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Original article

# Research on the design and governance of new rural public environment based on regional culture

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## ABSTRACT

With the rapid development of new rural construction, new rural tourism has become an effective means to develop new rural economy. However, the current new rural planning is in the development stage, many ideas and ideas are not mature enough, and the concept of regional culture has not been widely accepted. Taking the new rural public environmental governance under regional culture as the research object, this paper summarizes some theories of new rural environmental governance based on the characteristics of regional culture through on-the-spot investigation, consulting a large number of literature and combined with various case studies. Firstly, taking the village form design and spatial layout design as the starting point, this paper introduces the new rural environment design method from the perspective of regional culture. Then, based on the full analysis of the current situation of public environment governance, this paper studies the governance of public environment in new rural areas based on the relevant knowledge of dynamic game theory. Through the analysis of the equilibrium solution of the game model, this paper explores the relevant countermeasures of rural governance and complete settlement of disputes.

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## 1. Introduction

“Region” is an important concept in geography. It refers to the complex formed by the joint action of natural factors and human factors in a certain regional space. Its connotation usually includes: (1) region has a certain spatial boundary; (2) The natural and human characteristics within regions have obvious similarity and continuity, while there are obvious differences between regions; (3) Region has certain characteristics, functions and comparative advantages; (4) Regions are interrelated, influencing and communicating with each other. The so-called regional culture generally refers to the cultural tradition that originated and developed in a specific region, is unique due to the uniqueness of the regional environment, and still plays a role in social life today. It is a clear

expression of ecology, folk customs and habits in a certain region (Lindberg et al., 2018). The emergence and development of regional culture are integrated with a specific geographical background, which can be large or small, with relativity, such as Chinese culture, northern Chinese culture, northern Chinese grassland culture, etc; The object it refers to can be single element, such as local food culture, local architectural culture, local folk beliefs, or multi element. Regional culture is the product of the integration and intersection of natural environment, geographical environment, historical connotation, folk customs and human activities (Rinfret, 2020). He embodies the local unique cultural atmosphere, unique folk customs. The regional culture of a place represents the spirit of a place, which is reflected in all aspects of the place (Larson et al., 2019). Regional culture is a unique and irreplaceable accumulation of years. The planning and construction of new countryside can be reflected as its carrier (Lin et al., 2021).

Countryside is a concept relative to “city”. It refers to a general concept of social region including villages, market towns and other settlements of different sizes. It is the most basic unit of crowd settlement in China's social structure system (Ao et al., 2018). We can define rural areas from different angles. From a regional point of view, areas outside cities in human settlements can be defined as rural areas; From the perspective of population composition and

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occupation composition, rural refers to the area where agricultural producers live and engage in agricultural production; From the perspective of settlement mode, rural areas refer to settlement areas with small scale, low population density, scattered settlements and isolated from high-density population areas; In addition, from the perspective of ecological environment, social culture and economy, rural areas have their special positioning (Jiménez et al., 2019). It can be said that the countryside is a system full of complexity and relativity, and the corresponding rural construction problems are also complex and diverse (Ye et al., 2018). By comparing with cities, we can more accurately grasp the essence of rural areas. New countryside is a concept relative to “old countryside” (traditional countryside). The so-called traditional countryside refers to the rural areas with self-sufficient traditional agriculture as the main mode of production (Alcock, 2019). In contrast, the new countryside is a rural form with modern agriculture and other modern rural industries as the main production departments (Kim et al., 2019). It can be said that the new rural construction is a necessary stage of rural development in the process of traditional society moving forward to modern society (Leider et al., 2020). A large number of construction practices show that the new countryside is fundamentally different from the traditional countryside in many aspects such as production mode and construction path (see Table 1).

At present, the new rural planning and construction is in the development stage, many ideas and ideas are not mature enough, and the concept of regional culture has not been widely accepted (Sherval et al., 2018). There is a trend of complex, non-material and diversified development of regional culture. According to the actual construction situation, it is not difficult to find that there are still many problems in the specific operation process of new rural construction in different regions (Leider et al., 2020). With the progress of society, the pace of rural urbanization has gradually accelerated. If this paper wants to study how to protect the local culture and regional characteristics of rural areas while maintaining the rapid completion of rural urbanization; How to strengthen the governance of the public environment while building a new countryside, maintain the “temperament” of the countryside, and avoid all kinds of similarities after the end of the new rural construction (Mihai and Grozavu, 2019). Cheng (Cheng et al., 2018) pointed out that the rules and methods used in the process of public affairs are not only legal rules, but also informal rules in real life. Bringing informal rules into the scope of institutional analysis will further broaden the perspective of institutional analysis. After long-term practical research, she has come to the corresponding institutional principles: first, the boundary should be clear; Second, local conditions should be fully respected and consistency should be maintained in the rules of occupation and supply; Third, the arrangements chosen by all; Fourth, supervision; Fifth, the classification of sanctions; Sixth, conflict resolution mechanism; Seventh, the minimum level of recognition of organizational rights; Eighth, the decentralization of enterprises (Shojaefard, 2020). Behera’s eight principles provide a certain basis for solving rural environmental problems (Behera et al., 2020). In dealing with rural envi-

