cities is mainly led by the nation and is induced by investing public capitals (such as national and local governments) on national lands or by private investment triggered by the national-designated treated measure. On the other hand, in case of urbanization of rural areas represented by expansion of town center, support such as national subsidies is not available and, therefore, each town must raise business fund by own resources and efforts and go on development. To say in concrete, it is general to allot a part of the profits produced by local industries run collectively to business capital for development of the land possessed collectively and, then, to manage the area thus developed collectively. In other words, this case is characterized by accomplishment of urbanization based on various spontaneous development powers from the interior of the village. This is the urbanization pattern of villages peculiar to Changjiang delta and is discriminated from expansion of existing cities led by the nation.

Since 1980s, local industries achieved rapid growth as traction to drive village economics in the southern part of Jiangsu province in particular (abbreviated as southern Jiangsu) and town centers became the object of village development with local industries as the center. At the same time, local industries also advanced to "the era of raising level" consisting of improvement of quality standards, development of original products and merging with domestic and overseas enterprises from "the era of the barn factory" in 1960s and 1970s through "the era of subcontractors of urban industries" in 1980s and they selected town centers as the receptacle of their expansion and development in the evolution from scattered locations in villages to integrated industrial complexes. Thus, with mutual promotion of the development of local industries and expansion of town centers, the unique urbanization pattern in which town centers of about 2 km² are scattered in the rural areas of southern Jiangsu. In the case of Xishan city, the total area of the town center in 33 scattered locations achieved 72 km² almost equivalent to the area of 83 km² in Xishan city, the parent city. Therefore, it is only possible to comprehend the land-use change in Changjiang delta in all aspects by grasping the expansion of existing cities and that of town center simultaneously. Moreover, simultaneous elucidation of the process and mechanism of these two types of urbanization is indispensable for accurate prediction of urbanization and land-use trend in Changjiang delta in the 21st century.

Based on the above understanding, we focused first on the details of the expansion of Suzhou city in Jaingsu province while constructing new urban areas and industrial complexes around the existing city area and investigated its process and mechanism (Xia, 1966). In this paper, we picked up Xishan city of that province as the example and tried to elucidate the process and mechanism of urbanization of villages supported by the development of local industries.

In this study, elucidation of the actual state of town center expansion and that of the composition of land uses in town center were selected as the primary objects. In the study, satellite images (Landsat 5 TM) in 5-year intervals from 1980 to 1999 were used as the basic data to clear the problem of marked inadequacy of time-series data. For verification of the results of reading satellite images, they were collated with the land-use maps in 1984 (1/600000) and in 1996 (1/400000) available and accurate classification of land uses was attempted. Furthermore, field survey and hearing from the related organizations were carried out 3 times in the autumn of 1998 and spring and autumn of 1999. We tried to profile the whole picture of town center expansion as much as possible by feeding back the above philological analysis, image analysis and field surveys. Then, we discussed the mechanism of expansion. In the study, we also attempted to extract the conditions peculiar to Xishan city as well as analyzing common factors seen generally in the southern Jiangsu.

ANALYSIS BASED ON SATELLITE IMAGES

1. Qualitative analysis: Figure 1 shows the results of classification of land uses performed on satellite images of 5-year intervals from 1980 to 1999. In the macroscopic view, the areas of town centers in the northwest and south parts were wider than those in the east and urbanized land uses were prominent. In relation to Wuxi city, the nine towns surrounding the city had the widest town center areas and highest population densities. In relation to traffic ways, most town centers faced to both rivers and roads but they shifted gradually from riverside to the areas along the trunk roads in 1980s and T-shaped expansion with a river along a horizontal line and a road in a vertical line was confirmed in the satellite images. In the east along the road to Changshou city, the town areas of four towns consisting of Dongting, Chaquiao, Anzhen and Yangjian were distributed like ribbons while those of five towns consisting of Dongbeitang, Bashi, Zhangjing, Donghutang and Gangxia were distributed along the road to Changjiagang city. In the northwest part, town centers almost lined along the National Route 312. In relation to local industries forming the economic basis, urbanized land uses were outstanding in two areas where local industries were crowded, the northwest stretch of Qianzhou and Luoshe and the southwest stretch of Huazhuang and Dongjiang crossing perpendicularly with Shanghai-Nanjing railway.

