Model and Suggestions on Classified Treatment of Rural Domestic Waste

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Abstract. The classified treatment of rural domestic waste is an urgent need to promote the Rural Revitalization Strategy and an important way to meet the needs of people's better life. With the rapid development of rural economy and society and the continuous improvement of farmers' living standards, how to realize the reduction, recycling and harmless treatment of rural domestic waste has become an urgent issue for economic and social development. Based on the investigation of rural domestic waste classification and resource utilization pilot areas in Shaanxi Province, from the perspective of suppliers, this paper uses case analysis method to compare the basic situation, classification practice mode and suppliers of four pilot villages, and further comprehensively evaluate the domestic waste end classification degree, resource utilization rate and annual unit cost resource utilization of each pilot village. Reduction and harmless treatment effect. It is found that: at present, rural domestic waste classification is faced with supply dilemma, institutional dilemma, capital dilemma and Governance Dilemma. To solve these problems, we must start from four aspects: building a diversified supply subject, establishing a long-term stable capital investment mechanism, establishing and improving the relevant legal system and integrated collaborative governance system, so as to promote the formation of farmers' waste classification habit and form a waste management system Long term mechanism of garbage disposal.

1. Introduction
In recent years, with the development of rural economy and the improvement of living standards of rural residents, rural household waste emissions are becoming more and more large, which not only affects the appearance of the village, pollutes the water and air, but also poses a threat to the quality and safety of agricultural products, as well as the physical and mental health of residents.

Rural household waste refers to the solid waste produced by rural residents in daily life, which is a byproduct of modern civilization. In the era of economic underdevelopment and relative scarcity of materials, the types and quantities of household garbage in rural China were relatively small, mainly kitchen waste. The treatment method was mainly local consumption by households, that is, feeding livestock and poultry and returning to the fields. With the sustained and fast economic development, with the sustained and fast economic development, and in recent years China implements the policy of expanding domestic demand and stimulate consumption, farmers had greater change in lifestyle, a large number of production, a lot of consumption, leading to a large amount of wastes, Many places appear
garbage surrounding villages, rivers and ditches into a natural dumping ground phenomenon. The problem of rural household garbage treatment has not been effectively solved for a long time, which is the lack of environmental protection public goods in rural areas and the backwardness of public services. In essence, as a public good, rural household garbage treatment has a strong positive externality. According to the interpretation of traditional economics, public goods with externalities are generally provided by the government, so the supply of rural household garbage treatment outside the government has long been supply of rural insufficient. Moreover, even limited supply is inefficient in practice due to the lack of systematic and household garbage treatment outside the government has long been matching policy or technical support. Therefore, in order to completely solve the problem of rural household garbage, the implementation of rural household garbage on-site classification treatment and resource utilization, we must first solve the supply problem, and the key to solve the supply problem is who supply - the main body of supply. The difference of the main body of supply is directly related to the input, mode, operation and treatment effect of rural MSW classification treatment. Solve the problem of rural living garbage, not only help to improve the rural ecological environment, promote the construction of ecological civilization in rural areas, also helps to safeguard residents drinking water safety and the quality and safety of agricultural products, to improve the quality of life in rural area, therefore, our country rural residents living garbage classification behavior research has very important practical significance.

However, from the existing research, the research on these issues is still not clear. Based on this, this article from the perspective of rural public goods supply subject, in urban and rural housing ministry announced in June 2017, "the first batch of rural living garbage classification and recycling use demonstration county (area, city)" four demonstration county of Shaanxi province (area, city) 4 cases village as the research object, the comparative analysis of Shaanxi province four different mode of the supply of the rural living garbage classification processing practice, to reveal different practice mode selection of internal rules and external constraints, and on the basis of the rural living garbage classification process model for new exploration and development Suggestions are put forward.

