Research on Current Situation of Rural Waste Classification In China, based on Institutional Engineering

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ABSTRACT

With the rapid development of rural economy and the gradual improvement of urbanization level in China, the living standard of rural villagers in China has risen substantially, and their consumption capacity has increased day by day. At the same time, the total amount of rural garbage production in China is also increasing. In 2017, the amount of rural garbage production in China increased to 5.09 billion tons, but the harmless treatment rate of domestic garbage in established towns and townships is only 51.17% and 23.62% respectively. The increasing amount of rubbish in rural areas and its unscientific disposal methods have a certain negative impact on the ecological environment. Institutional engineering introduces the design method and analysis method of engineering organizational system, and puts the system into mathematical model and structure, so that the system maker can design and analyse organizational system in a more rational and quantitative way. Based on the theory and method of institutional engineering, this paper analyses the status quo of rural garbage classification in China from four aspects including behavioral resources, behavioral rewards, behavioral costs and observation intensity, and puts forward improvement suggestions, so as to promote the effectiveness of rural garbage classification, improve ecological environment and promote resource conservation.

Key words: garbage classification, rural garbage classification in China, institutional Engineering, Sun Diagram

1. Introduction

With the rapid development of China's rural economy and the gradual improvement of the level of urbanization, the living standards of rural villagers in China have risen sharply, the consumption capacity has increased, and the amount of garbage generated has increased. As of the end of 2017, the proportion of rural population in China has declined to 41,48%, the amount of rural waste generated in China increased from 4.66 billion tons in 2012 to 5.009 billion tons in 2017. The amount of rural garbage produced in China is growing rapidly, and the total amount is increasing [1]. According to the statistics of the Ministry of Housing and Urban-Rural Development, in 2017, the harmless treatment rate of domestic garbage in towns and towns in China was only 51,17%, 23,62% [2], and the effective collection and harmless treatment of rural domestic garbage Urgent need to solve. Unscientific waste disposal has caused a certain amount of waste of resources and environmental pollution. In 2019, the Central Agricultural Office, the Ministry of Agriculture issued "Implementation Opinions on Doing a Good Job of Agricultural and Rural Work in 2019", the opinion pointed out that - We need to implement village cleaning action, focus on cleaning up rural domestic waste, clean up the village pond, clean up agricultural production waste such as livestock and poultry manure, change bad habits, and gradually improve the appearance of villages [3]. It is obvious that it is necessary to formulate and implement a waste classification policy in rural areas to improve the rural ecological environment. China's rural urbanization process has significant impacts on promoting the development of rural circular economy and improving the quality of life of villagers.

At present, in the composition of rural garbage in China, the proportion of agricultural production waste reaches 93.53%, of which, the proportion of aquaculture waste is 76.20%, the proportion of straw waste is 17.33%, and the proportion of rural domestic garbage is 4.54%; township enterprise garbage and other The proportion of garbage is 1.93% [4]. In order to ensure adequate food supply, agricultural production waste accounts for the majority of rural waste. At this stage, China's rural garbage disposal methods mainly include landfill, composting, and incineration, but all three methods may cause secondary pollution. With the continuous improvement of technology, the straw in agricultural production waste can be used as biomass energy for power generation and reuse. The aquaculture waste can generate electricity, produce biogas and organic fertilizer and other resources, and can also achieve recycling purposes. Therefore, the rational classification of waste plays an important role in rural garbage disposal, resource conservation and environmental protection. However, compared with urban garbage, rural garbage has a wide range of production, scattered sources, random stacking, difficult collection and transportation, and inadequate garbage collection and disposal systems. Therefore, China's rural waste classification still faces severe challenges.

2. Analysis of current status of rural waste sorting system in China based on Sun Diagram

Professor Sun Shaorong believes that as a system designer, there are five measurements that can be considered when it comes to influencing the behaviour of individuals: controlling

behavioral resources, controlling behavioral rewards, controlling behavioral costs, controlling behavioral opportunities, and changing observations [5]. In the problem of garbage classification, behavioral opportunities are actually affected by behavioral resources. Therefore, this paper analyzes the current status of China's rural garbage classification system from four aspects: behavioral resources, behavioral rewards, behavioral costs, and observation strength.