In the microscopic review, town centers extended outwardly mostly by induction of town roads connected to trunk roads. The time-serial examination of the satellite images show that the most town centers followed the pattern of gradual outward extension based on the existing town centers. It can be seen that the growth of a town center was attempted with little investment while utilizing infrastructures in the existing town center in the early stage of development. In the satellite images, these circumstances appear in the form of light-colored areas prepared only for development surrounding the existing town areas in a dark color showing high building densities. Then, in the image in the same area after 5 years, a concentric pattern can be grasped; the light color changed to the dark color showing progresses in development and construction and light-colored areas showing the areas planned for development appeared outside.

With respect to the time, the town centers of the towns such as Yuqi, Qianzhou and Luoshe located in the northwest expanded remarkably in 1980s due to remarkable development of local industries. Yuqi and Qianzhou were the two local towns among nine that had the total industrial and agricultural output exceeding 100 million yuans in 1983 and dozens of local industries were already present. On the other hand, Gangxia town in the northeast and Dongting town where the municipal hall was present started rapid progresses in 1990s focusing to local industries although they were late starters. Twelve business groups including "Hougou" which was famous all over the country were located in Gangxia town with expansion of industrial complexes in the west and north parts of the town center. In 1996, the industrial output, shipment and profit in Gangxia town reached 4,000 million, 3,000 million and 200 million yuans, respectively, and the above 12 business groups occupied 88, 86 and 94% of these. With the increase in industrial land, the area of the town center expanded on 3 km² in 1994 and is expected to expand to 5 km² in 2010.

Another notable phenomenon was the equal growth of 33 towns without producing big differences in the scale and the expansion speed of town centers, except a few towns such as Luoshe particularly favored

