The Research on the Influence of Population Agglomeration on Environmental Pollution under the Background of Industrial Upgrading

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Abstract. Population environment system is a natural social system composed of population, resources and environment, and is a highly integrated organic whole. In order to further clarify the impact of population agglomeration on environmental pollution under the background of industrial upgrading, this paper studies the following. According to the characteristics of population concentration in the background of industrial upgrading, the evaluation algorithm of population environmental pressure is designed. On this basis, the model of the impact of population concentration on environmental pollution is constructed. The following conclusions are obtained through the example verification. The motive force of population environment system includes the promotion of population environment movement, the adjustment of relationship and the role of law. The total population and natural growth rate have obvious correlation with environmental indicators, and the correlation degree is higher. The pollution emission of industrial industry is negatively related to agricultural output value.

Keywords-industrial upgrading; Population agglomeration; environmental pollution

1. INTRODUCTION

In the final analysis, the problem of population and environment is the problem of sustainable development, which includes population, environment, resources and society. With the development of human society today, a series of global problems, such as the sharp increase of population, the deterioration of the environment, the shortage of resources and so on, have brought great threats to the survival of us and our future generations[1]. How to correctly deal with the relationship among population, environment, resources and society, and make it coordinated and sustainable development, is the primary problem facing the development of human society. Population lies in resources and environment, which constitute a huge system of mutual restriction. Population is the main body of the total system. Resources refer to the material, energy and information that can be used by human beings under certain technical

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conditions. They are the basis of human survival and development[2]. Environment refers to the sum of all the material, energy and information elements around human beings, which is the premise of human survival and development. Population is not only the independent core of the system, but also an important component of resources and an active element of the environment. Population is an important resource, power and power to develop natural environment. Labor force is the most important and active decisive factor in the productive forces, and it is the basic social productive forces. Without a certain number of people, there is no development environment[3]. The exploitation of the earth by human beings is expanding with the increase of population. However, population is also the main body of social consumption[4]. Excessive population will exert pressure on the natural environment, that is, the population quantity is inversely proportional to the population environment quality. The greater the population, the greater the pressure on the environment and the worse the environmental quality. With the increase of population, it is necessary to reclaim the environment, build houses, cut forests and open up water sources, so as to change the structure and function of the natural ecological environment, and even cause the imbalance of the natural ecological environment.

2. MODELING THE IMPACT OF POPULATION AGGLOMERATION ON ENVIRONMENTAL POLLUTION

2.1 Environmental change characteristics of population agglomeration under the background of industrial upgrading

In order to meet the needs of their own survival and development, human beings have launched a series of development, utilization and transformation activities on the environment. With the growth of population, the development of economy and the progress of society, the environment must bear all kinds of pressure (P), which reflects the social and economic motivation of sustainable utilization of environment; Environmental status (S) refers to the quantity, quality, type, structure and function of the environment under pressure, as well as the status quo of ecological environment quality, which is inseparable from the environment. It is the basic connotation of environmental sustainability[5]. Environment influences social economy through its state change, which is the feedback to human activities; Human response to feedback (R), including system construction, management and technology improvement, social development and economic restructuring, education and scientific and technological progress, is the regulation, support and capacity-building of environmental utilization[6]. Its scientificity and strength are closely related to the sustainable utilization of the environment, as shown in figure 1.

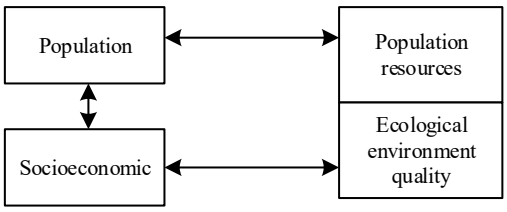


Figure 1. PSR model framework of population agglomeration land use

Because of the complex structure and changeable levels of the composite system, social economy, environmental resources and ecological environment, the subsystems have both mutual functions and mutual input and output[7]. The change of some levels, elements and some subsystems may lead to the change of the whole system from superior to inferior or inferior to superior. Therefore, it is not easy to select the most sensitive, easy to measure and rich connotation leading indicators among many indicators[8]. For complex systems such as regional composite systems, it is impossible to describe the state and change of the system with a few indicators. Therefore, according to the PSR framework of environmental sustainability research and the chain relationship closely related to it, according to the five principles proposed by the International[9]. Symposium on sustainable use of environment, multiple indicators should be selected to form an organic whole, and the development status of environmental utilization system should be described as table 1.