2.1 Status of Behavioral Resources

Behavior resources refer to the resources that actors need to carry out a certain behavior. In the process of rural garbage classification, if we want to encourage villagers to choose garbage classification behaviour, abundant available facilities are the most critical resources. Because the processes of putting in, collecting, transporting and disposing garbage are closely linked. Collection and transportation facilities play an important basic supporting role. At present, in most rural areas of China, the number of garbage bins is small, and the garbage bins are not classified, lack of garbage terminal treatment facilities, and fewer garbage storage points, resulting in the inefficiency of garbage classification in the process of classification collection and transportation.

2.2 Status of Behavioral Rewards

Behavioral rewards refers to the returns that the actor receives when he chooses an act. The returns include positive and negative returns. Although the quality of our country has been greatly improved in recent years, the overall level is relatively backward, and the environmental awareness of citizens is relatively weak, which can not fundamentally form the consciousness of conscious garbage classification. Especially in China's current rural areas, most of the residents are middle-aged and elderly, and their education level is low. They have not received environmental protection education since their childhood. They lack the initiative and consciousness of practicing garbage classification. Therefore, it is a challenge to carry out garbage classification work in rural areas in the early stage. Effective incentives or penalties are needed to encourage villagers' garbage classification behavior. However, at present, there are no reasonable incentives to improve the positive returns of villagers' garbage.

2.3 Status of Behavioral costs

Behavioral costs refers to the mental or material cost that an actor needs to pay when performing an action. In terms of spiritual costs, there is a lack of uniform and reasonable classification standards for rural waste sorting in China, which requires villagers to spend too much energy on thinking about correct and reasonable ways of sorting waste before placing garbage. According to the State Council issued [2017] No. 26, the domestic garbage is divided into three categories: hazardous garbage, perishable garbage and recyclable garbage. In the actual operation process, local standards are different. Moreover, there are many people in China, and each region has its own different status quo and characteristics. Especially in urban areas and rural areas in China, the education level of residents is quite different, the distribution of wealth is not balanced, the industrial structure is different, and urban and rural areas are produced. The garbage also has different characteristics. Among the rural wastes, a large part of the garbage comes from agricultural production activities. At present, China's fuzzy garbage classification standards are

obviously not reasonable, and they are not targeted, and they do not match the status of rural garbage.

2.4 Status of Observations

The intensity of observation refers to the regulatory effectiveness of an action. At present, one of the reasons for the disorderly release and non-category of rural garbage in China is that the supervision of the waste classification policy is insufficient and the regulatory body is lacking. After the government publicity, regardless of the behavior of the villagers, there was no substantive guidance and supervision on the classification and distribution of the villagers' garbage, which led to the promotion of "empty slogans". The villagers also reduced their consciousness and the effect of garbage sorting was greatly reduced.

3. Effective boundary conditions and Improvement Countermeasures of rural waste classification system

3.1 The sun diagram of rural garbage classification system

When analyzed the rural waste classification system, the local villagers were taken as the main body, and they had a binary behavior set-b_1, b_2. b_1 represents garbage sorting behaviour, b_2 represents garbage non-sorting behaviour. In the garbage classification system, as long as the villagers choose the garbage classification behavior b_1, they can get the behavior reward r_1. There is an inevitable relationship between the garbage classification behavior b_1 and the behavior reward r_1. If villagers choose the non-classification behavior b_2, they need to face the supervision of a binary observer p_2. When the non-classification behavior b_2 occurs, the binary observer p_2 can observe b_2 with the probability of p_{21}. At this time, villagers will be punished for choosing b_2. At the same time, the binary observer p_2 can not detect the non-classification behavior of garbage 100%. When villagers choose non-classified garbage behavior, the observer has a probability of 1-p_{21}, that is, p_{22} misjudgment. In this case, villagers choose non-classified garbage behavior because it is not monitored in place and thus get certain behavior reward r_2. The specific Sun's figure is shown below [6].

