

ECONOMIC GLOBALIZATION AND A CASE STUDY OF THE URBAN LAND USE GROWTH OF WUHAN, PR CHINA

Lu Wang^a, Huayi Wu^b, Fei Wang^c, Yuemin Hu^d

^a College of Information, South China Agriculture University, Guangzhou, 510642, China, selinachina@hotmail.com

^b LIESMARS, Wuhan University, 129 Luoyu Road, Wuhan, 430079, China, wuhuayi@mail.liesmars.wtusm.edu.cn

^c Dept. of Statistics, Renmin University of China, Beijing, 100872, China, steven_wang_fei@yahoo.com.cn

^d College of Information, South China Agriculture University, Guangzhou, 510642, China, ymhu@scau.edu.cn

Commission PS, WG III/7

KEY WORDS: GIS, Urban Land Use, Global City, Spatial Analysis Model, Dynamic Change, Development

ABSTRACT:

Urban land use is an important component in understanding the interactions of urban economic activities with environment as well as urban expansion, and thus it is necessary to simulate such changes. With the new trend of economic globalization from 1990, Chinese cities are facing a new boom of development, which is sure to be a mixture of urban land exploitation and redevelopment. Firstly, the paper introduces the initial results from a pilot study on urban land use growth of Wuhan in the 1990s. This study is primarily based on the theory of Metropolis Globalization. Spatial and attributes data are organized in GIS and spatial analysis functions of GIS are applied. Spatial analysis model and expansive contribution rate of land use are applied in a detailed case study to measure dynamic changes of land use in urban fringe of Wuhan of PR China. Finally, the study shows that the spatial features and forming mechanisms of urban land use of Wuhan in the 1990s coincided with Global-cities (B) in the theory of Metropolis Globalization.

1 INTRODUCTION

Since the 1970s, when China initiated economic reform and an open-door policy, rapid changes of land use and land cover have taken place in most of its territory. Fast industrialization and urbanization has resulted in cities' rapid sprawl with the loss of a significant amount of agricultural land and allured a series of transformation in urban land use structure as well as spatial distribution. This is especially true in many central areas and big cities in China, such as Wuhan, where economic efficiency is in rapid growing from the 1990s. The same phenomenon appears in big cities of the world, which gives birth to the study of urban land use changes and urban sprawl under the guidance of the theory of Metropolis Globalization. The theory holds that development of economy plays a critical role in the changes of urban land use. Firstly, the demands of economic development show an impetus to urban sprawl; secondly, the possibility of urban sprawl lies in economic capacity. With the improvement of economic development level, different motivations of urban sprawl will cause new characteristics of urban land use. On one hand, trans-corporations promote local finance and trade in tertiary industry, which brings reconcentration and renewal of old local city center; on the other hand, industries transferring among global cities and capital inputted from multinational corporations will impulse global cities themselves to intensify their industry and to arose their sprawl space marginalize. Additionally, bargain products provided by trans-corporations accelerate tertiary industrialization courses among global cities.

2 THEORY OF METROPOLIS ON URBAN LAND USE CHANGES

In the Theory of Metropolis global cities are divided into two types: Global City(A) of fast developed country and Global City(B) of new developing industrial country. It concludes typical characteristics of land use structure and spatial distribution changes of these two types of global cities.

2.1 Characteristics of Land Use Changes of Global City(A)

- (1) Renaissance of old city centers represents the trend of recentralization of metropolises in developed countries.
- (2) It is entry of house building of high salary classes and small corporations to the suburbs that indicates further development of suburbanization.
- (3) Regions of old city centers and urban fringes develop faster than other parts of the city, which proves the existence of developing axis leading by recentralization and suburbanization.

2.2 Characteristics Of Land Use Changes Of Global City(B)

- (1) The most active factor of urban development is the emergence of booming industry parks in the suburbs, which reflects the trend of intensive industrialization in newly industrialized countries.
- (2) There springs up large scale of rebuilding in city center with low expansion degree, comparing with new industry parks of suburbs.
- (3) New industry parks cluster in some directions of urban fringe and urban land exploitation congregates in some concentrative regions in the space.