ronmental problems in the United States, sustainability is emphasized (Zhang et al., 2020). Liu (Liu et al., 2021) proposed sustainable agriculture to solve rural environmental problems in the United States. Specifically, it includes five aspects: first, the speed of using renewable resources (such as soil) cannot be higher than the regeneration speed of the system; Second, the speed of using non renewable resources (such as oil) cannot be higher than that of developing alternative resources; Third, the pollution rate (waste) cannot be higher than the speed of system decomposition (or assimilation); Fourth, provide an ideal high-grade life; Fifth, maintain cross generational balance. Under the premise of agricultural intensive management, developed countries use advanced technology to change the mode of agricultural production, and improve the environmental problems of agriculture and rural areas by constructing ecological environment, political strategy, finance, law and relevant supporting policies and measures. Kolodinsky (Kolodinsky et al., 2017) have tried to systematically investigate the current rural environmental problems from the perspective of system, and tried to find the internal institutional reasons affecting rural environmental problems. They made a profound analysis of the relationship between the deterioration of agricultural ecological environment and agricultural land system.

2. Relevant theories and research methods

2.1. Polycentric governance theory

Among the many schools and propositions of new public management theory, the most representative is the institutional school represented by Wilkinson (Wilkinson et al., 2017), which puts forward the theory of “polycentric governance”, as shown in Fig. 1. Their polycentric governance theory is developed on the basis of Sieber’s (Sieber et al., 2020) “social order theory”, but different from them, they emphasize more and more governance that pays attention to the interaction of participants and the rules and forms of creative activities. First of all, the theory of “multi center gover-

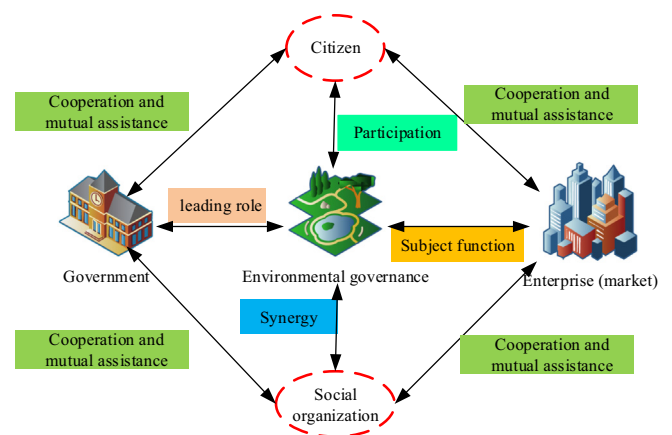


Fig. 1. Polycentric governance theory.

Table 1  
Relative characteristics of new countryside and traditional countryside.

	New countryside	Traditional countryside
Village population characteristics	Professional development	Agriculture is dominated by owners
Characteristics of village industry	Industrial diversification	Traditional agricultural production
Village construction path	Government guidance and villagers' cooperation	Development of village names
Village scale	Large scale, complete equipment and high level of facilities	Small scale and backward facilities
Relationship with the city	Mutual complementarity and urban-rural integration	Their respective development and less contact

nance” is no longer the main body of the market or government. It should be a pluralistic and composite subject including government, mass autonomous organizations, civil society, enterprises, non-profit organizations and so on (Liu et al., 2019). Polycentric governance theory deals with the relationship between public sector and private sector, government and market, and pays more attention to and participates in the joint management of all subjects of public affairs (Burgoon et al., 2019). However, each subject should take measures suitable for their characteristics and advantages, share responsibilities of multiple subjects, and multiple subjects should establish interdependence, mutual negotiation and cooperation. Secondly, the system of “multi center governance” based on independent governance emphasizes the importance of spontaneous order and basic independent governance. Finally, “multi center governance” is carried out through cooperation, competition and cooperation. Multiple center processing means that the government, enterprises, civil society and other subjects can provide social public goods and services, but the cost of public goods and services provided by each is different (Hill et al., 2018). A cooperation is needed in the production, use and maintenance of public goods. The comprehensive management of rural environment itself belongs to the management of public affairs. From the current situation, a multi-level and multi-body governance mechanism of government, enterprises, mass autonomous organizations and individual citizens has been established. Through the mode of cooperation, competition and cooperation, it effectively integrates the advantages of the authority of the government, the efficiency of the market and the universality of the masses, so as to maximize the interests of citizens.