TABLE I. INDEX SYSTEM OF ENVIRONMENTAL SYSTEM

Pressure index	Company	State index	Response index	Company
population growth rate	%	Environmental load	Population control	0-10 points
Sigel coefficient	%	Degree of environmental utilization	Growth rate of fixed assets investment	%
Annual growth rate of GDP	%	Comprehensive environmental planning	Adjustment of industrial structure	0-10 points
Water resources satisfaction	%	Comprehensive treatment rate of water environment	Proportion of environmental protection investment in GDP	%

On the premise of adhering to the principles of scientificity, operability, relative completeness, relative independence, principal component and flexibility, the following matters shall be noted: the indicators only provide an evaluation tool, and other qualitative information shall be added[10]. But human beings are living and developing by social groups, material means production and population reproduction, which is an essential basic condition for human social development. These two kinds of production are the process of material transformation, energy flow, information exchange and value-added process between human and environmental system, and are the essential relations between population and environment. It is it that it combines population and environment into population environment system, which shows the high integrity of population system. The relationship between population environment coupling and population environment is shown in Figure 2.

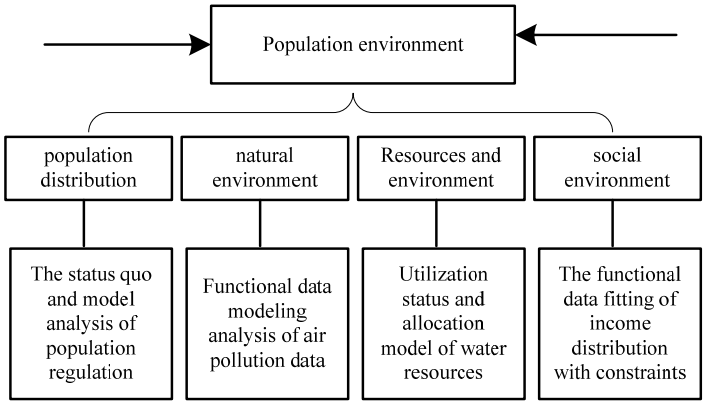


Figure 2. Population environment coupling and population environment relationship

The basic contradiction of population environment system is the basic motive force of the development and change of population environment system. The contradiction between the infinite demand of population development to environmental system and the limitation of productivity, resource supply and resource renewal ability of environmental system to meet this demand is the basic contradiction of population environment system. These contradictions always exist in the process of population and environment system development, and are hidden for a long time.

2.2 Population environment pressure assessment algorithm

Aiming at the problems of "population environment", the population environment pressure evaluation algorithm constructs the system design model, adds the reward and punishment coefficient, adjusts the benefit function by setting the reward and punishment coefficient, considers the constraint conditions of urban functional area division, and uses the idea of game theory to maximize the benefit function to make the government of each functional area close to the maximum benefit area, The government's system policy design is added to the model calculation, and the multi-objective optimization model of system structure is constructed. The multi-objective model can reflect various requirements and is more suitable for our problems. However, the solution is not unique, and it is difficult to solve. For our practical problems, we need to find some satisfactory feasible solutions. Therefore, based on the mechanism of multi-objective model, we will analyze the sensitivity of various possible adjustments of control variables, and compare the simulation results of various adjustment schemes with the desired target value, so as to realize the selection of multi-objective feasible schemes, which can not only judge whether government policies are effective, but also make the government better play the guiding role of institutional guidance. Using data to estimate a zero or negative variance can cause various problems, so we don't want to convert zero variance to zero estimation. For another example, in the observation of children's growth data, due to the lack of data, in the process of fitting with the idea of functional data analysis, there may be over fitting, which may lead to zero or negative estimates, but children's growth can not be negative. This requires that

in the process of fitting, the constraint function should be added to ensure its non negativity. x(t) is defined as:

$$x(t) = e^{W(t)} \tag{1}$$

Where w(t) is an unconstrained function, x(t) is a non negative function, w(t) is the logarithm of x(t) i, and x(t) i is the case of positive constraint. Then we take the logarithm to fit, and the constrained problem is transformed into the general case of unconstrained. Because NCO can be positive or negative and is not restricted in any other way, it is feasible to expand w(t) by a set of basis functions.

$$W(t) = \sum_{k} C_k \phi_k(t) \text{-} x(t) \tag{2}$$

The differential equations are obtained by solving the differential equations on both sides.

$$Dx(t) = W(t)x(t) \tag{3}$$

The solution of the differential equation is as follows.