3 BACKGROUND OF STUDY REGION AND RESEARCH METHODOLOGIES

3.1 BACKGROUND OF STUDY REGION

Urban fringe is an artificial lab to study land use changes. This

research chooses fringe of Wuhan as study object, including inner ring areas of Dongxihu District, Han'nan District, Caidian District, Jiangxia District, Huangpi District and Xinzhou District; regions between inner and outer ring circle such as Qingshan District, Hongshan District, Jiang'an District and Hanyang District and so forth. In order to simplify the research, we put parts of Jiang'an District, Qiaokou District, Wuchang District, Qingshan District, Hongshan District and Jiang'an District together as urban center. Wuhan has a dense traffic network composed of main highway, railroad and sea-route to form a radicalized traffic structure. The main traffic routes are shown in Figure 1.

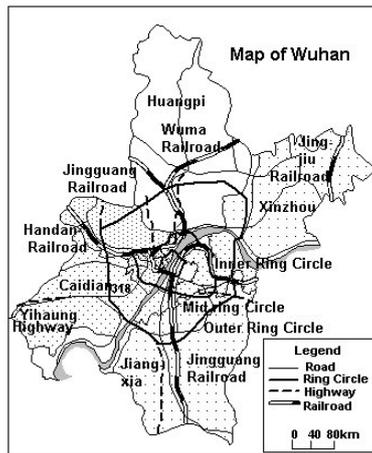


Fig 1. Map of Wuhan

3.2 Data

We adopt 1:8,000,000 Wuhan administrative map as regional data resource. Land use data comes from Wuhan Statistical Book and Wuhan Real Estate Statistical Book from 1990 to 2000. We choose land use category system of 8 categories, such as, arable land, garden plot, woodlands, pastures, urban land use, country residential settlement, water area and non-reclaimed land. Urban land use is composed of 4 kinds of land use styles with town land use, industrial land use, traffic land use, and

special land use respectively. The central city land use mainly attributes to town land use. Because town land use and industrial land use have distinct whole effects in expansion of urban land use, so we combine these two kinds land use as a whole to research.

3.3 Research Methodology

This study utilizes spatial statistical analysis function of GIS software such as Mapinfo and ArcView to handle spatial attribute data. The concrete technical procedure is as follows: Firstly, establishing the vector map of 1:8,000,000 Wuhan map, including regional layers and traffic factor layers, and associating attribute data with spatial data; Secondly, spatial statistical and overlap analysis are done, and maps of land use change are constructed by land use data of different periods; Finally, concluding characteristics of Wuhan land use changes in the 1990s.

4 EXPANSION OF WUHAN URBAN LAND USE IN THE 1990S

Under the influence of global economic development, expansion speed of urban land use of Wuhan can be divided into two periods from 1990 on: The first period (1990-1997) was urban land use fast increasing period, with the upsurge of constructing exploration parks and real estate in Wuhan as well as in the whole China. And the direct investment of Wuhan by foreign companies increased quickly, for example: direct foreign investment of 1990 increased by 62 percent compared with that of 1988, and it is the double of 1987's. The driving force of urban land use expansion of this period was foreign investment stimulated by the economic globalization. The second period (1997-2000) was a smooth increase period of urban land use expansion. During this time urban land use began to expand reasonably because a series of macroscopical adjustment policies were carried out by the government to control excessive urban land use exploitation and lead urban land use to a reasonable development.

land use style	1990 area	1997 area	2000 area	1990□1997		1997□2000			
				expansive area	expansive contribution rate	expansive area	expansive contribution rate		
	ha.	ha.	ha.	ha.	%	ha.	ha.	%	ha.
Town land use	82894.8	91220.4	94959.5	8325.6	80.8	1387.6	3739.1	75.1	1246.4
Traffic land use	12261.8	14243.2	15479.2	1981.4	19.2	330.2	1236	24.8	412
Total land use	95156.6	105463.6	110438.7	10307	100	1717.8	4975.1	100	1658.4

*Expansive contribution rate is the percentage of a certain expansive area of urban land use in the total expansive area of urban land use at the same time.