## 2.2. Research methods

### (1) Literature collection and theoretical research

It mainly refers to an indirect research method to collect, identify and sort out relevant literature, analyze and summarize the overview of relevant theories, form a scientific understanding of objective things, and finally summarize and analyze the theoretical basis. In terms of theoretical research, by collecting and sorting out literature and books, we can summarize the data we have seen and checked, and refine the useful theoretical data or practical experience. Finally, summarize the relevant information, so as to accurately and comprehensively understand the relevant research progress and relevant experience at home and abroad, provide reference basis for the author's paper, and provide theoretical support for the smooth completion of the paper.

### (2) Site investigation

Conduct on-site investigation of rural villages to understand the local natural resources, landform and humanistic connotation, and understand the folk customs of rural villages through visits with villagers. Get the basic status of all aspects of the project site, and lay a solid foundation for later practice.

### (3) Inductive summary

This paper summarizes the basic theory of literature collection and theoretical research and the basic situation of the scene obtained from the field investigation, and summarizes the abstract and general principles, so as to provide reference for later practice.

### (4) Through the practice of new rural landscape planning and design, this paper analyzes and discusses the embodiment of regional culture in the design of new rural public environment.

## 3. New rural environment design method from the perspective of regional culture

### 3.1. Research on the orientation of new rural construction

The construction of new countryside involves all aspects of rural development. It can not be simply regarded as the renovation of villages or the concentration of population, nor can it be equated with the development model of cities. Intensive land conservation is the most direct benefit of new rural construction. Compared with the traditional rural loose and disordered land use mode, the new rural construction can not only save a large amount of homestead for rehabilitation and other industrial development (as shown in Fig. 2), but also establish the best land use structure and layout according to local conditions.

Land is the greatest wealth of farmers. All affairs of rural development are closely related to land. With more land and rational use, rural economy can have better development conditions. Therefore, from this point of view, the new rural construction is actually a process of rural land use standardization and intensification. From another perspective, the new rural construction is not only the improvement of rural living and production environment, but also a baptism of rural culture. We have repeatedly stressed that in the process of new rural construction, we should maintain rural characteristics and inherit local context. What we should retain is the simple rural life style, elegant living environment, superb folk skills and various distinctive and valuable folk activities and ideas, and its extensive mode of production Chaotic social order and simple and rough housing manufacturing are things to be completely abandoned in construction. Therefore, the new rural construction can be said to be a “filtration” of material and non-material culture in rural areas, a process of removing the rough and selecting the fine of rural culture. The greatest significance of the work of planning and architectural designers lies in how to distinguish the value of rural culture, make trade-offs and integrate it into the planning and design of new countryside.

### 3.2. Village form design (take village a as an example)

The village form of new countryside is related to the overall style effect and land use efficiency of the village. In an ideal state, the more square the village is, the smaller the total length of the road is, and the more conducive to architectural layout, so the higher the land utilization rate is. At the same time, the agglomerated new village land form facilitates the sharing of various public facilities and is conducive to the formation and organization of neighborhood units. Therefore, the village form of the new countryside should be built into a mass and regular form as far as possible. For the development of new rural village form, we should consider it in two cases.

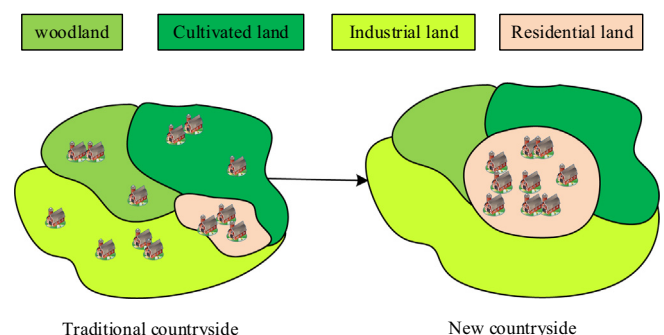


Fig. 2. Transformation of traditional rural and new rural land model.