2. Supply main body analysis, case selection and research framework

2.1. Rural public goods supply main body

Rural public goods relative to the farmers' personal belongings or household spending, has certain typical characteristics, according to Samuelson put forward the concept of public goods, rural public goods can be defined as within the scope of the specific rural communities, to meet the needs of farmers and rural economic development of production and life of the public needs or consumer has a non-exclusive and non-competitive public goods. Rural public goods can be generally divided into rural pure public goods and quasi-public goods [1]. Whether in theory or in practice, the government is the main supply of rural public goods, or even the only main body. However, the government's resources are relatively limited, and it is difficult to supply rural public goods comprehensively and continuously with high quality and high efficiency. In addition, on the one hand, due to the lack of systematic policy or technical support, it is difficult to form a stable profit model for rural household waste classification operation, resulting in the lack of motivation for market participants to participate. And with the rapid development of China's rural economic, social and information and progress, the farmers of the rural public goods demand shows a tendency of diversification, differentiation, and complicated, the government has a single supply cannot satisfy a variety of needs of farmers, rural public goods supply main body constantly tend to be diversified, forming the government-led, market, the third sector, rural communities and farmers participating the supply of rural public goods.

2.1.1. The government. The classical theory of public goods supply holds that the existence of strong externalities makes the phenomenon of "free riding" in the supply of quasi-public goods ubiquitous, and the market, the third sector and other subjects lack the supply motive of public goods driven by interests [2], so the government is obligated to undertake the supply responsibility of rural public goods. In the
treatment of rural solid waste, the government should not only play a leading role in the supply process, but also properly handle the relationship with other supply subjects, such as the market, the third sector, rural communities and farmers.

2.1.2. *Market.* In the dual transformation period of economy and society, the property right system is increasingly clear, the classification of public goods is further refined, and consumer demands are increasingly diversified. The rural public goods have reached a consensus through the supply of market subjects. Market supply can not only effectively relieve the financial pressure of the government, but also make up for the defect of the single supply of the government and meet the multi-level demands of farmers for public goods. In the classification treatment of rural solid waste, profit-making organizations or individuals are usually authorized by the government to provide related public goods for rural solid waste treatment, and they charge certain fees to the authorized parties or users in accordance with the principle of equivalent exchange in the market to compensate their investment costs and make profits. The drive of maximization of interests will urge individuals or profit-making organizations as rational "economic people" to try to control the cost of rural solid waste treatment. As the authorizer, the government needs to implement corresponding incentive measures while strengthening regulatory constraints, such as giving more autonomy to the market, optimizing its investment environment and implementing preferential tax policies.

2.1.3. *The third sector.* The third sector generally refers to the non-governmental social organizations or individuals with the nature of public welfare or non-profit, engaging in public welfare and charitable activities. As the main supply of rural public goods, the third sector not only conforms to the property of rural public goods, but also can solve the problem of government supply shortage and "market failure" in the supply of rural public goods. The participation of the third sector in the supply of rural household waste treatment means that the third sector independently decides the amount, type and mode of supply of funds or goods. In the treatment of rural household waste, the government or the community must establish a sound supervision mechanism to ensure that the goods and funds provided by the third sector are delivered to specific rural communities or farmers, and establish a corresponding incentive system to disclose relevant information to the society, and publicize and encourage the public welfare supply behavior.

2.1.4. *Rural communities.* As the smallest collective organization in the main body of rural solid waste management and supply, rural communities can not only organize and coordinate the production and life of the community, develop the community economy, raise funds to participate in the supply, but also gather the strength of other main body of supply and guide farmers to participate. In the treatment of rural solid waste, rural communities should fully participate in the decision-making, implementation, supervision and evaluation of supply to ensure the thorough treatment of solid waste and the improvement of rural environmental hygiene.

