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An Empirical Study on the Relationship between Urbanization and Changes in Resources and Environment

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Abstract The expansion of urban scale is the inevitable outcome during urbanization, and it has exacerbated the contradiction between urbanization, and resources and environment. Based on the environmental indicator data related to the urbanization of Chongqing Municipality during the period 2000 - 2012, this article uses regression analysis and ARIMA forecasting model to study the impact of rapid urbanization on the resources and environment. It is found that urbanization is significantly and positively correlated with the built-up area, the annual electricity consumption, domestic waste water discharge amount, and industrial waste gas emission, but significantly and negatively correlated with the industrial solid waste discharge amount; before 2020, along with the improvement of the level of urbanization in Chongqing, the degree of deterioration of the environment and resources will be further increased; after 2020, urbanization and ecological environment will be in a new round of balance, and the resources and environment will be improved.

Key words Urbanization, Resources and environment, Sustainable development, Chongqing

1 Introduction

Urbanization is the increasing number of people that live in urban areas[1]. It predominantly results in the physical growth of urban areas, be it horizontal or vertical. The United Nations projected that half of the world's population would live in urban areas at the end of 2008. By 2050 it is predicted that 64.1% and 85.9% of the developing and developed world respectively will be urbanized. Urbanization is closely linked to modernization and it can tap the maximum potential of domestic demand. The rapid development of urbanization greatly accelerates the pace of economic development, improves the living standards, and promotes the social civilization; but at the same time, the accelerated pace of urbanization has generated serious pressure on the resources and environment[2]. Currently, the contradiction between the development of urbanization and the protection of resources and environment has become increasingly prominent, and how to well handle the relationship between urbanization, and resources and environment is a major issue facing us. The history of the world urbanization shows that urbanization has the obvious stage characteristics, and its development path is similar to a flattened "S" curve. Generally speaking, when a country or region's urbanization rate is between 30% and 70%, it is at the middle stage of urbanization, and will enter a rapid development stage[3]. From the level of economic development, the World Bank's statistics on 133 countries in the world show that when per capita GDP is increased from $ 700 to $ 1000 - 1500, and the economic development reaches the standard of moderately developed countries, the urbanization will be accelerated, and the proportion of urban population to total population will reach 40% - 60%[4]. Chongqing is regarded as an important growth pole of economic development in the western region. In 2012, Chongqing had a total population of 29.45 million, and the urban population was 16.78 million; the level of urbanization reached 56.98%, and the per capita GDP was 38914 yuan, 6.2 times the per capita GDP in 2000 (6274 yuan), indicating that Chongqing City was at the stage of rapid development of urbanization. Based on Chongqing's urban development and the changes in resources and environment, this paper uses the statistical analysis to explore a resource-saving, environment-friendly, and economy-efficient new path of urbanization.

2 The impact of the development of urbanization on the changes in resources and environment

The positive impact of the accelerated urbanization of Chongqing on the resources and environment is mainly manifested as follows: the urbanization promotes the improvement of urban infrastructure, conducive to the formation of industrial clusters and economic agglomeration, while the economic agglomeration helps to improve the efficiency of resource use and reduce the management costs by increasing returns to scale[5]. At the same time, the rapid development of urbanization in Chongqing has brought significant pressure on the resources and ecological environment, inevitably resulting in the environmental problems and resource shortages (Table 1).

2.1 The impact of urbanization acceleration on the resources

2.1.1 Increasing bearing pressure for land resources. A concrete manifestation of the rapid development of urbanization is the rapid expansion of urban areas[6]. In 2000, the land area of Chongqing's administrative regions was 845.68 square kilometers, and in 2012, it was increased to 3548.17 square kilometers, with an increase of 2702.49 square kilometers within 12 years, and the annual growth rate of 26.63%. In the incessant expansion of urban land, the urban built-up area grew most significantly. In 2000,

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the Chongqing's built-up area was only 439.22 square kilometers, and in 2012, it soared to 1324.94 square kilometers, an increase of 885.72 square kilometers within 12 years. The rapid development of urbanization continues to squeeze the arable land resources, and the agricultural land has been swallowed. In the period 2000 – 2012, the total sown area of crops in Chongqing declined significantly, and it was decreased by 113121 hectares in 2012 compared to 3590815 hectares in 2000. The increasing built-up are and urban land expansion, have reduced the urban per capita land resources and caused large bearing pressure for land resources.