- (1) The old village was remodeled. For a considerable number of villages in village a, they already have the rudiment of mass form. However, due to the free and disorderly development for a long time and the lack of initiative in the transformation and utilization of unfavorable terrain, most villages have loose structure, fuzzy boundary and incomplete plane form. Although the village form is “mass” but not centralized, and “block” but not regular. Therefore, for the old village transformation village, the construction direction of the village form is to transform the village plane to the direction of compactness and regularity on the basis of maintaining the original village spatial pattern; The expansion area of the village should make full use of the obstacle terrain around the old village to make the overall plane shape of the village more complete and regular; The expansion area should develop towards the road direction; Properly remove the “redundant” part on the village area plan (as shown in Fig. 3).
- (2) Create a new profile. New villages should actively choose unfavorable terrain (such as gentle slope, hills, etc.) for construction, and minimize the occupation of cultivated land. Since there are few constraints on the development of plane form in newly-built villages, the tone for the development of village plane to block form should be determined from the initial stage of construction, and the sequence and expansion direction of village construction should be determined according to external traffic conditions, the layout of public service centers, the relocation and merger of villages and the organization of groups (Fig. 4).

### 3.3. Spatial layout

The spatial layout of new countryside should select the group division, road distribution and house distribution of villages, and reasonably allocate and select various public service facilities and spatial nodes. Group division: for the new countryside built on the basis of the old village, the original planning structure of the village shall be respected, and the construction shall be carried out on the basis of the original basic spatial pattern and original facilities of the village. The original “areas” of the village shall be defined by means of strengthening pavement construction, differentiated treatment of building style, setting up green belts and establishing identification systems Strengthen its sense of region as the basic group of the new village. It must be noted that the division of the regional structure of the original village is not only the objective expression of the village spatial pattern, but also closely related to the villagers’ subjective cognitive habits. Only by fully considering the villagers’ psychology and emotion and maintaining the integrity of the villagers’ cognitive map can the group planning

of the new village be more reasonable. In addition, the villages merged into the village should be constructed as an independent group according to the development principle of village form.

## 4. Research on public environmental governance

### 4.1. Existing environmental problems (take village B as an example)

- (1) The discharge of domestic waste is increasing

The continuous growth of agricultural economic level is an important reason for agricultural pollution. The research shows that “the change of agricultural output value is an important reason for the emission of agricultural non-point source pollutants”. In recent years, with the improvement of rural economic level, the quality of life in rural areas is also significantly improved, and the economic income of village B is increasing year by year. As shown in Table 2, the income level of rural residents is generally higher than the national average level. The pursuit of quality of life of rural residents is gradually increasing, which leads to the simultaneous improvement of consumption demand, which greatly accelerates the consumption purchasing power of rural residents. In rural areas, catering, clothing and market trade are gradually rising, and packaging bags and boxes that were only widely used in cities are also widely used in rural areas. Coupled with the gradual improvement of the quality of rural residents in the network information age and the convenience of online shopping, it has gradually become the norm of rural residents’ life and consumption. The improvement of rural consumption demand will inevitably lead to the increase of domestic waste, which is bound to increase the carrying capacity of rural waste treatment.

The substantial improvement of the material life of rural residents has also led to the increase of rural domestic waste year by year, especially the continuous increase of domestic waste such as old furniture, bad electrical appliances, broken clothes and kitchen residue. In addition, due to the convenience of life and the impact of urbanized lifestyle, the use of plastic bags, packaging paper and packaging boxes in rural areas is also increasing year by year, as a result, the amount of packaging waste in rural areas is increasing.

- (2) The pollution level of animal husbandry increased

The unreasonable disposal of livestock manure and sewage is also one of the reasons for rural environmental pollution. Due to considerable economic benefits, the breeding industry of village B has expanded rapidly in recent years, mainly including pigs, cattle, chickens, minks, foxes and other special fur animals. At present, most farmers are local rural villagers, with small scale and high density of livestock and poultry. In addition, the government did