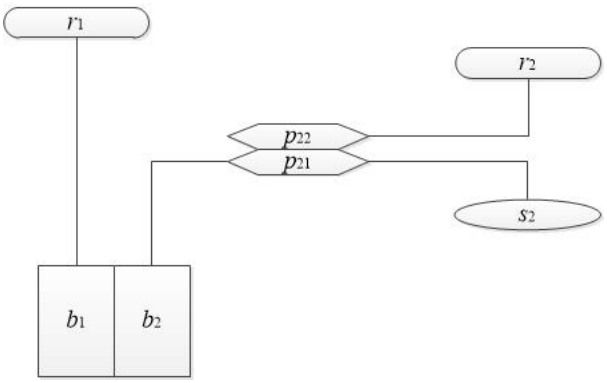

Figure 1 The Sun Diagram of the rural waste classification system

3.2 The System Parameters and Effective Conditions of Rural Waste Classification System.

The system parameters of rural waste classification system are as follows [7]

Table 1 System parameter table of rural waste classification system

Behaviour	Behavioral content	Behavioral rewards	Behavioral probability	Behavioral costs	Behavioral utility
b1	Garbage classification	r1	1	c1	u1=r1-c1
b2	Non-classified garbage	r2 s2	p22 p21	c2	u2=p22r2+p21s2-c2=(1-p21)r2+p21s2-c2

The effective conditions for the rural waste sorting system are u1>u2, ie r1-c1>(1-p21)r2+p21s2-c2. Among them, c1 is the behavior cost of the villagers choosing the garbage classification behavior b1, and c2 is the behavior cost of the villagers choosing the garbage non-classification behaviour.

3.3 Measurements for improvement of rural waste classification system

3.3.1 Reducing the Behavior Costs of Waste Classification

It can be obtained by transforming the effective condition $r_1-c_1>(1-p_{21})r_2+p_{21}s_2-c_2$. When the garbage classification system is effective, it should satisfy: $c_1<r_1-(1-p_{21})r_2-p_{21}s_2+c_2$. It can be seen that reducing c_1 can improve the effectiveness of the rural waste classification system. The specific countermeasures are as follows:

(1) Formulating a unified and reasonable classification standard for rubbish.

At present, rubbish treatment in rural areas of China is in the exploratory stage, and there is no stable and popularizable general management model. Legislative conditions and relevant rules and regulations on rural rubbish are not yet mature in the whole country, which can easily lead to blank content and poor operability. Local governments should improve relevant policies and systems, strictly and reasonably stipulate the classification standards of local rural garbage, reduce the complexity of the villagers' garbage disposal, and improve the operability. There are two key points in this strategy. First, the classification criteria should be reasonable. Based on the composition of rural garbage, it is suggested that the classification standard of rural garbage should be divided into compostable garbage, recyclable garbage and other garbage. The compostable garbage includes the garbage that can be reused for crop cultivation, such as leftovers, plant defoliation, melon peel, etc. The recyclable garbage includes plastic bottles, clothes, paper, waste household appliances, etc. The other garbage is other garbage besides compostable and recyclable. The classification of garbage should also be adapted to local conditions. The areas with different garbage composition should be adapted to local conditions and make reasonable changes in

classification standards. Secondly, the classification criteria should be detailed. When formulating relevant classification standards and regulations, the scope of each kind of garbage should be specified in detail, so as to improve the operability of garbage classification by villagers.

(2) Strengthen propaganda efforts.

Waste classification is based on the progress of social civilization and the improvement of citizens'quality. To cultivate citizens'garbage classification habits and improve citizens' awareness of garbage classification, we need to do a good job in garbage classification publicity and education. For the publicity work of rural garbage classification, the suggestions are as follows: First, rural schools can strengthen the education of students and introduce garbage classification education into the campus, which can not only enable students to establish garbage classification consciousness from an early age, but also pass the idea of garbage classification to parents through their children's learning. Secondly, we can organize a series of activities such as knowledge popularization, best household selection of garbage sorting, application of sorting standards, etc. in administrative villages, so as to enhance villagers'enthusiasm and participation in garbage sorting, and then achieve the purpose of publicity and education. Third, government agencies can design simple, clear and comprehensive posters, brochures, posters and other propaganda tools based on villagers'educational level, so that the concept of garbage classification can permeate villagers' daily life.

(3) Increase the number of garbage bins and reasonably select them.

The rational arrangement of the garbage can is of great significance for promoting the classification of rural waste. The rural houses are relatively scattered, and the traditional layout mode of sharing a garbage bin in one area increases the travel distance of the villagers to the garbage, which increases the behavior cost of the village garbage classification. Therefore, the government departments should appropriately increase the input of garbage bins according to the distribution of local villagers' houses, reasonably select the address of the garbage bins, minimize the travel distance of the villagers, and facilitate the garbage sorting behavior of the villagers.