$$x(t) = C \exp\left[\int_t^i W(u)du\right] \tag{4}$$

$$\begin{aligned} W(t) &= \log x(t) \\ &= \log C \exp\left[\int_{i,}^{i} W(u)du\right] \\ &= \int_{t,}^{t} w(u)du + \log C \\ &= D^{-1}w(t) + \log C \end{aligned} \tag{5}$$

Corresponding to different constant *C*, the solution of differential equation is a kind of function. The relationship between a function and its first or higher derivative is expressed by differential equation, and the function with special structure is described by relatively simple method. In the method of functional data analysis, we have known that a smooth function with restricted conditions can be transformed into a non restricted function, and a strictly monotonic increasing

function has a positive first derivative. According to the estimation of positive function in the previous section, we now assume that the first derivative of X (T) is positive, that is, a strictly monotonic function.

$$Dx(t) = e^{W(t)} \tag{6}$$

By integrating the two sides of the above formula at the same time, we get the following results:

$$x(t) = C + \int_k^t \exp[W(u)]du \tag{7}$$

By integrating the two sides of the above formula at the same time, we get the following results:

$$\Delta x(t) = C + \int_{\text{to}}^t \exp[W(u)]du \tag{8}$$

Here the constant C is estimated from the data. A strictly monotone function is represented by a differential equation.

$$D^2x(t) = WDx\Delta x(t) \tag{9}$$

The general solution of this differential is as follows:

$$x(t) = C_0D^2x(t) + C_1\int_{t_0}^t \exp\left[\int_{t_0}^v W(v)dv\right]du \tag{10}$$

Conversion available.

$$\begin{aligned} W(u) &= \int_{t_0}^v w(v)dv + \log C_1 \\ &= D^{-1}w(u) + \log C_1 \end{aligned} \tag{11}$$

The environmental utilization planning system in China mainly includes the overall planning of environmental utilization, special planning for environmental utilization and detailed planning of environmental utilization. Therefore, according to the structure system of environmental utilization planning, the corresponding environmental assessment is also divided into three types. As shown in the figure, the overall environmental utilization planning is a plan with overall impact and is at the highest level, It is the basis of special planning and project planning; Special planning and project planning of environmental use are the means to realize the overall planning of environmental utilization, and it is a regular work.

2.3 Model construction of the impact of population agglomeration on environmental pollution

Environmental impact assessment of environmental use planning belongs to the category of sea, while sea and project EIA are the environmental impact analysis means corresponding to the action plan, which are two components of environmental impact assessment in the pre planning process of development activities. The figure 3 shows the hierarchy of action plan and environmental impact assessment.

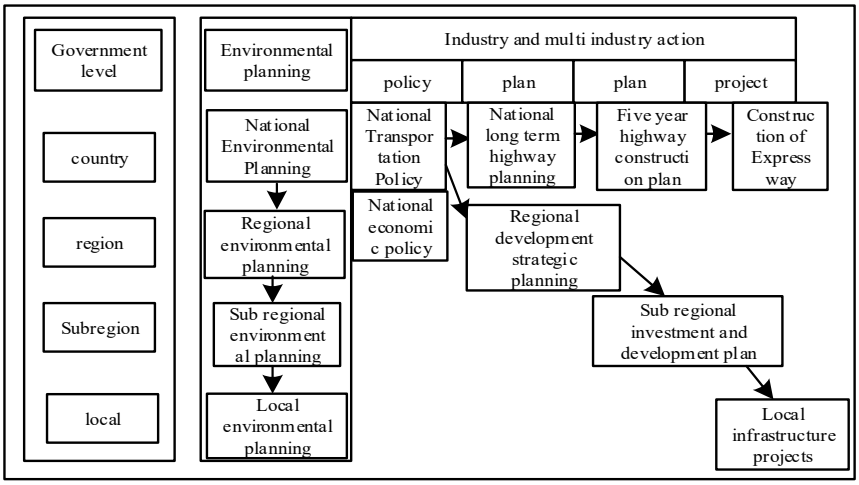


Figure 3. Hierarchy model of action plan and environmental impact assessment

It can be seen from the figure 3 that EIA conducted at different stages of the planning process is consistent with each other and can be complementary to each other. Sea is carried out early in the planning process and EIA for the project is carried out later. Sea is mainly used to improve the EIA level of the project. It is the inevitable result of EIA development that the EIA of the project is extended to PPP level. By considering potential impacts and comprehensive alternatives in the early stage, sea can help overcome some defects of EIA of the project, or simplify or reduce project EIA by establishing appropriate working procedures related to project EIA, so as to fully save human, financial, material and time input. From the overall perspective of environmental protection and ecological construction in the planning area, we can learn from foreign regional environmental impact assessment methods to highlight and