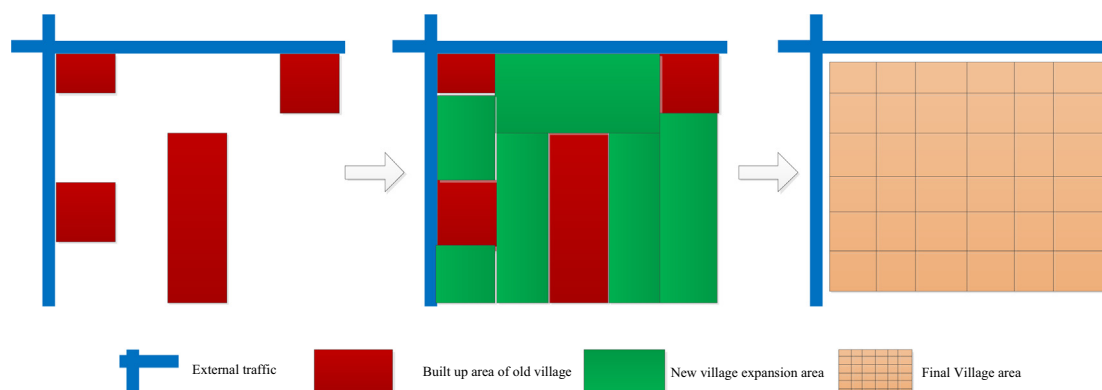


Fig. 3. Development diagram of old village and transformed village.

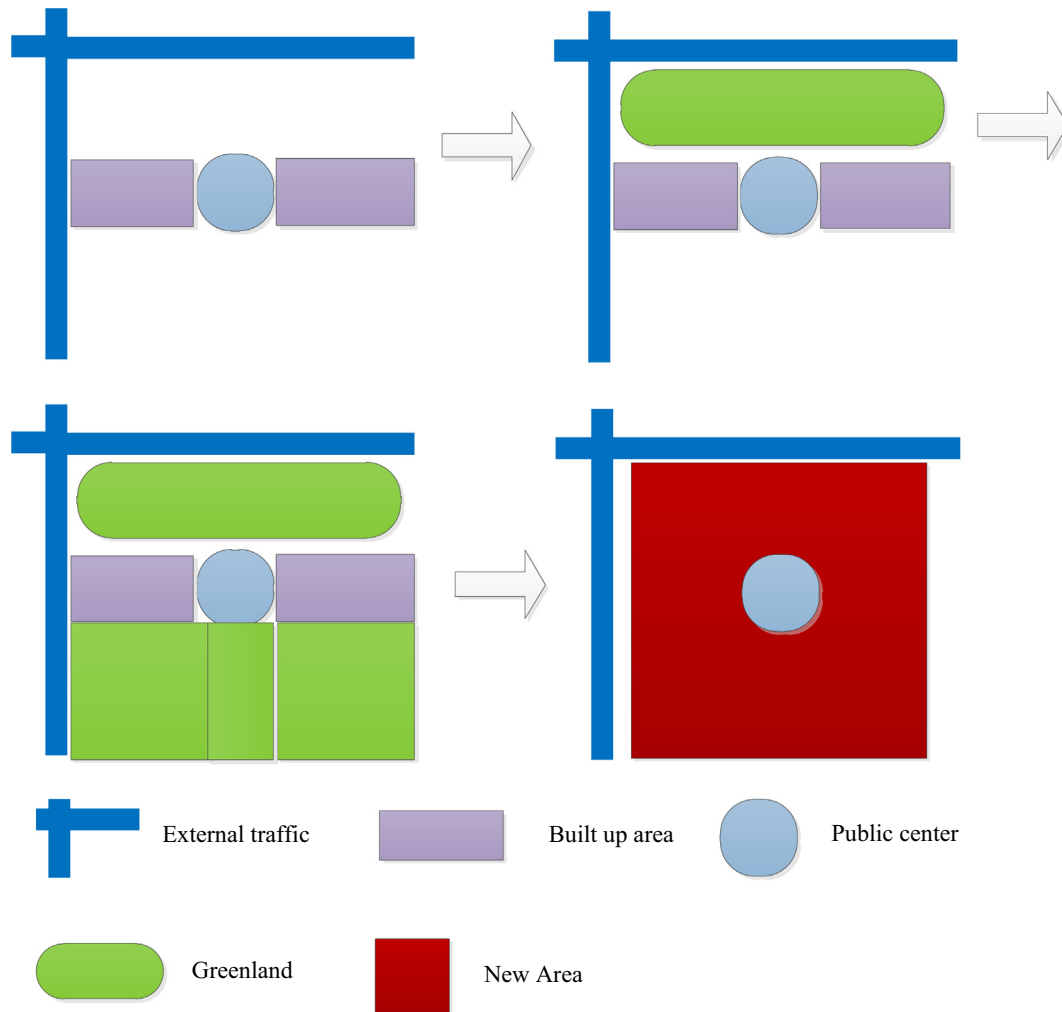


Fig. 4. Schematic diagram of village development of new villages.