2.1.5. *Rural communities.* In recent years, as Mr. Ostrom part proposed the development of autonomous governance theory and practice[3], put forward relevant scholars, the rural environment problem of cracking to give play to the role of farmers to actively participate in and the main body, rely on farmers for rural environment of autonomous management, solve the rural endogenous pollution[4,5], formed by farmers multivariate cooperation as the main force of rural public goods supply mode in order to solve a single main supply failure[6,7]. Farmers are not only the producers of rural household garbage but also the beneficiaries of the treatment effect of household garbage. They have the endogenous motivation to participate in the supply of rural environmental protection public goods spontaneously. Therefore, guiding and encouraging farmers to participate in the cooperative supply of rural solid waste treatment can not only improve the supply efficiency, but also effectively meet the demand preferences of farmers.
2.2. Case selection and investigation.
In June 2017, the Ministry of Housing Construction announced the "first batch of rural solid waste classification and resource utilization demonstration counties (districts, cities)" of 100 demonstration counties (districts, cities), Shaanxi Province has 4 pilot counties (districts), namely Xi'an city, A county, Ankang city, B county, Wei'nan C city, C county and Yan'an city, D district. From March to April 2018, the research group learned about the pilot villages in different regions through the Housing and Construction Department. Then, members of the research group went to 10 villages in 4 pilot areas to carry out field interviews and surveys. In order to obtain the relevant information needed for the research, the research group designed the interview outline and survey questions. The investigation mainly includes three parts. First, under the leadership of village cadres, we observed and understood the related facilities and operation modes of garbage classification and treatment. Secondly, face to face with the township and village cadres to conduct in-depth interviews; Finally, one-to-one questionnaire survey was conducted among random sampling households. By deep 10 village survey research, found that 10 villages of garbage sorting treatment facilities and service inputs, classification, processing method, operating mode and system of rules, there is a certain difference, from the perspective of rural public goods supply subject classification, there are different main body involved in the supply of 4 kinds of practice patterns, respectively is "government + market", "government + rural communities", "government + rural community + farm households" and "government + market + third sector + rural communities" mode of supply.

2.3. A research framework.
In this paper, based on the main body of rural public goods supply, combined with the Shaanxi rural living garbage classification and recycling use of the actual situation of the four pilot areas of the four different main body joint supply of garbage classification processing of village case comparison, analyzes the basic situation, classification, processing mode, the supply main body and the treatment effect, and then to the rural living garbage classification processing model for new exploration and development Suggestions are put forward. The main research framework of this paper is shown in Figure 1.

Figure 1. Research framework for the practice mode of classified treatment of rural domestic wastes and development suggestions.

3. Comparison of practical models of rural household waste classification treatment by different suppliers

3.1. A Basic situation of pilot village.
Different supply main body of the rural living garbage classification and recycling use the basic situation of pilot villages as shown in table 1, in this interview survey, first understand the basic situation of four pilot village, village of Xi’an area A E distance nearest in section A, highest per capita annual income in 2017, more than 20000 yuan, Ankang municipality B F county village in 2017, the lowest annual per
capita income 8100 yuan, while Yan'an region D H village population of only 390 people. The main crops grown in the four villages are similar, all of which are mainly vegetables and fruits (Table 1).

| Pilot villages       | The distance from a district (county)/Km | Number of groups of villagers | The number of farmers | The number of population | Per capita annual income in 2017 | Interview time of pilot village |
|----------------------|------------------------------------------|-------------------------------|----------------------|-------------------------|-------------------------------|---------------------------------|
| Village, A District, Xi'an City | 8                                        | 8                             | 567                  | 1894                    | 21 710                         | March 27, 2018                   |
| F Village, B District, An'kang City | 13                                       | 9                             | 396                  | 1380                    | 8 100                          | April 30, 2018                   |
| G Village, C District, Weinan City | 9                                        | 9                             | 587                  | 2287                    | 13 820                         | April 26, 2018                   |
| H Village, D District, Yan'an City | 15                                       | 2                             | 140                  | 390                     | 14 500                         | April 28, 2018                   |