Table 1. Urban land use expansive speed(ha.)and expansive contribution rate(%) of Wuhan (1990-2000)

5 SPATIAL DISTRIBUTION OF URBAN LAND USE EXPANSION IN WUHAN

5.1 Land Use Spatial Model

Expansive intensity index per year is selected to describe spatial model of urban land use distribution in this study. Expansive intensity index is the percentage of expansive area of urban land

use in the total area of urban land use in the certain period of our research. Average expansive intensity index per year is the standardization value of expansion speed per year by area of each spatial cells, which is also calculated to compare urban land use changes in different periods.

$$B_{i,t \square t+n} = [(ULA_{i,t+n} - ULA_{i,t}) / n] / TLA \quad (1)$$

$B_{i,t+n}$, $ULA_{i,t+n}$, $ULA_{i,t}$ separately are expansive intensity index per year of spatial unit i , land use area of year $t+n$, land use of year t , TLA_i is total land use area.

5.2 Spatial Distribution Of Urban Land Use Expansion (1990-1997)

5.2.1 Spatial Distribution of Town Land Use

Expansive intensity index per year of town land use is 0.1389. Standard variation of per year expansive intensity index of each district is 0.91077. It is shown in Figure 2(a): □ Dongxi Lake District and Hankou District are expanding with high speed. Low speed expansion is along the axis of Huangpi-Jiangxia. □ Expansion of town land use is concentrated in the north of Yangtze River and between inner and outer ring circles, such as Qiaokou District, Jiangnan District, Jiang'an District, Dongxi Lake District and Hanyang District in the space, which is an outskirts distribution style. □ Distribution along main traffic routes is the main characteristic of town land use expansion of this period, especially the expanding along Jing-guang Railroad and Han-dan Railroad.

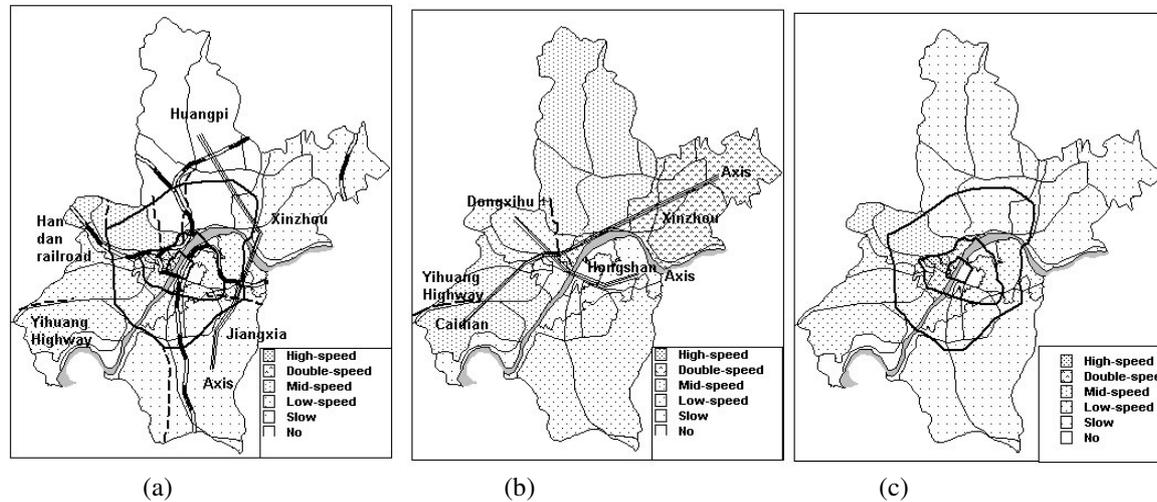


Fig 2. Spatial distribution of Wuhan land use expansive intensity (1990-1997)

5.2.3 Spatial Distribution of Urban Land Use Expansion

Expansive intensity index per year of urban land use is 0.17192. Standard variation of per year expansive intensity index of each district is 0.9664. It is shown in Figure 2(c): □ The expansive intensity index gradually decreases from south west to north east. □ Urban land use extends in a homologous circle-like structure in space with the center of Qiaokou District and Jiangnan District and decreases gradually to its circumambience. □ During this period, the motive sources of urban land use expansion came from the pulling function of foreign capital from trans-corporations. In the period of 1990-1997, correlation between actually utilized foreign capital and real estate exploitation of Wuhan is 0.9974, and at the same time, correlation between direct investment of foreign company and real estate exploitation is 0.891. It seems that utilization of foreign capital is closely related to land use expansion of Wuhan.