not regulate the breeding site in time at the beginning of construction. Most of the site construction investment is insufficient, the conditions of the farm area are limited, the sewage facilities are simple, and the degree of sewage treatment technology is low. Therefore, the bearing capacity of the breeding area is weak, most of them do not have the conditions of “dry and wet separation and diversion of rain and sewage”, and do not have the ability of resource recycling of livestock and poultry excreta. The resource utilization of manure returning to the field and biogas production is very low. Many small-scale breeding industries have too much livestock carrying capacity, too much livestock and poultry excreta, livestock and poultry excreta are stacked in the open air nearby, and the sewage is discharged along the ditch. As shown in Table 3, it can be inferred that in recent years, with the continuous expansion of the scale and quantity of the breeding industry in village B, the discharge of livestock and poultry manure and sewage has increased, which has continuously exacerbated the regional pollution level. Although the government has started to carry out special treatment, it is still far from meeting the requirements of “zero discharge”.

#### 4.2. Investigation on environmental governance

The survey results show that rural residents have a certain degree of understanding of the current local rural environmental situation. Among them, 12.58 % of the villagers believed that the local environment was not polluted; 55.58 % of the villagers

believed that there was environmental pollution, but it had little impact on daily life; 31.84 % of the villagers believed that the local environment was seriously polluted, which had a negative impact on their lives. It can be seen that villagers have a certain understanding of local environmental conditions, but their overall understanding is relatively backward. This understanding is affected by their lifestyle and behavior, and will have an impact on their behavior of participating in environmental governance. As shown in Fig. 5a.

According to the survey, among the investigated objects who believe that the local environment has been polluted, 11 % of the villagers believe that it is soil pollution, 26.6 % believe that the main type of local environmental pollution is water pollution, 31.14 % believe that it is air pollution, 57 % believe that it is livestock manure pollution, and 71 % choose domestic waste pollution. As shown in Fig. 5b. From this, we can conclude that domestic waste pollution is the pollution type that has the greatest impact on the lives of local villagers, which may be an objective and real situation. However, it may also be that the pollution of domestic waste and livestock manure is relatively obvious, which is easy to be noticed by villagers, while the air pollution, water pollution and soil pollution are not significant enough, so the attention is not enough. In terms of the understanding of the main contents of environmental governance in village B, in the survey, residents have different understanding of the local environmental governance, such as village garbage collection and treatment, garbage cleaning of main roads and rivers, replacing coal with gas, banning

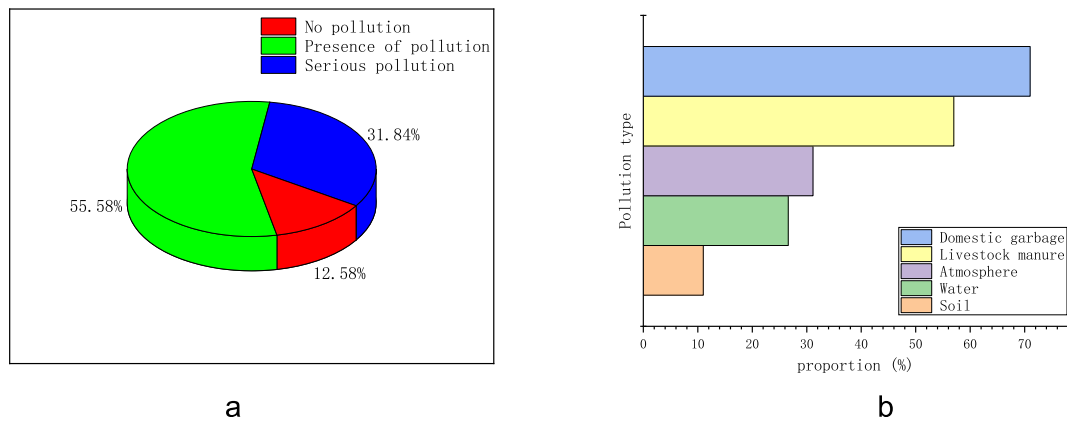


**Table 2**  
Rural economic revenue and expenditure and per capita income of farmers in recent years.

project	2015	2016	2017	2018	2019	2020	2021
Economic income (100 million yuan)	1466	1563	1643	1702	1855	1988	2188
Economic growth rate	6.6	6.9	5.1	3.6	8.9	7.2	10.6
Per capita income (yuan)	12,003	14,776	16,882	18,700	19,881	23,002	25,400
Revenue growth rate	12	23	14.2	10.7	6.3	15.6	10.4
National per capita income	8322	9876	12,321	14,578	16,822	17,655	18,700