Table 1 Chongqing's urbanization rate and the related environmental indicators in the period 2000 – 2012

Indicators	2000	2001	2002	2003	2004	2005	2006
Urbanization rate//%	35.6	37.4	39.9	41.9	43.5	45.2	46.7
The land area of the administrative region//km^2	845.68	1 295.35	1 543.67	1 756.17	1 759.72	2 143.71	2 367.73
Built-up area//ha	439.22	452.03	559.89	654.95	647.78	732.87	810.71
Residential land area//ha	143.06	146.11	169.78	188.53	179.25	256.68	287.85
Public facility land area//ha	54.23	66.68	75.37	79.04	77.68	78.77	87.73
Industrial land area//ha	90.4	75.05	86.24	107.20	105.35	138.95	141.73
The total sown area of crops//ha	3 590 815	3 555 871	3 464 566	3 307 179	3 435 957	3 444 733	3 073 880
The annual electricity consumption//10^4 t standard coal	296.65	344.54	348.44	361.56	379.84	428.86	497.98
Industrial electricity consumption//10^4 kwh	1 129 430	1 457 462	1 650 339	1 787 528	1 809 364	2 030 558	2 328 248
Household water use amount//10^4 m^3	41 885	33 715	33 835	34 664	36 160	39 433	42 279
Total industrial waste water discharge amount//10^4 t	84 344	81 214	79 872	81 973	83 031	84 885	85 866
Domestic sewage discharge amount//10^4 t	43 953	45 301	46 394	51 988	52 487	60 336	62 621
Total industrial emissions//10^8 m^3	1 907.90	1 856.24	1 978.89	2 276.94	3 540.86	3 654.55	5 066.96
Fixed industrial waste discharge amount//10^4 t	238.42	168.23	160	142	118.00	184.00	133.00

Indicators	2007	2008	2009	2010	2011	2012
Urbanization rate//%	48.37	49.99	51.59	53.02	55.02	56.98
The land area of the administrative region//km^2	2 578.34	2 716.8	2 999.6	3 319.87	3 745	3 548.17
Built-up area//ha	872.70	933.04	1 026.84	1136.53	1 325.44	1 324.94
Residential land area//ha	318.36	338.15	353.35	362.87	392.45	358.95
Public facility land area//ha	96.35	102.34	105.5	117.78	127.31	101.18
Industrial land area//ha	158.14	164.85	209.14	240.03	266.32	225.13
The total sown area of crops//ha	3 134 700	3 215 064	3 308 300	3 359 387	3 413 088	3 477 694
The annual electricity consumption//10^4 t standard coal	552.08	597.2	654.25	768.18	881.22	888.6
Industrial electricity consumption//10^4 kwh	2 813 099	3414033	3 674 216	4334935	4 824 286	4 994 779
Household water use amount//10^4 m^3	39 548	42 523	44769	50 177	52 138	56 007
Total industrial waste water discharge amount//10^4 t	69 003	67027	65 684	45 180	33 954	30 611
Domestic sewage discharge amount//10^4 t	65 238	78 086	81 385	82 933	97 355.6	101 676.7
Total industrial emissions//10^8 m^3	7 616.62	7 350.73	12 586.52	10 943.13	9 121.07	8 359.88
Fixed industrial waste discharge amount//10^4 t	138.00	149.00	150.00	134.00	24.00	5.00

Data source: *Chongqing Statistical Yearbook* (2000 – 2012).

