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Article

Study on the Status of Urbanization Development and the Change of Cultivated Land Area in Nanjing

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Abstract: The urbanization rate of Nanjing has increased in the past 55 years. Its development process can be roughly divided into the reverse urbanization phase, the stagnant development phase, the recovery development phase, the steady development phase, and the accelerated development phase. The area of cultivated land has a decreasing trend at each stage. In 1971 and beyond, urbanization development had a significant negative effect on the area of cultivated land, and the coordination between the two was not high and there was a downward trend.

Keywords: Nanjing; urbanization; cultivated area; variety

1 Introduction

Urbanization is a historical process. In this process, human society will shift from agricultural production to service industry and industrial production. After the arrival of the industrial society, the proportion of urban populat ion and non-agricultural activities will increase, the proportion of rural population and agricultural activities will decrease, people's material level will be strengthened to the urban level, and the human lifestyle will gradually shift to urban areas. The main manifestations of urbanization include the increase in the size and quantity of cities, the increase of urban population and the improvement of urban modernization level [1].

At the end of 2014, the resident population of Nanjing reached 8.216 million, an increase of 28,000 over the previous year. The regional GDP increased by 10 percentage points over 2013, reaching 882.08 billion yuan [2]. Among them, the added value of the primary industry was 22.4 billion yuan, an increase of 3.5 percentage points; the added value of the secondary industry increased by 9% compared with last year to 367.15 billion yuan, and the added value of the tertiary industry was about 492.53 billion yuan, an increase of 12%. The per capita GDP reached 107,545 yuan [3]. The overall economic situation continued to grow steadily.

The total industrial output value and the total output value of agriculture, forestry, animal husbandry and fishery and its service industry were 132,397 million yuan and 38.462 billion yuan, respectively [4–7], an increase of 5 percentage points and 9 percentage points from the end of 2013. Among them, the output value of agriculture, forestry, animal husbandry and fishery services reached 1.819 billion yuan, an increase of about 10 percentage points; the total output value of animal husbandry was about 4.823 billion yuan [8,9], a decrease of 1% over last year; the agricultural output value was 21.185 billion yuan, an increase of 11.8%; The fishery output value was 7.986 billion yuan, an increase of about 8 percentage points over the previous year; the forestry output value reached 1.984 billion yuan, an increase of 11% compared with 2013. The overall agricultural production situation is relatively stable.

In 2014, in the industrial structure of Nanjing, the proportion of the tertiary industry increased by 1.2 percentage points compared with last year [10,11]; the output value of high-tech industries accounted for

43% of the industry, reaching 574.1 billion yuan; the output value of advanced manufacturing increased compared with 2013. 1.5%, accounting for about 45% of the above-scale industries; the added value of software, information transmission and computer services contributed 6% of GDP, reaching 50.76 billion yuan, an increase of 24% over last year; financial added value is regional Gross domestic product contributed 11% to 95.881 billion yuan, an increase of 0.3% compared with last year [12]. The industrial structure of Nanjing continues to be optimized.

2 Analysis Methods

The methods of urbanization level measurement include a single indicator method and a comprehensive indicator method. When using a single indicator method to describe the level of urbanization, the selected indicators are relatively simple, easy to analyze, and most directly representative. The commonly selected indicators include the proportion of non-agricultural GDP to total GDP, and the non-agricultural population as the total population. The proportion and the proportion of urban population to the total population [13,14]. Although the single indicator method is simple, it cannot fully describe the urbanization process, and the deviation rate is generally large. Therefore, the comprehensive indicator method can more accurately measure the level of urbanization [15,16]. According to the actual situation of Nanjing, the comprehensive index K of the following two indicators is used to measure the urbanization level of Nanjing: (1) The ratio of non-agricultural GDP to total GDP K_1; (2) The ratio of non-agricultural population to total population K_2. The weights of K_1 and K_2, 0.2 and 0.8 are respectively assigned by the Delphi method, and a weighted average is obtained to obtain a comprehensive index K. That is, $K = 0.2K_1 + 0.8K_2$, and the change of K value represents the development of urbanization.

3 Results Analysis

3.1 Changes in the Level of Urbanization in Nanjing

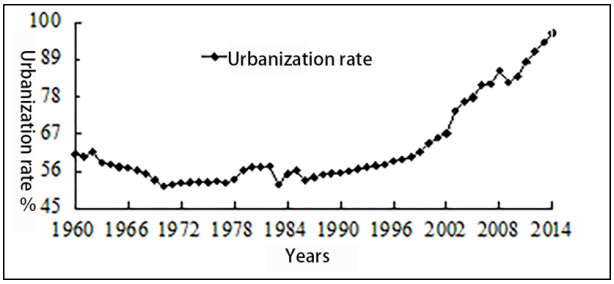

Figure 1: The urban development of Nanjing in the past 55 years

As can be seen from the above figure, the urbanization rate in Nanjing has generally increased over the past 55 years. The average annual increase is 0.6%. In 1970, Nanjing's urbanization rate was the lowest, at 51%; in 2014, the urbanization rate reached the highest, at 96%; the difference between the two extremes was 45%. The average urbanization rate in the past 55 years is 63%. From this trend of urbanization, it can be seen that the proportion of non-agricultural population in Nanjing is gradually increasing, the proportion of agricultural population is relatively low, the economic development is growing steadily, and the proportion of secondary and tertiary industries in the social economy is also increasing. The higher as can be seen from the figure, the development process of urbanization in Nanjing can be roughly divided into the following stages:

(1) Reverse urbanization stage (1960–1970)

During this period, the urbanization development of Nanjing City showed a downward trend, with an average annual decline of 0.95%. In 1962, the urbanization rate was the highest, at 61.86%; in 1970, the urbanization rate was the lowest, at 51.59%, and the difference between the two extremes was 10.27%. During the “Great Leap Forward”, the main goal of the state in economic construction was to achieve high indicators, the rapid development of urban industry, and the social economy showed a state of abnormal

growth. To this end, the state began to adopt a series of measures, such as the reduction in the number of urban construction, the improvement in quality, and the partial return of the population to the urban areas. During this period, the proportion of the agricultural population in Nanjing gradually increased, non-agricultural. The proportion of the population has gradually decreased, and the city is in the stage of de-urbanization.

(2) Stagnation development stage (1971–1977)

During this period, the urbanization development of Nanjing City has tended to stagnate, with no obvious fluctuations and relatively stable. The highest urbanization rate and the lowest urbanization rate are 0.45%, and the average urbanization rate is 52.70%. During this period, influenced by the "Cultural Revolution", the idea of vigorously developing urbanization was transformed. In order to overcome the differences between industry and agriculture, urban and rural areas, mental and physical labor, and realize urban-rural integration, urbanization in Nanjing suppressed.

(3) Recovery and development stage (1978–1982)

After 1978, Nanjing began to restore urbanization. At this stage, the highest level of urbanization occurred in 1982, which was 57.59%; the lowest urbanization level appeared in 1978, which was 53.55%, which was 4.04% different from the highest urbanization rate; The average urbanization rate was 56.42%. After the reform and opening up, the state promoted the household contract responsibility system in rural areas. The rural productivity of Nanjing has been greatly improved, and the economy has been vigorously developed. At the same time, the rise of township enterprises has also driven the urbanization of Nanjing. Under such circumstances, a large number of rural population and surplus labor have flocked to cities. According to statistics, between 1978 and 1982, the total population of Nanjing increased from 3,379,500 to 3,743,700; the non-agricultural population increased from 1,523,100 to 189.03.

(4) Steady development stage (1983–2002)

After reviewing the Nanjing Statistical Yearbook, it was found that after 1983, Gaochun County and Lishui County were classified as Nanjing Municipality. The total population of Nanjing City was changed from 3,743,700 in 1982 to 4,563,100 in 1983. The increase in the total population base led to a decrease in the ratio of non-agricultural population to the total population, and the urbanization rate also decreased to 52.00%. By 2002, the urbanization level of Nanjing City had risen to 67.25%, and the urbanization water has grown steadily, with an average annual increase of 0.64%. At this stage, the urban system in Nanjing changed, and the original rural labor force in small towns was transferred to the rural areas. The government's encouragement to establish non-agricultural industries in rural areas slowed down the urbanization process in Nanjing. Since then, the construction boom of high-tech development zones, science parks, and industrial parks has begun to emerge. According to statistics, the average growth rate of the second and third industries in Nanjing at this stage is 3.30 billion yuan and 3.684 billion yuan respectively, while the growth rate of the primary industry is only 308 million yuan per year. This shows that the second and third industries develop rapidly. The level of urbanization in Nanjing has risen steadily with the deepening of reforms.

(5) Accelerated development stage (2003–2014)

The urbanization level of Nanjing has accelerated at this stage, with an average increase of 1.89% per year, which is greater than any previous stage. In 2014, the urbanization rate was the highest, reaching 96%. In 2003, the urbanization rate was the lowest, at 73%, which was 23% from 2014. The average urbanization level in this 12-year period was 84%. During this period, on the basis of national conditions, the central government decided to coordinate the common development of small towns, large, medium and small cities, and actively enter urbanization. In response to the call of the central government, Nanjing Municipality promoted various economic policies and vigorously developed the economy. The non-agricultural GDP increased from 16.1226 billion yuan in 2003 to 860.65 billion yuan in 2014. The average growth rate of total GDP is 0.15% per year.