**Table 3**  
growth of livestock and poultry meat and eggs in recent years.

project	2013	2014	2015	2016	2017	2018	2019	2020	2021
Meat (10000 tons)	3.23	3.56	3.78	3.99	4.21	4.41	4.62	4.87	5.15
Increase rate (%)	6.5	10.2	6.2	5.6	5.5	4.8	4.9	4.4	5.8
Eggs (10000 tons)	3.65	3.87	3.99	4.12	4.22	4.32	4.45	4.67	4.89
Increase rate (%)	5.8	6.2	3.1	3.3	2.4	2.6	3	4.9	4.7



**Fig. 5.** Villagers' understanding of rural pollution.

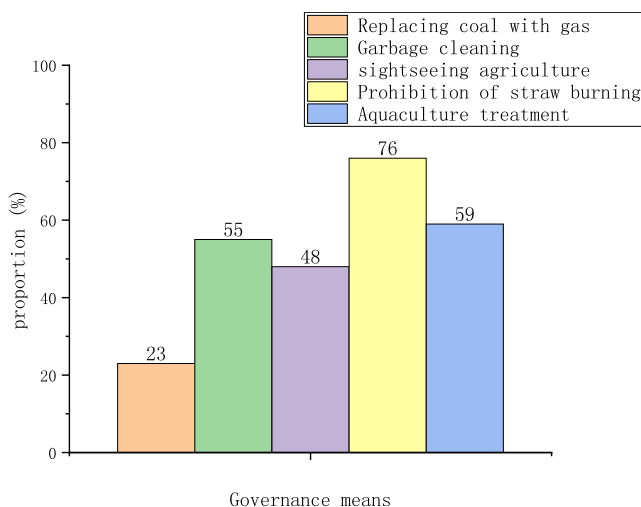
straw burning, aquaculture garbage treatment, and Developing Sightseeing and leisure agriculture. As shown in Fig. 6.

4.3. Environmental control countermeasures

Rural pollution disputes will force local governments and polluting enterprises to pay attention to environmental governance,

but the interest coordination mechanism of dispute handling at the grass-roots level will affect the effectiveness of environmental governance of local governments and polluting enterprises. Rural environmental governance is a long-term and systematic process. Once despised, it will lead to environmental pollution and environmental disputes again. Polluting enterprises focus on their own corporate interests and will not take environmental governance as a consideration in production decision-making. Local villagers can most directly perceive the severity of environmental problems. They are the participants in environmental protection and the supervisors in environmental governance. Local governments balance economic development, social stability and environmental governance, act as a mediator of environmental disputes and a supervisor of environmental pollution. Due to the mutual game among stakeholders in rural pollution, there is a continuous alternating cycle trend of rural pollution disputes and pollution control. This paper uses the basic principle of game theory to establish a dynamic model of petroleum enterprises, environmental supervision departments and injured villagers, and obtains the equilibrium solution of the model, The equilibrium solution is analyzed to explore the Countermeasures for the complete treatment of rural environmental pollution.

Dynamic game means that the actions or decisions of game participants are in order, and the latter social actors can observe and find the actions selected by the former actors. Participants: petroleum enterprises, environmental regulatory authorities and local affected villagers. Strategy choice of participants: the strategy