3.2. A Basic situation of pilot village.
The household garbage classification treatment in E Village mainly adopts the intelligent garbage classification system and the "second four division method" which is well understood by villagers for classification treatment. "Second Quarter Method" means that the villagers divide the household garbage into "perishable" and "non-perishable" garbage at home, and then the cleaning staff will sort and recycle the garbage for the second sorting, and the garbage is divided into perishable garbage, recyclable garbage, toxic and harmful garbage and other garbage. Finally, the cleaner will use the recycling garbage classification transport, classification treatment. The principle of household garbage classification in F village is that farmers classify compostable garbage and non-compostable garbage, and then pour compostable garbage into the sunshine garbage composting room for composting by themselves. The non-compostable garbage is put into the centralized garbage can in the village, and the town uniformly collects and transports the garbage to the county for landfill. But from the survey found that due to farmers is relatively frugal life, they will produce in life have economic value of recyclable waste, sold to the village after collect garbage collection points, other all garbage into the garbage bins in the village, the early stage of the government investment of the construction of the sun to F village compost room didn't really use, therefore, F village does not implement can organic manure waste processing. The household garbage classification and treatment process of G Village is divided into three steps. Firstly, the household garbage is classified into three categories, and the household garbage produced every day is put into the three-classification and three-color garbage cans (degradable, non-degradable, toxic and harmful) at the door of the household. Secondly, the cleaners collect garbage from the door every day, second sorting, classification and transportation to the garbage centralized storage site; Finally, the organic waste is fermented through the sunshine compost room, the recyclable waste is purchased by the specialized company, and the other waste is regularly poured into the gully behind the village for simple landfill. H Village Garbage Classification and Treatment Mode The classification and treatment process of household garbage in H Village is as follows: First, the household garbage produced every day is classified and put into the three-color and three-classification garbage cans (recyclable, non-recyclable, toxic and harmful); Secondly, the farmers send the recyclable garbage to the garbage exchange bank in the village for points exchange. After accumulation, the recyclable garbage can be exchanged for daily necessities. The other garbage can be directly dumped into the centralized garbage bin in the village. Finally, every two to three days, Cleaner transports the waste to the local landfill for disposal.
3.3. Analysis of main body of supply in classification treatment of domestic waste in pilot village.

Rural public goods supply mainly involves decision-making mechanism, the scope of supply, funding and incentive mechanism and so on several parts [8], the government, the market, the third sector, rural communities and farmers, and other main body plays a different role in the supply of different segments, and its supply behavior will be affected by the level of economic development and the subjective consciousness. The supply of rural household garbage classification treatment is mainly used for garbage classification delivery, collection, transportation, recycling and other related facilities and environmental services. Therefore, according to the different links of rural public goods supply, combined with the actual situation of rural household waste classification treatment, this paper analyzes the supply subjects of the four pilot villages from the aspects of decision-making, basic facilities, operating funds and services, publicity and reward and punishment system and supervision.

4. Suggestions on the development of rural household waste classification treatment

The above compares the advantages and problems of the supply subject, practice mode and treatment effect of waste classification treatment in different pilot villages. On the basis of this, the paper puts forward some suggestions on the development of rural MSW classification treatment from the following aspects.

4.1. Select precise multi-agent participation and cooperative supply model.

In order to truly achieve reduction, recycling and harmless utilization of rural household waste, it is necessary to encourage regions with different economic development levels to carry out waste classification treatment and recycling utilization according to local conditions, and choose precise cooperative supply mode. The classification treatment of rural solid waste needs to play the leading role of the government. Governments at all levels should not only participate in the supply, but also continuously optimize policies and external environment, formulate favorable policies to guide and encourage market participation in the supply, but also give play to the role of local enterprises and encourage the active participation of non-profit organizations and individuals. Encouraging farmers to actively participate in cooperative supply and mobilizing farmers to conduct garbage classification from the source is the core of solving rural household garbage treatment.

4.2. Optimization of rural household waste classification and treatment process based on multi-agent participation and cooperative supply.

Compared with urban MSW, rural MSW is more suitable for fertilizer and biomass resources because of its relatively simple composition, large proportion of organic waste (about 55%-72%), high moisture content (≥ 60%), and easy to be affected by seasons[9]. Therefore, this article combined with the characteristics of the rural living garbage and rural residents living custom and waste disposal habits, in order to reduce the proportion of mixed rural living garbage landfill, reduce the secondary pollution, increase the degree of garbage classification at the end and resource utilization, to achieve waste reduction as the goal, based on the perspective of the multi-agent supply cooperation, to explore suitable for ordinary rural living garbage processing pattern. In the classification treatment of rural household garbage, each village should take into account the actual situation, encourage multiple parties to participate in the cooperative supply, collective consultation and decision-making, joint investment in construction, joint supervision and management and maintenance of infrastructure. For classification dustbin, concentrated in the processing of garbage classification dustbin, garbage trucks, garbage cleaning tools and compost sunshine room (mechanical) compost room such as infrastructure construction by various joint investment, cleaner provides garbage secondary sorting and cleaning, sorting, transport and other environmental health services can be set up public welfare jobs, also can cooperate with enterprises. Township governments and communities should actively guide the participation of non-profit organizations and individuals, such as donations of public goods and funds, and setting up garbage exchange banks, so as not only to encourage farmers to properly classify, but also to recycle recyclable garbage. The proportion of toxic and harmful waste in rural areas is small, so
the community can cooperate with the renewable company to deal with it. The final non-recyclable, non-compost, non-toxic and harmless inorganic waste can be scientifically buried by the township or county (district) unified landfills. This classification treatment mode can not only realize the four classification of rural household garbage, improve the utilization rate of waste resources, but also can greatly reduce the amount of garbage mixed landfill, reduce soil, groundwater and air pollution caused by mixed landfill.