5.3 Spatial Distribution Of Urban Land Use Expansion (1997-2000)

5.2.2 Distribution Of Traffic Land Use

Expansive intensity index per year of traffic land use is 0.0331, only one fifth of town land use. Standard variation of per year expansive intensity index of each district is 0.6902. It is shown in Figure 2(b): □ The expansive intensity index of traffic land use holistically increases from double sides of the axis of Dongxihu-Qiaokou-Hongshan. In a whole, most of the districts take on high speed expansion, because the government invest large amount of money in local infrastructure construction to accelerate economic development in Mid-China. □ Sprawl of traffic land use shows a style of asymmetrical enhancement from inner of the city to the outer, evidently along the axis of Caidian-Xinzhou. □ Driven by investment Wuhan traffic land use expands quickly. Meanwhile Wuhan have finished building Tianhe National Airport and rebuilding part of 318 National Highway using foreign capital, and connecting with Yihuang Highway, which integrates national highway, main city road and regional traffic road together facilitated expansion of traffic land use towards mid-ring circle. Subsequently, it is visible that expansion of traffic land use sprawls directing suburbs.

5.3.1 Spatial Distribution Of Town Land Use Expansion

Expansive intensity index per year of town land use is 0.146. Standard variation of per year expansive intensity index of each district is 0.2633. The town land use becomes more concentrative than before. It can be seen in Figure 3(a): □ Compared with the first period, town land use becomes concentrated in the outside of inner ring circle, such as, Jiangnan District, Hongshan District, and Caidian District. □ The expansion axis becomes much clearer than before, that is, Caidian-Hongshan-Xinzhou axis. It reflects fringe area comes into being the hotspot of real estate exploitation. On the contrary it is more difficult to reform old city center, which makes the appearance of "city hollow" phenomenon gradually, leading more citizens to choose suburbs for dwelling.

5.3.2 Spatial Distribution Of Traffic Land Use Expansion

Expansive intensity index per year of traffic land use is 0.1446, higher than the former period. Standard variation of per year expansive intensity index of each district is 0.2398. It is shown in Figure 3(b): □ Traffic land use expansive index reduces from south west to north east. Fast expansion districts are concentrated on Caidian District, Jiangxia District and Hanyang District. And the expansion direction is opposite to the former

period of Xinzhou direction. Expansion of traffic land use further strengthens in suburbs and it will be the new trend in the coming year.

5.3.3 Spatial Distribution Of Urban Land Use Expansion

Expansive intensity index per year of urban land use is 0.1940. Standard variation of per year expansive intensity index of each district is 0.2331. The expansive intensity of urban land use in this period has undertaken a great rise in the whole. It is shown in Figure 3(c): The barycenter of urban land use exploitation

has moved from city center of the former period to urban fringe area. The core belt of the expansion of urban land use mainly focus on region of outside of inner ring circle including Hongshan District, Jianghan District, and Dongxihu District. Expansion of urban land use stretches along Jing-guang Railroad and Han-da Railroad, which passes many economic developing zones, for example, Yanluo economic developing zone, Donghu IT zone and so on. Moreover, urban land use will become more rational driven by economic globalization.