**Fig. 6.** Village name's understanding of environmental governance.

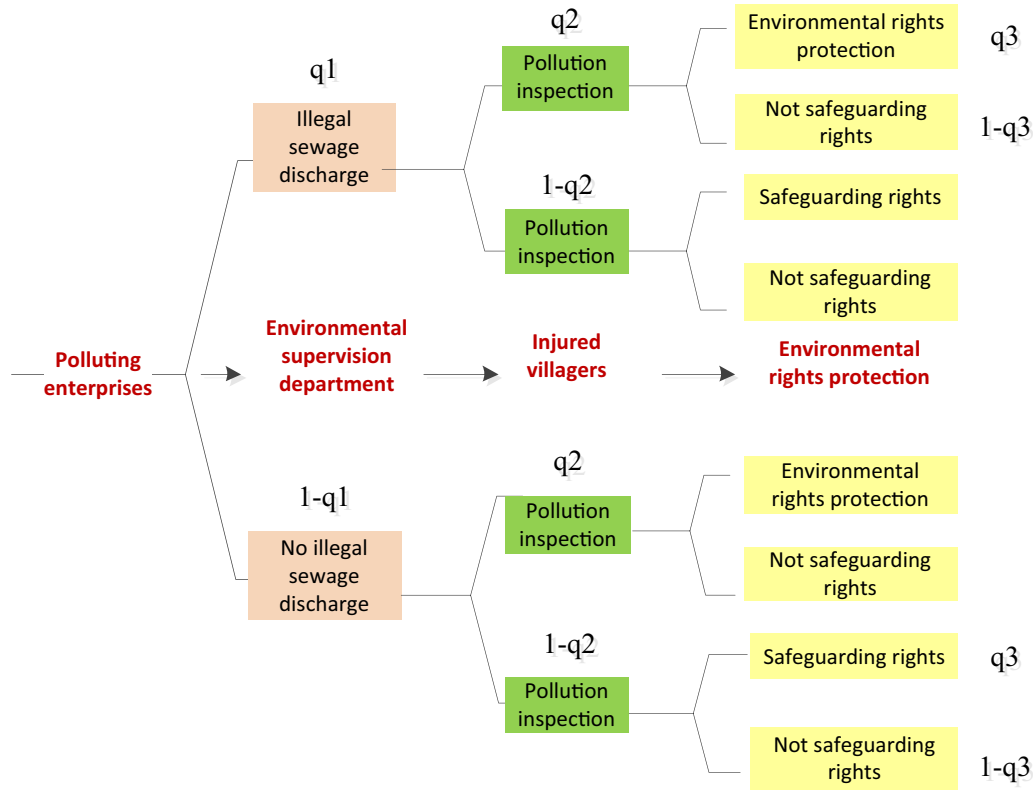


Fig. 7. Game tree of environmental governance.

choice of the enterprise is to discharge pollutants in violation of regulations and standards, the strategy choice of the environmental supervision department is to check and punish, no inspection and no punishment, and the strategy choice of the local villagers is to protect their rights and interests in the environment. Participant's information set: the probability that the oil enterprise does not truthfully report the discharge in violation of regulations is  $q_1$ , and the probability that the polluting enterprise complies with the regulations and truthfully reports the discharge is  $1-q_1$ ; The probability of the environmental supervision department to inspect the polluting enterprises is  $q_2$ , and the probability of not inspecting is  $1-q_2$ ; The probability of local injured villagers' environmental rights protection is  $q_3$ , and the probability of not protecting their rights is  $1-q_3$ . The expected return functions of the three players (oil enterprises, environmental supervision departments and local injured villagers) are  $q_1$ ,  $q_2$  and  $q_3$ . In order to obtain the return function of the participants, first draw the game tree of environmental governance, as shown in Fig. 7.

The petroleum enterprise is the initial decision-making point in the game process. The probability that the petroleum enterprise discharges pollutants in violation of regulations and fails to report the amount of pollutants is  $q_1$ , the probability that the petroleum enterprise does not discharge pollutants in violation of regulations and truthfully reports is  $1-q_1$ , the environmental supervision department takes action again after the petroleum enterprise takes action, the probability that the environmental supervision department carries out pollution inspection is  $q_2$ , and the probability that the environmental supervision department does not carry out pollution inspection is  $1-q_2$ , Finally, the local injured villagers carry out environmental rights protection actions. The probability of local injured villagers carrying out environmental rights protection is  $q_3$ , and the probability of injured villagers not carrying out environmental rights protection is  $1-q_3$ .

### 5. Conclusion

New rural construction is a major event related to people's livelihood. Due to the lack of foundation, huge workload and eager for success, many old problems can not be solved, and new problems continue to appear. Reflected in the planning and design level, planners and architects blindly pursue efficiency, do not fully study the design objects, and do not understand the creative ideas, resulting in the embarrassing situation that most new rural planning and design schemes are not accepted by farmers and dissatisfied with the government. Regional culture is the eternal source of inspiration for architectural creation. Rural areas have a deep foundation of regional culture. These valuable regional cultures will only disappear if they can not be inherited in the process of new rural construction. Based on the above thinking, the author launched the research on the design and governance of new rural public environment from the perspective of regional culture. The innovation of this paper lies in: (1) This paper examines the existence value of the new countryside from different angles, analyzes its characteristics and disadvantages that should be avoided, and expounds its most reasonable existence mode; (2) Taking regional culture as the starting point and foothold, absorbing the excellent design ideas of traditional villages in Eastern Henan, and bringing them into the planning and design theoretical system of new countryside; (3) From the perspective of regional culture, this paper establishes the positioning of new countryside, and expounds the corresponding specific planning and design methods. This paper also analyzes the dynamic game process of participants in environmental governance from the perspective of game theory. By establishing a three-party dynamic game model of local government, oil enterprises and injured villagers, due to the sequence of action decisions of game participants, the game strategies of the three parties are interrelated and restricted. Through the analysis of

the equilibrium solution of the game model, Explore relevant countermeasures for rural pollution control and thorough settlement of disputes.

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### Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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