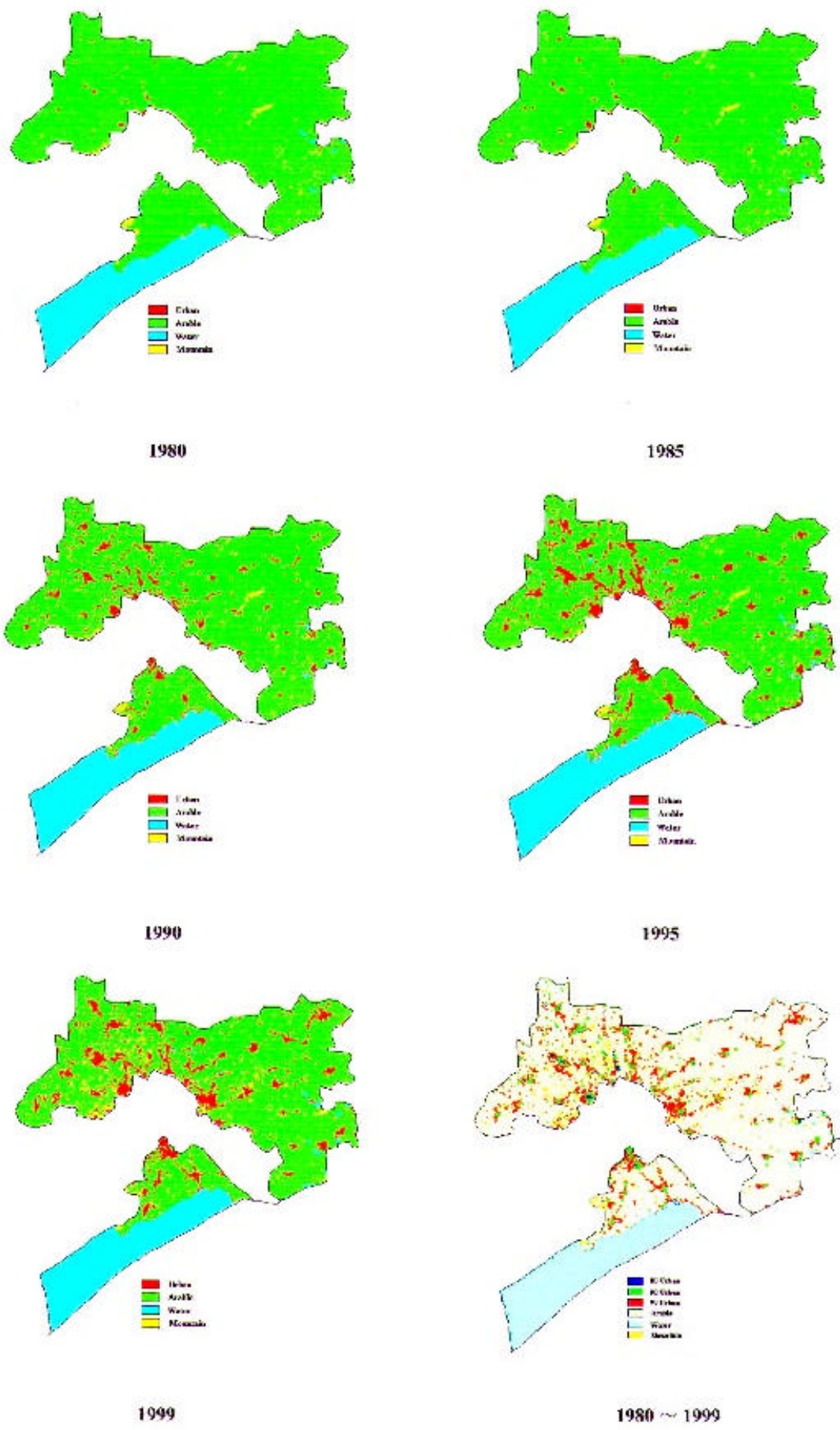


Fig. 1 Land-use change in Xishan city in 1980, 1985, 1995, 1999 (Grid size: 100 in x 100 in)

with traffic condition, because they advanced expansion of own town centers independently without cooperation. In other words, a unique circumstance was shown such that a vertical structure of strata consisting of cities, towns and villages was developed in the expansion of town center but no horizontal connection or coordination was observable. There was little exchange of funds, techniques and manpower over a number of towns because of separations by rivers or by administrative command system and economic and cultural blocs of self-conclusion type were formed limited to individual town areas. Every town formed similar commercial, financial and distribution facilities trying to form so-called a full-set urban area. It can rather be said that expansion of the town center in each town was accelerated by the competition among towns based on the energy such as this.

2. Quantitative analysis: The area of Xishan city center recorded the peak of the first rapid increase from 1985 to 1990 and exceeded 45 km² after a slow increase from 1980 to 1984. This is also shown in Fig. 2 that shows the change in the areas of the respective land uses from 1980 to 1999 calculated on the basis of the classification of the satellite images. Increases in local industries and the boom of building new houses by farmers were present in the background of this expansion. Conversion of farmlands to the lands for construction by local government increased rapidly from 1984 and reached 866 ha in 1985 and 1241 ha in 1986. As the right for approval of land conversion was transferred from the city to villages and towns in 1983, conversion to the land for local industries and tile factories became free temporarily in 1983. There were 4249 local industries and 15 km² of industrial lands in the whole city in 1985 but the number of local industries increased to 5020 and the area to 24 km² in 1987. The licensing right was recovered by the city in 1987 and the boom of agricultural land conversion was subsided for a time. However, the boom for building new houses by the farmers, who had become rich by the development of local industries since 1987, was started and 612 ha of land were diverted to residential land in 4 years from 1987 to 1990. Of these, 128 ha corresponding to just over 20% were agricultural land. In these 4 years, a total of 62750 houses were built newly.

From 1991 to 1995, the second peak of rapid change appeared. The urban area increased to 35 km² whereas the agricultural area decreased to 46 km². This was largely attributable to the boom of preparing industrial complexes at the city, town and village levels. In 1992 in particular, industrial complexes expanded rapidly. The “district for economic and technical development” (industrial complex) at Jiangsu province level was planned in Dongting town in 1991 and its construction was started in May 1992. According to the calculation by Chinese researchers based on remote sensing data, the urban area in Xishan city in 1990 was 51 km² almost agreeing with the figure, 52 km², measured by us. In 1992, 2.2 km² of farmland were converted to industrial complex. The increase in the urban area was confined to 6 km² and the decrease in agricultural area to 17 km² between 1996 and 1999 because the government took strict measures such as temporary freezing of land diversion to the purposes other than agriculture to stop excessive industrial development in and after 1994.