4.3. Increase publicity and reward and punishment.
Propaganda and rewards and punishments can effectively promote the correct classification of farmers, therefore, are as follows: first, government, community and public welfare organizations and individuals can through design and bright color, clear and easy to understand environmental protection garbage sorting wall posters and publicity column, enhance farmers green consumption idea and environmental awareness, guiding farmers to correct garbage classification; Second, through community collective activities such as learning and training, cultural and entertainment activities to carry out garbage classification publicity; Third, the classification of garbage cans should be clearly marked and the color and lustre should be obvious. At the same time, the garbage classification guide card should be bound for each household for the reference of farmers. Fourth, a reward and punishment system for garbage classification should be established through collective decision-making to encourage farmers to classify garbage. Fifth, in villages with kindergartens and schools, garbage sorting education should be introduced into classrooms and passed on to parents through children's learning.

4.4. We will improve the rural household garbage treatment system that combines rule of law, rule of virtue and autonomy.
Classified treatment of rural household garbage not only requires correct source classification of farmers, but also classification collection, classification transportation and final classification disposal. The disjunction of any link cannot effectively implement garbage classification and resource utilization. At the same time, it is necessary to give full play to the positive role of the self-governance rules and regulations of rural communities in the treatment of domestic garbage, promote public order and good customs, and promote the organic integration of rule of law, rule of virtue and autonomy through legal protection, moral restraint and voluntary cooperation. We should balance, support and restrict each other so as to achieve common development and governance.

5. Conclusion
On national urban and rural housing ministry announced in June 2017, "the first batch of rural living garbage classification and recycling use demonstration county (area, city)" four demonstration county of Shaanxi province (area, city) in four pilot village as the research object, from the supply main body Angle, using case analysis method, the comparison of four pilot, classification, treatment practice mode and the basic situation of the supply main body, on the basis of the degree through the end of the living garbage classification, resource utilization, the cost per unit resource utilization, reduction and innocuity of several indexes such as comprehensive evaluation of the pilot living garbage classification treatment effect.

The main conclusions and suggestions are as follows: (1) The supply body, treatment mode, capital and facility investment, end classification degree and resource utilization rate of waste classification in the four pilot villages are different. It can be found that capital investment is one of the keys to solve the rural household waste problem, and the pilot villages have certain guarantee on capital investment, but the waste treatment mode of the pilot villages cannot be completely copied and copied. For the villages with large government financial support, high economic income of the village collective and strong farmer participation and supply ability, we can learn from the intelligent waste classification mode of E village in A district of Xi'an City. However, for most ordinary rural areas, this mode cannot be simply copied. Instead, the treatment mode of different pilot villages should be used for reference, and the local economic development level, population size, income level and production and life style should
be combined according to local conditions to choose a garbage classification treatment mode suitable for local conditions. (2) to fully implement the rural living garbage classification processing, not only need to encourage the government, market and the third sector, rural communities and farmers supply main body participation in cooperation, and more, multimode raise funds through various channels, and to strengthen the rural living garbage classification processing of propaganda and rewards and punishment, give full play to the rural community of village autonomy of articles of association, the positive role, improve the rule of law, moral, autonomy, "the unity of" three for the rural living garbage management system, to achieve common governance and common development, improve rural living environment and the construction of the beautiful countryside goal.

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