2.1.2 The shortage of water and electricity resources and exacerbated contradiction between supply and demand. With the continuous development of urbanization and ceaseless expansion of urban scale, the urban demand for resources will increase significantly, resulting in the further tension in the contradiction between supply and demand of water and electricity resources[7]. In the period 2000 – 2012, the household water use amount in Chongqing constantly climbed. The household water use amount was 418.85 million cubic meters in 2000, and it was increased to 560.07 cubic meters in 2012. In the period 2000 – 2012, the annual electricity consumption in Chongqing continued to rise. The annual electricity consumption reached 2.9665 million t standard coal in 2000, and it was increased to 8.886 million t standard coal in 2012, with an increase of 5.9195 t standard coal over 12 years, and the average annual growth rate of 16.63%. The industrial electricity consumption was the most prominent. It was only 11.2943 billion kwh in 2000, and it was increased to 49.94779 billion kwh in 2012, with the annual growth rate of 3.2211241 billion kwh. This fully reflects the trend of water and electricity use in recent years, and with the accelerated development of urbanization, people's demand for water and electricity will continue to increase.

2.1.3 Surging consumption of energy resources. Chongqing is at the early stage of accelerated development of urbanization, and the tertiary industry is not yet developed. The power source for the development of urbanization mainly relies on the secondary industry, while the secondary industry is primarily based on energy – consuming industries[8].

As can be seen from Fig. 1, in the period 1997 – 2004, Chongqing's GDP maintained relatively stable growth rate, and the total energy consumption in this period steadily rose, and was always higher than the growth rate of GDP. In the period 2005 – 2009, Chongqing's GDP was substantially increased, and at the same time, the total energy consumption showed a rapid growth trend, and was still significantly higher than the growth rate of GDP. After 2009, GDP experienced drastic growth, and the growth rate was far greater than the energy consumption rate. With the introduction and implementation of energy-saving and emission-reduction policies, the energy efficiency is clearly improved, but the energy consumption is still rising. With the rapid economic growth in Chongqing, the industrialization and urbanization

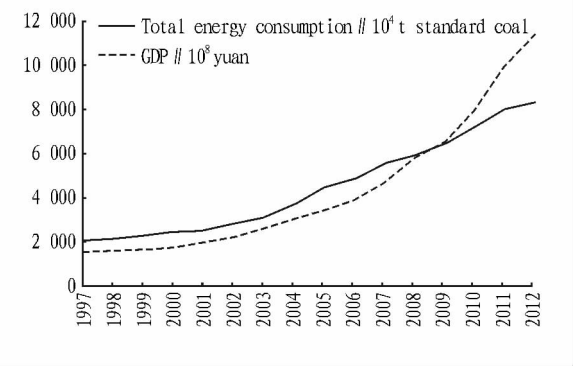

Fig. 1 The changes in the total energy consumption and regional GDP in Chongqing during the period 1997 – 2012

process will be accelerated, and the energy consumption will be increased year by year. In addition to the serious external dependence in energy consumption, it has resulted in the energy shortages in the markets and seriously affected the stability of economic and social development.

2.2 The impact of urbanization development on the environment

2.2.1 The impact on the water environment. The urbanization development and growing urban population have increased the demand for water while the shortage of water resources and the threat of water pollution are constantly deteriorating. In addition, the extensive mode of economic development, high intensity of human activity and unreasonable resource development, have seriously contaminated the water resources and sharply reduced the available fresh water. In the period 2000 – 2012, the household water use amount in Chongqing showed a rising trend, an increase of 137.28 cubic meters. At the same time, the sewage discharge amount was increased year by year. The sewage discharge amount was 439.53 million t in Chongqing in 2000, and it was increased to 1016.767 million t, with the annual growth rate of 48.1031 million t. Along with the acceleration of urbanization, the water environment in Chongqing still allows of no optimist.

2.2.2 The impact on air quality. The air pollution is mainly affected by the density of urban population, vehicles, ships, aircraft exhaust emissions, emissions from industrial production, residents' living and heating, waste incineration and other factors. With the increasing population density in urban areas, there is a lot of vehicle exhaust emission, and the carbon dioxide in the air is significantly higher than in other regions. The extensive mode of production and low efficiency of energy use in industrial enterprises, have increased pollution of the atmosphere. In 2000, the industrial waste gas emission was 190.79 billion standard cubic meters in Chongqing, and it surged to 835.988 billion standard cubic meters in 2012, an increase of 645.198 billion standard cubic meters over the 12 years. The sulfur dioxide, carbon dioxide and other harmful gases in the industrial emissions have a serious impact on the urban air quality and the improvement of people's living standards.