3.2 Dynamic Changes of Cultivated Land Area in Nanjing

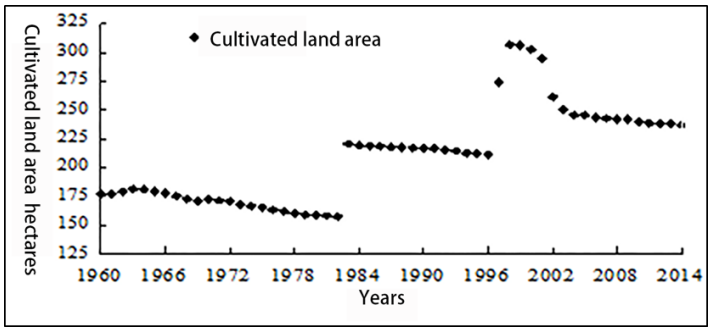

Figure 2: Changes in cultivated land area in Nanjing in the past 55 years

The above arable land area data are all obtained in the Nanjing Statistical Year book website. It can be clearly seen from the above figure that between 1960 and 2014, the data on the area of cultivated land in Nanjing was not continuous and had obvious phase characteristics. In 1983, Lishui County and Gaochun County were classified as the jurisdiction of Nanjing and the administrative divisions were expanded [17,18]. Therefore, the arable land area increased after 1983; the cultivated land data in 1996 and before were the Nanjing agricultural census data, and after 1997, the cultivated land area was calculated by the Nanjing Municipal Bureau of Statistics on the basis of the agricultural census data, and the statistical method was changed. Therefore, the cultivated land area data was not continuous with the previous one. In the analysis of the dynamic changes in the area of cultivated land in Nanjing in the past 55 years, it should also be described in stages.

Introducing cultivated land dynamics K, U_a is the area of cultivated land in the initial research area; U_b is the area of cultivated land in the final study area; T is the length of the study period.

(1) 1960–1982

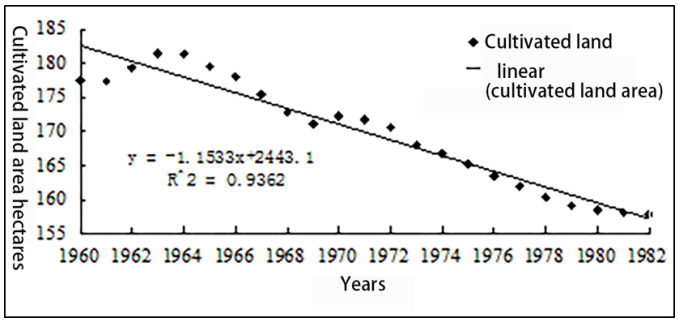

Figure 3: Dynamic change of cultivated land area in Nanjing from 1960 to 1982

The area of cultivated land at this stage has generally decreased, and the reduction is 1.15 thousand hectares/year. F = 308.02, t = –17.55, the corresponding p values are less than 0.01, R = 0.976 > $R_{(0.01)}$ = 0.527, passed the significance test of 0.01 level. The average cultivated area was 169.94 thousand hectares; in 1963, the cultivated land area was the largest, which was 181.49 hectares; in 1982, the cultivated land area was the smallest, which was 157.81 thousand hectares, which was 23.68 thousand hectares from the maximum. The dynamic degree of cultivated land is 0.54%. During this period, China experienced the Great Leap Forward Movement, the three-year natural disaster and the Cultural Revolution Movement. In order to speed up urban construction, blindly develop industry, chaos and deforestation, the awareness of cultivated land protection is weak, and a large area of cultivated land is occupied. Since the reform and opening up, Nanjing has accelerated urban and rural construction, focusing on the development of social economy. Farmers' production enthusiasm has been greatly improved. The development of township industrial enterprises must be accompanied by the expansion of urban land use, the acceleration of urban

expansion and the loss of cultivated land.