accumulate the impact, direct and indirect impact, longer time scale environmental impact and larger spatial scale environmental impact. Monitoring and follow-up evaluation is to monitor the environmental impact after the implementation of the plan by using the existing environmental standards and monitoring system, and to supervise the environmental impact after the implementation of the plan through expert consultation and public participation. It mainly includes whether the environmental impact assessment and the proposed mitigation measures have been effectively implemented, the improvement measures needed to further improve the environmental benefits of the plan, and the experience and lessons of the environmental impact assessment of the plan.

In the PSR model, the most characteristic is to use the logical thinking process of "cause effect response" to construct the index system, that is, "problem driven", as figure 4.

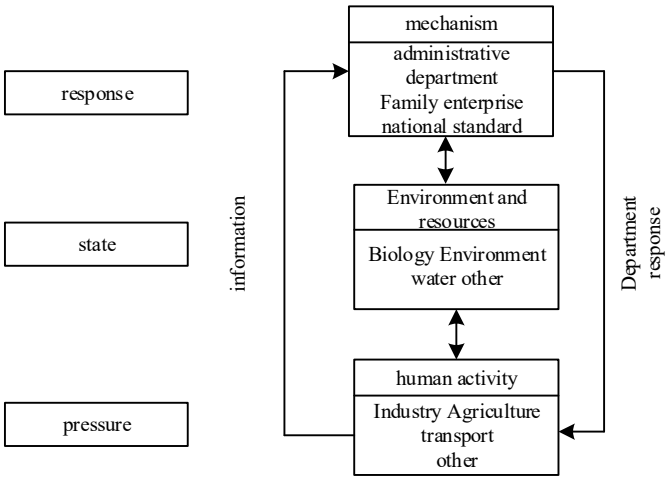


Figure 4. Framework model of environmental pressure population state response

PSR framework model contains strong logical causality, and it is proposed to solve problems, so it is very suitable for solving specific practical problems. At the same time, PSR framework model has good universality and can be used to evaluate various phenomena related to sustainable development. PSR framework model puts forward a complete idea of constructing index system, which is a real framework. Therefore, in a few years, PSR framework model has been widely used. According to the framework of PSR, the economic cooperation organization has put forward an indicator system at the national level for the world's important environmental problems, including climate change, ozone layer destruction, eutrophication, acidification, toxic pollution, waste, biodiversity and landscape, urban environmental quality, water resources, forest resources, fishery resources, ecological environment, ecological environment and so on Soil degradation (desertification and erosion) and other general indicators that can not be attributed to specific problems, and corresponding pressure, state and response indicators are proposed for each problem.

3. ANALYSIS OF EXPERIMENTAL RESULTS

In order to study the impact of population size on social economy and ecological environment more accurately, deeply and quantitatively, the correlation coefficient of relevant indicators has been unable to meet the requirements, and the regression analysis and equation fitting between relevant indicators need to be considered. In terms of the impact of population size on social economy, GDP is selected as the dependent variable and the total population as the independent variable to carry out regression fitting; In terms of the impact of population size on the environment, the total amount of wastewater discharge and agricultural output value are selected as dependent variables, and the total amount of population is selected as independent variables to carry out regression fitting, so as to quantitatively describe the specific quantitative relationship of relevant indicators. The population environment system is a natural social system of unity of opposites. There are not only similarities but also essential differences between population environment system and biological environment system. In the biological environment system, organisms are only connected with the ecological environment through biological attributes. In the population environment system, the relationship between population and ecological environment is not only through the natural attribute of population, but also through the social attribute of population, which includes social organization, social structure and only human specific population environment behavior. Human beings can actively, organizationally and purposefully transform nature, create a new environment suitable for their own survival and development, and make it more suitable for human needs. The total population and natural growth rate required for model establishment and empirical analysis as table 2:

TABLE II. TOTAL POPULATION AND NATURAL GROWTH RATE IN RECENT YEARS

particular year	Total population (10000)	Natural growth rate (%)
2016	9248	5.83
2017	9309	5.50
2018	9367	5.00
2019	9417	5.09
2020	9470	5.62

The indicators reflecting the impact of population size on economic development of the province (i.e. economic development indicators) are shown in the table below. The population environment system is an organic whole with high integration of population and environment.