2.2.3 The impact on other environments. With the acceleration of urbanization, it has brought rich material civilization, but also caused the increasing solid waste. However, due to the inadequate urban environmental infrastructure, it results in the lagged rubbish disposal, having a great impact on the urban environment. The rapid development of urbanization has caused the "heat island effect" in urban areas. The development of urbanization has accelerated industrial agglomeration, increased population density, and sharply raise the number of automobiles, leading to traffic congestion and noise pollution.

3 Empirical analysis

Through the qualitative analysis of the urbanization rate and resources and environment in Chongqing from 2000 to 2012, it is easy to see that the rapid development of urbanization in Chongqing has contributed to the resource shortage and aggravated the environment while undoubtedly accelerating the industrial agglomeration and promoting the economic and social progress of Chongqing. In order to make more comprehensive and scientific evaluation of the relationship between the development of urbanization in Chongqing, and resources and environment, we use the quantified indicators for specific analysis, to better reflect and predict the changes in the relationship between the two.

3.1 Analysis methods and selection of indicators

3.1.1 Selection of indicators. The selection of indicators should follow the principles of typicality, accessibility and usability. Based on this, we use the measuring scale established by K Button (2002)[10] and SL Huang (1998)[11]. With the built-up area and annual electricity consumption as resource indicators, and domestic waste water discharge amount, industrial waste gas emission and industrial solid waste discharge amount as the environmental indicators, we analyze the relationship between urbanization process, and resources and environment. The Cronbach's alpha value of scale reliability coefficient is 0.89, indicating that the selected urban resources and environment indicators have good reliability.

3.1.2 Analysis methods. Through qualitative analysis, it can be found that there is a significant linear relationship between urbanization, and resources and environment. Based on this, this paper uses the correlation analysis and regression analysis to quantitatively analyze the impact of urbanization on resources and the environment. By correlation analysis, this paper demonstrates the positive correlation between urbanization, and resources and environment, to pave the way for the regression analysis. By regression analysis, this paper measures the significant impact of urbanization on resources and environment, predicts and corrects the trend of the relationship between them.

3.2 Correlation analysis Through the correlation analysis of urbanization rate and some indicators (built-up area, annual electricity consumption, domestic waste water discharge amount, industrial waste gas emission, and industrial solid waste discharge amount) selected about Chongqing in the period 2000 – 2012, we draw the following conclusions:

(i) The correlation analysis of urbanization rate and built-up

area. From the analysis results in Table 2, the correlation coefficient between urbanization rate and built-up area is 0.984 at the 0.01 level, and there is a significant positive correlation, that is, the higher the urbanization rate, the larger the built-up area.

Table 2 The correlation coefficient between urbanization rate and built-up area

	Urbanization rate
Built-up area	
Pearson Correlation	0.984 * *
Sig. (2-tailed)	0.000
N	13

(ii) The correlation analysis of urbanization rate and annual electricity consumption. From the analysis results in Table 3, the correlation coefficient between urbanization rate and annual electricity consumption is 0.958 at the 0.01 level, and there is a significant positive correlation, that is, the higher the urbanization rate, the more the annual electricity consumption.

Table 3 The correlation coefficient between urbanization rate and annual electricity consumption

	Urbanization rate
Annual electricity consumption	
Pearson Correlation	0.958 * *
Sig. (2-tailed)	0.000
N	13

(iii) The correlation analysis of urbanization rate and domestic waste water discharge amount. From the analysis results in Table 4, the correlation coefficient between urbanization rate and domestic waste water discharge amount is 0.97 at the 0.01 level, and there is a significant positive correlation, that is, the higher the urbanization rate, the larger the domestic waste water discharge amount.