(4) Design different garbage bags and distribute them free of charge.

The classification of household waste means an increase in the use of garbage bags. In the initial stage of regulating waste sorting, the behavior cost of villagers should be reduced as much as possible. Relevant departments can design special garbage bags for different types of garbage and distribute them to each villager. On the one hand, it can strengthen the villagers' understanding of the garbage classification standards, on the other hand, it can also reduce the cost of garbage bags of villagers and a certain degree of economic pressure brought about by garbage classification.

3.3.2 Improving the behavioral rewards of garbage classification

It can be obtained by modifying the effective condition $r_1-c_1>(1-p_{21})r_2+p_{21}s_2-c_2$. When the garbage classification system is effective, it should satisfy: $r_1 > (1-p_{21})r_2+p_{21}s_2-c_2+ c_1$. Increasing r_1 can improve the effectiveness of the rural waste classification system. The specific countermeasures are as follows:

(1) Establish a reasonable reward system

In the initial exploration stage of waste control, one of the important tasks is to fully mobilize the enthusiasm of villagers for garbage sorting. Therefore, the establishment of an incentive system is an indispensable part of the process of promoting waste sorting. A point system can be set up to reward households with outstanding performances with daily necessities, cash or certain honors; or administrative villages can be used to reward material awards or honors for outstanding administrative villages. Through the reward system, everyone is actively involved and encourages the classification of waste.

3.3.3 Reducing the behavioral rewards when garbage is not classified

It can be obtained by transforming the effective condition r_1-c_1>(1-p_{21})r_2+$p_{21}s_2$-c_2. When the garbage classification system is effective, it must satisfy: $s_2<\frac{r1-c1+c2-(1-p21)r2}{p21}$, So it is shown that reducing s_2 can improve the effectiveness of the rural waste classification system. The specific countermeasures are as follows:

(1) Establish a reasonable punishment system

Garbage classification is not a voluntary behavior, but a certain degree of government compulsory behavior. Therefore, its implementation process must be accompanied by a certain punishment system. After clarifying the responsibilities of each villager in the relevant rules and regulations, individuals who evade responsibility and ignore the system should be given certain punishments. In the initial stage, it can be “reward-based, supplemented by punishment”, which makes the system deterrent but does not hit the enthusiasm of the villagers. When the garbage classification develops to a certain stage, the villagers are accustomed to further cultivation, they can “take punishment as the mainstay and reward as the supplement”, and manage the villagers’ behavior more strictly.

3.3.4 Adding an observer

It can be obtained by transforming the effective condition r_1-c_1>(1-p_{21})r_2+$p_{21}s_2$-c_2. When the garbage classification system is effective, it must satisfy: $p_{21}>\frac{(r2-r1)+(c1-c2)}{r2-s2}$, so improving p_{21} can improve the effectiveness of the rural waste sorting system. The specific countermeasures are as follows:

(1) Set up the supervision department

A sound system cannot be separated from a strong supervision department to ensure the implementation of the system. In the process of implementing the waste sorting system, relevant supervisory departments should be set up in the administrative villages to improve the supervision of the villagers' behavior and ensure the behavioral norms at the grassroots level. For example, one or two supervisory personnel may be recruited per unit in the administrative village. They are responsible for supervising the garbage classification behavior of the villagers in the village, and recording them, and conducting the reward and punishment assessment of the villagers based on the records.

4. Conclusion

This paper applies the relevant knowledge of institutional engineering such as Sun's diagram, analyzes the status quo of rural garbage classification in China from four aspects: behavioral resources, behavioral returns, behavioral costs, and observational strength, and gives behavioral returns, behavioral costs, observations, etc. Relevant suggestions have been put forward by relevant departments. Relevant departments can formulate uniform and reasonable classification standards, increase publicity, increase the number of garbage bins and rationally select their sites, design different garbage bags and distribute them to villagers free of charge, and establish reasonable ones. The reward and punishment system and the establishment of supervision departments and other means to strengthen the garbage classification behavior of villagers and promote the process of garbage classification.

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