(2) 1983–1996

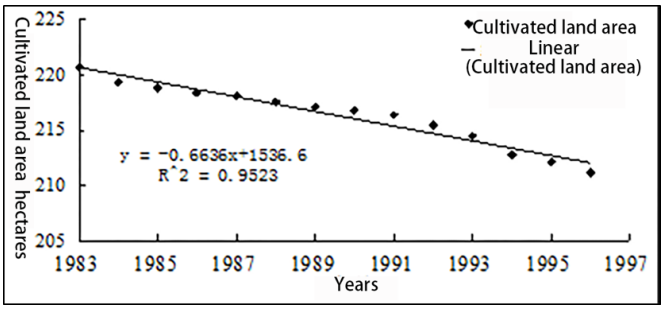

Figure 4: Dynamic change of cultivated land area in Nanjing from 1983 to 1996

As can be seen from the above figure, the number of cultivated land in Nanjing has a decreasing trend at this stage, and the reduction is 0.66 thousand hectares/year, F = 239.387, t = –15.472, corresponding p values are 0, R = 0.976 > $R_{(0.01)}$ = 0.66, passed the significance test of 0.01 level. Compared with the previous stage, the rate of reduction of cultivated land area at this stage has been alleviated. In 1983, the largest cultivated land area was 220.73 thousand hectares. In 1996, the cultivated land area was the smallest, which was 211.21 thousand hectares, which was 9.52 thousand hectares from the maximum. The average cultivated area at this stage was 216.41 thousand hectares. The dynamic degree of cultivated land was calculated to be 0.32%, which was smaller than the dynamic degree of cultivated land in this stage from 1960 to 1982, indicating that the rate of change of cultivated land area in Nanjing was small compared with the previous stage. In the meantime, in order to complete the seventh five-year plan, Nanjing City expanded the scale of urban infrastructure construction, increased the use of agricultural land for non-agricultural use [19,20], and adjusted the agricultural structure. At the same time, Nanjing has set off a boom in the development of development zones and real estate. Occupied part of the cultivated land. For reasons of policy and system, the change of cultivated land area from 1983 to 1996 was smaller than that of the previous stage [21,22]. For example, the Land Administration Law enacted in 1986 and the Interim Regulations on Farmland Occupation Tax issued in 1987, 1991. The implementation of the Land Administration Law Regulations and the Basic Farmland Protection Regulations in 1994, are promulgated to establish a farmland protection mechanism to raise people's awareness of cultivated land protection and reduce the loss of cultivated land.

(3) 1996–2014

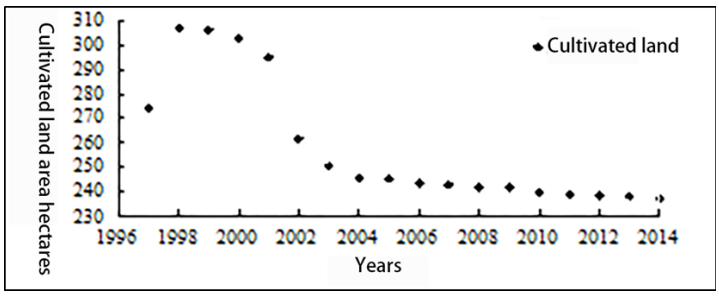

Figure 5: Dynamic changes of cultivated land area in Nanjing from 1996 to 2014

From 1997 to 2014, the area of cultivated land in Nanjing showed a significant decrease, with an average reduction of 4.05 thousand hectares per year. The largest amount of cultivated land occurred in 1998, which was 306.82 thousand hectares; the minimum appeared in 2014, which was 237.19 thousand hectares, which was 69.63 thousand hectares from the maximum; the average cultivated area was 258.43 thousand hectares. The dynamic degree of cultivated land is 0.87%, which is the maximum of the three

stages, indicating that the number of cultivated land in Nanjing has changed greatly during the 18 years. From 1997 to 2002, the cultivated land decreased rapidly. After 2002, the rate of reduction of cultivated land was moderated. From 1997 to 2002, the total population and non-agricultural population increased rapidly, and the increase in population must inevitably increase the demand for urban construction, such as roads, houses and other public facilities. Driven by urbanization, in order to develop the social economy, a large number of development zones and industrial parks have been established in the suburbs, all of which are at the expense of occupying the area of cultivated land, plus the adjustment of agricultural structure, during this period, cultivated land. The area is rapidly reduced. After 2002, the area of cultivated land decreased slowly. Although the urbanization construction is still continuing, the cultivated land is still being continuously occupied, but as agriculture is increasingly valued by the state, various policies conducive to the protection of cultivated land have been introduced, such as severe legal punishment for illegally occupying cultivated land [23]. Limit urban land expansion and so on. In order to protect cultivated land, the Nanjing Municipal Government has formulated a master plan for land use and rationally utilized every inch of land. People's awareness of the protection of cultivated land has also been strengthened. Therefore, the reduction in cultivated land after 2002 is reduced.

4 Conclusions and Discussion

The urbanization rate of Nanjing has increased volatility in the past 55 years, and the overall trend has increased. Its development process can be roughly divided into the reverse urbanization phase [24] the stagnant development phase, the recovery development phase, the steady development phase, and the accelerated development phase. The area of cultivated land has a decreasing trend at each stage. In 1971 and beyond, urbanization development had a significant negative effect on the area of cultivated land, and the coordination between the two was not high and there was a downward trend. The average annual increase is 0.6%. The average urbanization rate is 63%. The proportion of non-agricultural population has gradually increased, the proportion of agricultural population has decreased relatively [25,26]; the economic development has grown steadily, and the proportion of secondary and tertiary industries in the social economy has also increased. The development process of urbanization in Nanjing can be roughly divided into the reverse urbanization phase, the stagnant development phase, the recovery development phase, the steady development phase, and the accelerated development phase.

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