(iv) The correlation analysis of urbanization rate and industrial waste gas emission. From the analysis results in Table 5, the correlation coefficient between urbanization rate and industrial waste gas emission is 0.875 at the 0.01 level, and there is a significant positive correlation, that is, the higher the urbanization rate, the greater the industrial waste gas emission.

Table 4 The correlation coefficient between urbanization rate and domestic waste water discharge amount

	Urbanization rate
Domestic waste water discharge amount	
Pearson Correlation	0.970 * *
Sig. (2-tailed)	0.000
N	13

Table 5 The correlation coefficient between urbanization rate and industrial waste gas emission

	Urbanization rate
Industrial waste gas emission	
Pearson Correlation	0.875 * *
Sig. (2-tailed)	0.000
N	13

(v) The correlation analysis of urbanization rate and industrial solid waste discharge amount. From the analysis results in Table 6, the correlation coefficient between urbanization rate and industrial solid waste discharge amount is 0.775 at the 0.01 level, and there is a significant negative correlation, that is, the higher the urbanization rate, the smaller the industrial solid waste discharge amount.

The main reason is that in the process of urbanization, along with technological innovation and industrial upgrading, the comprehensive utilization rate of industrial solid waste has been improved, and the ability to convert industrial solid waste into resources has been enhanced, so that the discharge amount of industrial solid waste is decreased to some extent.

Table 6 The correlation coefficient between urbanization rate and industrial solid waste discharge amount

	Urbanization rate
Industrial solid waste discharge amount	
Pearson Correlation	−0.775 * *
Sig. (2-tailed)	0.002
N	13

3.3 Regression analysis As can be seen from the correlation analysis, there is a significant correlation between urbanization rate and some indicators (built-up area, the annual electricity consumption, domestic waste water discharge amount, industrial waste gas emission, and industrial solid waste discharge amount), in line with the laws of normal distribution, so the regression analysis can be conducted.

Based on this, the regression equation between urbanization rate and some indicators (built-up area, the annual electricity consumption, domestic waste water discharge amount, industrial waste gas emission, and industrial solid waste discharge amount) is built.

(i) The regression equation of urbanization rate (X_1) and built-up area (Y_1) is as follows:

$$Y_1 = -1198.338 + 43.782X_1 \quad R^2 = 0.968 \tag{1}$$

(ii) The regression equation of urbanization rate (X_2) and annual electricity consumption (Y_2) is as follows:

$$Y_2 = -830.673 + 29.410X_2 \quad R^2 = 0.918 \tag{2}$$

(iii) The regression equation of urbanization rate (X_3) and domestic waste water discharge amount (Y_3) is as follows:

$$Y_3 = -64957.146 + 2832.588X_3 \quad R^2 = 0.941 \tag{3}$$

(iv) The regression equation of urbanization rate (X_4) and industrial waste gas emission(Y_4) is as follows:

$$Y_4 = -16497.147 + 480.399X_4 \quad R^2 = 0.766 \tag{4}$$

(v) The regression equation of urbanization rate (X_5) and industrial solid waste discharge amount (Y_5) is as follows:

$$Y_5 = 461.559 - 7.034X_5 \quad R^2 = 0.6 \tag{5}$$

As shown in regression equation (1), (2), (3), (4), (5), R^2 is 0.968, 0.918, 0.941, 0.766 and 0.6, respectively; the coefficient of determination is above 0.6, and the goodness of fit is good; the independent variables can well explain the dependent variables, and the linear impact is strong, therefore, it can be

presumed that the linear relationship of model is established. From the regression coefficient, it can be found that for each additional one percentage point of the urbanization rate, the built-up area will increase by 43.782 square kilometers; the annual electricity consumption will increase by 294100 tons of standard coal; the domestic waste water discharge amount will increase by 2832.588 tons; the industrial waste gas emission will increase by 48.0339 billion cubic meters; the industrial solid waste discharge amount will increase by 7.034 tons.