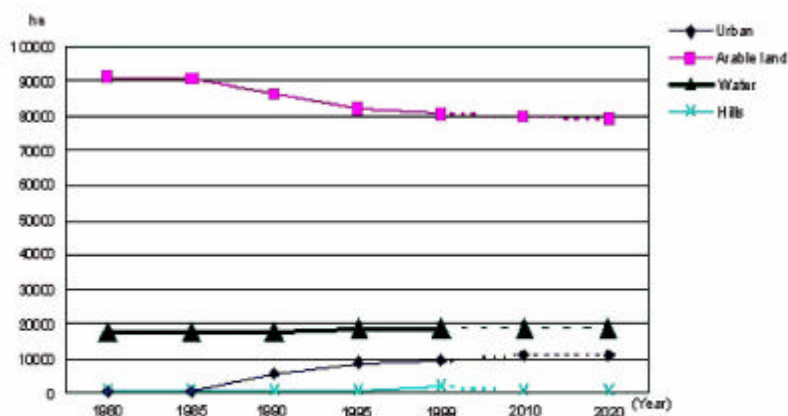


Fig.3- Change in land uses in Xishan city between 1989 and 1999 and prediction in 2010 and 2020

CONCLUSION

We have summarized the whole picture of urbanization presented by expansion of a town center and major factors inducing expansion of a town center taking Xishan city as the study area with emphasis on

land uses, the basis of productive activities in rural society and found the following points.

(1) The population pressure against land in this area was high in the history and the rural region had the problem of surplus working power. The most fundamental driving force that accelerated urbanization in Xishan city may be the constant demand for upgrading of land uses due to such population pressure. However, apart from basic reasons seen anywhere in the southeast coast of China, there were backgrounds peculiar to the region including presence of fertile Taihu plain, favored water and land traffic conditions, close distance to big cities such as Shanghai and Wuxi, long history of engagement in dual industries and commerce, accumulation of funds in stock in the era of "commune" to start local industries, precedent development of local industries, high education level, close territorial bond with Shanghai, flexible management of policies from 1950s and "the age of shortage of things" in 1970s when "anything can be sold if it is made".

(2) While self-helped promotion of urbanization was sought for, local industries not only grew up as a driving force of local economy but also played an important role in local management through investing their profits and paying their taxes to town finance. Therefore, expansion of a town center was regulated by the growth of local industries and their rise and fall was reflected immediately to expansion or reduction of the town center area. On the other hand, accumulation of various functions such as circulation and finance in turn supported local industries. In addition, one cannot ignore presence of a strong driving force produced by Trinitarian unification of the party, administration and business controlling administration, economy, land and personnel completely.

(3) With the accumulation of local industries to town centers, a chain reaction was produced as the employees (village populations) also moved and the increase in the permanent population in the town center urged development of housing lands and accumulation of commerce, transport, communication, finance and service industries resulting in expansion of town center. Depending on the progress of urbanization, the nature of the town center changed from a distribution center of the primary industry to the place accepting industries and, further, to incubator of the tertiary industry.

(4) In Xishan city, adjustment of land uses with emphasis on rearrangement of town center shall be promoted from now on aiming at continuous and profitable land uses.

In the prospective survey of the town center expansion in future, Xishan city plans to move 975,000 persons corresponding to 65% of its population to town centers by 2010. Following the regulation of Jiangsu province to restrict the area occupied by one person to 100 m² or less, the urban area shall have the area of 97.5 km² fit to the population of 975,000 in the town centers. It is probably correct to assume that expansion of town center shall slow down gradually due to enforcement of a new "Land Control Law" and strict instruction from the upper-rank organization such as province related to preservation of agricultural area.

In future, it will be necessary to perform time-series and spatial analysis or internal factors such as a change in the industrial structure and increase in income, external factors such as expansion of Wuxi city, improvement of usability of trunk roads, inflow of population from undeveloped regions, and how expansion of a town center is affected by interaction of these two types of factors and to reflect the analytical results appropriately on a developmental plan and prediction scenario. It is essential for total elucidation of the mechanism of town center expansion to carry out image processing in individual towns as well as to grasp political, administrative, economic, social and cultural aspects related to preparation of development funds and ordering of town center in detail in a number of study areas by categorizing town centers. In concrete, it will be necessary to elucidate themes such as what factor caused expansion of what land use in a town center, or furthermore, how a town center will change in future, which cannot be clarified by satellite image analysis alone through a steady field survey. At that time, it will be needed to promote social and economic approach strongly by focusing to the human level such as the economic situation, thinking pattern, living habit and social territory of inhabitants

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