Based on the above sample data, using the statistical analysis function of ms-office-excel 2003, the correlation coefficients of the total population and natural growth rate of the province to the environmental indicators are calculated respectively. Correlation coefficients of total population, natural growth rate and environmental indicators as table 3:

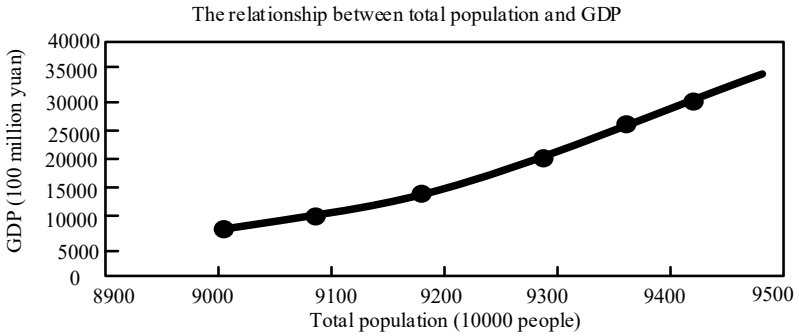
TABLE III. CORRELATION COEFFICIENTS OF TOTAL POPULATION, NATURAL GROWTH RATE AND ENVIRONMENTAL INDICATORS

correlation coefficient	Total population	Natural growth rate
Total amount of wastewater	0.9764	0.4344
Domestic wastewater	0.9674	0.4157
industrial waste water	0.9716	0.4474
Waste water volume per unit GDP	-0.9703	-0.6261
Total COD	-0.9813	-0.5872
Total output value of Agriculture	0.9829	0.4733
Agricultural output value per unit GDP	-0.9746	-0.5592

The regression fitting results show that the quantitative relationship between population and GDP, total wastewater discharge and total agricultural output value is as follows.

$$\begin{cases} y = 0.0671x^2 - 1183.7x + 5E + 06 \\ y = 0.5725x^2 - 10233x + 5E + 07 \\ y = 0.0098x^2 - 173.23x + 766692 \end{cases} \tag{12}$$

By using the regression analysis function of MS Office Excel 2003, the quantitative relationship between the total population (x) and GDP (y), total wastewater discharge (y) and agricultural gross output value (y) in each year is found. Through the comparison of linear equation relationship, polynomial equation relationship, logarithmic equation relationship and exponential equation relationship, the best fitting equation is found to be quadratic polynomial equation, as figure 5.



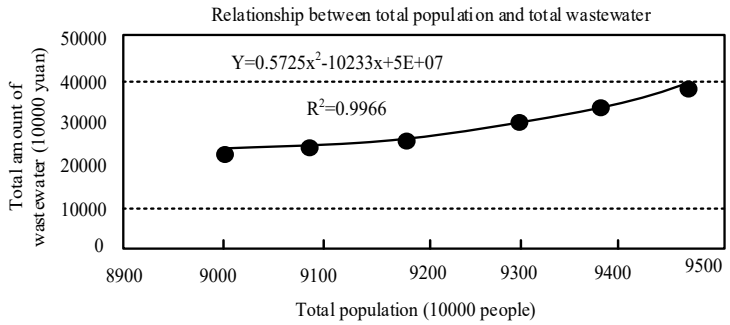


Figure 5. Analysis of experimental investigation results

The results of correlation coefficient calculation show that there is an obvious correlation between the total population and natural growth rate and environmental indicators, and the correlation degree is very high. Among them, the population base has obvious positive correlation with industrial wastewater discharge, domestic wastewater discharge, total wastewater discharge and total agricultural output value, and obvious negative correlation with wastewater discharge per unit GDP, total COD, ammonia nitrogen discharge and agricultural output value per unit GDP.

4. CONCLUSIONS

As far as the impact of population size on environment is concerned, with the increase of population and natural growth rate, the industrial wastewater discharge, domestic wastewater discharge, total wastewater discharge and total agricultural output value of the province are gradually increasing, and the impact of population size on environment is gradually increasing; At the same time, the total amount of COD, ammonia nitrogen emission, waste water discharge per unit GDP and agricultural output value per unit GDP decreased. At the same time, compared with the population growth rate, population size or base is likely to have a more significant impact on industrial wastewater discharge, domestic wastewater discharge, total wastewater discharge, total COD, ammonia nitrogen discharge and total agricultural output value.

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