3.4 Regression forecasting According to regression analysis and ARIMA forecasting model, we carry out the time series analysis of Chongqing's urbanization rate and the related resources and environment indicators in the period 2000 – 2012, and exclude the impact of historical data autocorrelation, to get the forecast value of Chongqing's urbanization rate and related resources and environment indicators in the period 2013 – 2020, as shown in Table 2.

Table 7 The forecasting of the relationship between Chongqing's urbanization rate, and resources and environment in the period 2012 – 2020

Items		2013	2014	2015	2016	2017	2018	2019	2020
Urbanization rate		59.31	61.00	62.69	64.38	66.06	66.75	69.43	71.12
Built-up area	Forecast	1 398.75	1 472.56	1 546.37	1 620.18	1 693.99	1767.80	1 841.61	1 915.42
	UCL	1 518.96	1 642.56	1 754.58	1 860.60	1 962.78	2 062.25	2 159.65	2 255.42
	LCL	1 278.54	1 302.56	1 338.16	1 379.76	1 425.20	1 473.35	1 523.57	1 575.42
Annual electricity consumption	Forecast	937.93	987.26	1 036.59	1 085.92	1 135.25	1 184.58	1 233.90	1 283.23
	UCL	1 018.73	1 101.53	1 176.54	1 247.52	1 315.92	1 382.50	1 447.68	1 511.77
	LCL	857.13	872.99	896.64	924.31	954.57	986.65	1 020.12	1 054.69
Domestic waste water discharge amount	Forecast	108 986.66	116 700.74	124 414.82	132 128.90	139 842.98	147 557.06	155 271.14	162 985.22
	UCL	117 210.15	126 291.62	136 530.61	147 756.69	159 754.53	172 370.33	185 505.10	199 093.83
	LCL	100 763.17	107 109.87	112 299.03	116 501.12	119 931.43	122 743.79	125 037.18	126 876.62
Industrial waste gas emission	Forecast	8 387.35	8 387.35	8 387.35	8 387.35	8 387.35	8 387.35	8 387.35	8 387.35
	UCL	12 570.34	14 205.17	15 472.30	16 544.93	17 492.05	18 349.54	19 138.85	19 874.05
	LCL	4 204.36	2 569.54	1 302.40	229.78	−717.35	−1 574.83	−2 364.14	−3 099.34
Industrial solid waste discharge amount	Forecast	−14.45	−33.90	−53.36	−72.81	−92.26	−111.71	−131.16	−150.61
	UCL	82.12	102.66	113.91	120.33	123.67	124.83	124.33	122.52
	LCL	−111.02	−170.47	−220.62	−265.94	−308.19	−348.25	−386.66	−423.75

Theoretically, the urbanization rate in 2013 will reach 59.31% in Chongqing; the built-up area will reach 1 398.75 square kilometers; the annual electricity consumption will reach 9.379 3 million tons of standard coal; the domestic waste water discharge amount will reach 1.089 866 6 billion tons; the industrial waste gas emission will reach 838.735 billion standard cubic meters; the industrial solid waste discharge amount will reach −0.144 5 million tons. The urbanization rate in 2020 will reach 71.12% in Chongqing; the built-up area will reach 1 915.42 square kilometers; the annual electricity consumption will reach 12.832 3 million tons of standard coal; the domestic waste water discharge amount will reach 1.629 852 2 billion tons; the industrial waste gas emission will reach 838.735 billion standard cubic meters; the industrial solid waste discharge amount will reach −1.506 1 million tons. Grossman & Krueger (1995)[12] used the econometric method to carry out the empirical study of the panel data about 42 developed countries, and made famous Environmental Kuznets Curve (EKC) hypothesis, revealing that with the improvement of the level of urbanization, the urban ecological environment quality would exhibit the inverted U-shaped evolution laws. In this paper, based on regression analysis and ARIMA forecasting model, it can be found that from 2013 to 2019, Chongqing's urbanization rate will be still in the accelerated phase, and the relationship between the level of urbanization, and resources and environment, will be at the bottom of inverted U shape, that is, with the improvement of the level of urbanization, the degree of deterioration of the environment and resources will be further increased. The new trend of urbanization in Chongqing will occur in 2020 when the coupling point between the level of urbanization, and environment and resources, is at the top of inverted U shape, that is, with the deepening of the concept of sustainable development and the implementation of resource-saving and environment – friendly measures, it will have a positive impact on the relationship between urbanization, and resources and environment, and the cities and ecological environment will be in the new round of balance. Based on the above theory and model analysis, the forecasted trend of the relationship between the urbanization rate, and resources and environment in the paper is correct.