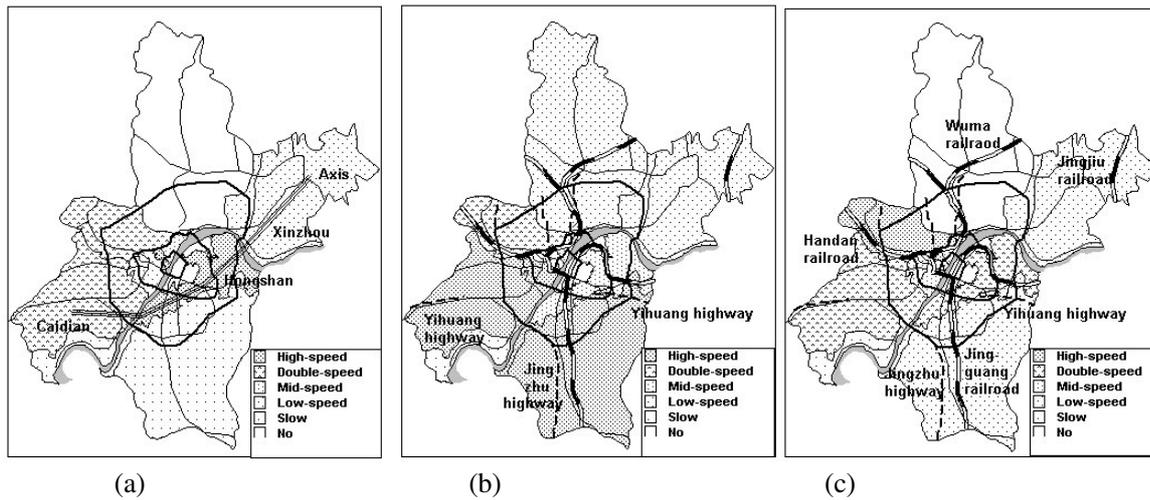


Fig 3. Spatial distribution of Wuhan land use expansive intensity (1997-2000)

6 EXPANSION MODEL OF URBAN LAND USE OF WUHAN UNDER THE BACKGROUND OF GLOBALIZATION

6.1 Expansion Model Of Town Land Use

The suburbs in the south west of Wuhan is the most active and concentrating region of the expansion of town land use. The center of the expansion of town land use transfers gradually from central city to the outside. Expansion of town land use is a model of circular expansion in the space, that is, it transforms from the inner ring circle of Qiaokou-Dongxihu axis to the outer ring circle of Dongxihu-Jianghan-Hongshan-Caidian axis.

6.2 Expansion Model Of Traffic Land Use

The space form of traffic land use expansion of Wuhan is mainly a gradually scattering expansion, whose expansion center transfers from north to south. The driving force of this expansion is the construction of transportation infrastructure. Since 1990, the government has poured 96.7 hundred million into transportation infrastructure constructing to shape three-dimensional, networked, high-speed and intelligent traffic system in Wuhan. Expansion of traffic land use will integrate with regions of foreign capital afflux to build good investment environment, and to enhance comprehensive service and radiate ability of Wuhan, which makes expansion of traffic land use of Wuhan toward the direction of Dongxihu District, Hanyang District, Caidian District, and Jiangxia District.

6.3 Expansion Model Of Urban Land Use

The space form of urban land use expansion of Wuhan is

superior in axial expansion and secondary for circular extension. Its expansion axes develop from single axis to multi-axis with relevant marked enhancement, for example, from Qiaokou-Dongxihu axis of year 1990-1997 to Dongxihu-Jianghan and Caidian-Hongshan axes of year 1997-2000. The active center of expansion of urban land use is transferring from center to circumambience.

7 CONCLUSIONS

Driven by the economic globalization, Wuhan land use has got dynamic changes in 1990s. The evidence is in the followings: Industrial and traffic land use plays a great role in shaping expansion models of urban land use. Expansive intensity of urban land use has certain increase in different directions of the city, which forms Wuhan land use pattern of gradual expanding from central city to circumambience, from near suburbs to outer suburbs. In the process of urban land use growth, on one side central city has gained a strong driving power to economic development, for instance, utilizing of foreign capital promotes the development of old city center and real estate; on the other side spatial distribution of urban land use appears to extend toward suburbs with the enhancement of Caidian-jiangxia axis in the near suburbs and the slow improvement of Huangpi-Xinzhou-Han'nan axis in the outer suburbs.

In conclusion, the spatial features and forming mechanisms of urban land use of Wuhan in the 1990s coincided with Global-cities (B) in the theory of Metropolis Globalization, which are all in the prophase of developing or fast developing industrialization in great need of funds to rebuild city center. So urban fringe becomes highlight of investment urged by the

capital inputting. Subsequently, in the process of economic globalization Wuhan should integrate its industry, commerce, finance, IT and tourism to reform its industrial structure and to adapt world economic development as soon as possible. At the same time, it is urgent to expand finance channels, improve investment environment and to control the rational growth of urban land use, in order to facilitate Wuhan from a regional city to a global city.

8 REFERENCES

Wu Z.Q., 1998. Background and its framework of Globalization Theory. *Urban Planning Forum*, (2), pp. 1-6.

Wu Z.Q., 2000. A case study of globalization theory: spatial distribution of land exploitation in Shanghai. *Urban Planning Forum*,(4), pp. 38-46.

Liu S.H., 2000. A GIS model of urban land use growth in Beijing. *Acta Geographica Sinica*, 55(4), pp. 407-416

Wu Z.Q.,1998.Expansion model: urban development model of global city. *Urban Planning Forum*, (5), pp. 1-8