4 Conclusions and recommendations

4.1 Conclusions Based on the perspective of urbanization development in Chongqing, this paper makes a detailed analysis of the relationship between the urbanization rate and five indicators (built-up area, the annual electricity consumption, domestic waste water discharge amount, industrial waste gas emission and industrial solid waste discharge amount). On this basis, we draw the following conclusions:

(i) The development of urbanization in Chongqing has an important impact on the changes in resources and environment, and this impact is divided into positive impact and negative impact. At the same time, the resources and environment also play a role in inhibiting or promoting the development of urbanization.

(ii) At the initial stage of the development of urbanization, the urbanization is based on the waste of resources and environmental damage, and the urbanization rate has a significant positive impact on resources and the environment, that is, the higher the level of urbanization, the greater the consumption of land, water, electricity and other resources, and the more serious the environmental damage. Moreover, the scarcity of resources and the deterioration of the environment will have a significant inhibitory effect on the improvement of the level of urbanization, thus becoming the bottleneck of the development of urbanization.

(iii) As the urbanization tends to be stabilized, the level of urbanization, and resources and environment reach new coupling, and the mutual promotion between the two is increasingly prominent, that is, the higher level of urbanization brings the implementation of ecological protection concept, the demand for land, water, electricity and other resources tends to be stabilized, and the industrial pollution is gradually reduced. Likewise, the resources and environment will also actively promote the development of urbanization.

(iv) It is predicted that the new trend of urbanization development in Chongqing will appear in 2020 when the level of urbanization and resources and environment will reach a new round of balance. Therefore, the development of urbanization in Chongqing still has great potential, and the future optimizing focus lies in investing in green industry and eco-industry.

4.2 Recommendations We draw the following recommendations:

(i) Transforming the concept of urban construction to promote the green urbanization process. In the process of promoting green urbanization, it is necessary to fully consider the carrying capacity of regional resources and ecological environment, enhance the intensive use of resources, highlight the concept of environmental protection, and achieve high quality urbanization at the cost of low resource consumption and low pollution, so as to make the social development take a green urbanization road.

(ii) Optimizing the industrial structure to promote scientific development of urbanization. Chongqing should draw on the regional advantages and policy advantages, to formulate the strategic emerging industry development plan, build the strategic emerging industry financing system, and strengthen the policy support, to promote industrial structure optimization and enhance the scientific development of urbanization.

(iii) Strengthening the overall planning control to promote low-carbon urbanization. Chongqing should actively implement the planning of main functional areas, and coordinate the main functional positioning of different regions; for all types of main functional areas, build the implementation path of emission reduction to promote low-carbon urban construction.

(iv) Improving the environmental rule of law and strengthening the urban environment regulation. It is necessary to strengthen the division of labor of government departments with individual responsibility, enhance the unified supervision and management of environmental protection departments, promote the active public participation, and establish the environmental assessment system, to actively promote the comprehensive environmental protection during the urbanization of Chongqing.

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(From page 71)

4 Conclusions

Based on the Chongqing market source pollution PSR model framework, combined with the status quo of Chongqing agricultural non-point source pollution, PSR model is used to construct index system, and then each index is standardized using SPSS, to analyze the agricultural non-point source pollution pressures, state and response, in order to comprehensively assess the agricultural non-point source pollution. And according to the chart on agricultural non-point source pollution, we analyze the agricultural non-point source pollution pressures and responses, and the results indicate that the overall trend shows linear increase and decrease and the agricultural non-point source pollution is in a state of fluctuation. Through the further analysis and evaluation, it aims to provide a reference for the future quantitative analysis of agricultural ecological security in Chongqing.

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