The impact of environmental benefits and institutional trust on residents’ willingness to participate in municipal solid waste treatment: a case study in Beijing, China

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Abstract

The municipal solid waste (MSW) treatment is capable of significantly boosting healthy and orderly urban development. Urban dwellers act as generators and direct beneficiaries of the effectiveness of waste management. The present study aims to determine the impact of environmental benefits and institutional trust on residents’ willingness to participate in MSW treatment (willingness to be paid (WTA) and willingness to pay (WTP)) by complying with micro-survey data from residents of four districts in Beijing, with the use of the tobit model. In addition, environmental benefits and institutional trust interaction effects are incorporated into the analysis. As revealed from the results: (1) positive environmental benefits can significantly decrease WTA and increase WTP; negative environmental benefits significantly increase WTA and decrease WTP. (2) Institutional trust is capable of significantly decreasing WTA and increasing WTP. (3) When positive environmental benefits and institutional trust are incorporated, residents have significantly lower WTA and noticeably higher WTP; when negative environmental benefits and institutional trust are incorporated, WTA of the population is significantly higher and their WTP is significantly lower. Besides, years of education and household status negatively affect residents’ WTA, in which households with higher incomes have relatively higher WTP for engagement in waste management. The mentioned findings place the following stresses: (1) improving the positive environmental benefits of urban living and establishing a system of compensation for negative environmental benefits, (2) creating a good climate of trust in the system and elevating the level of trust in the system among residents and (3) raising residents’ awareness of environmental protection and enhancing the effectiveness of urban waste management.

Keywords: municipal solid waste treatment; WTA; WTP; institutional trust; environmental benefits

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1 INTRODUCTION

Worldwide cities are rapidly expanding, which has imposed huge challenges on cities, i.e. the sharp increase in municipal solid waste (MSW). As of 2020, 2.01 billion tons of MSW is generated in the world annually, of which at least 33% that is extremely conservative is not managed in an environmentally safe manner [1]. The garbage of urban life growth cannot undergo its treatment, recycling, conversion and reuse, which has imposed a global problem [2–4]. Its potential threat to city residents’ health and environmental health and the loss of important recyclable resources are particularly challenging for developing nations with higher economic growth rates (e.g. China) [5, 6]. China is recognized as the leading country to produce MSW with an estimated 3.6 billion of MSW production for 2020, and Figure 1 presents the production situation of MSW in China [7]. The outputs of
MSW in the USA and India are second only to that of China [8]. In China, MSW disposal turns out to be a top environmental concern for the government and a research hotspot in the environmental field [9].

To tackle down the mentioned issues, the Chinese government has promulgated a series of regulations to facilitate the MSW reduction, recycling and harmless (i.e. ‘San Hua’) treatment. At present, the harmless treatment of MSW in China primarily complies with three major ways, i.e. sanitary landfill, composting and incineration (Figure 2). To be specific, the sanitary landfill has been the most utilized. In landfill decomposition, harmful substances are gradually released (e.g. bacteria and viruses) and landfill leachate is easy to be produced [10]. If the landfill leachate leaks, secondary pollution will be imposed on the surrounding environment [11]. To address the limitations of sanitary landfill waste, the Chinese government has been issuing policies to underpin the waste-to-energy industry [12]. Over the past decade, the number of waste incineration plants has been up-regulated by 303% and the incineration capacity has been improved by 577% in China [13] (Figure 3). However, the surrounding residents generally resist and oppose the construction and operation of the facilities when the government builds garbage scoring facilities (Table 1). Though government departments have been proactively promoting the harmless treatment of MSW, waste incineration is applied to generate electricity to increase the social welfare. Nevertheless, residents’ resistance to the construction of garbage treatment facilities and their indifference to garbage treatment have landed Chinese MSW treatment into a dilemma [14].

To overcome the mentioned difficulties, the Chinese government has attempted to encourage residents to participate in MSW treatment by popularizing environmental protection knowledge [15, 16], disclosing waste disposal information [17, 18] and establishing exchange platforms with environmental NGOs [19, 20]. However, the harmless treatment of MSW is still significantly challenged for low public participation rates and weak willingness to participate [21]. The building and operation of MSW treatment facilities may cause residents’ living environment to be polluted, thereby affecting the health of surrounding residents and ultimately lowering the comprehensive income of residents. The residents’ distrust of government policies, however, has also increased their resistance. For policy makers, understanding the great concern of residents in the environmental process is a vital step to increase their willingness to participate, so makers can access effective information to set a reasonable approach to MSW treatment. However, rare studies have attempted to address this issue, especially in China [22].

Figure 1. Statistics of China’s MSW production from 2015 to 2020.

Figure 2. The structure of harmless treatment of MSW in China in 2018.

Figure 3. 2016–2020 China’s waste incineration power generation project/equipment industry market scale.

Table 1. The controversial incident against waste incineration in China.

| Time  | Location   | Cause of the event                      |
|-------|------------|----------------------------------------|
| 2007.6  | Beijing    | Against waste-to-energy plants         |
| 2009.8  | Beijing    | Against waste incineration plants      |
| 2009.12 | Guangzhou  | Against waste-to-energy plants         |
| 2014.5  | Yuhang, Zhejiang | Against waste-to-energy plants  |
| 2015.6  | Xiangshan, Zhejiang | Against waste incineration plants  |
| 2016.6  | Xiantao Hubei | Against waste-to-energy plants |
| 2018.9  | Beijing    | Against waste-to-energy plants         |
Differences may exist in the level of trust of residents in institutional policies, which will cause differences in their willingness to participate in MSW treatment. Likewise, environmental benefits may impact the willingness of residents to accept higher compensation costs for waste disposal, which has been largely ignored in existing studies. Accordingly, the present study incorporated environmental benefits and institutional trust into the theoretical analysis framework of residents’ willingness to participate and analyzed the effects of positive environmental benefits, negative environmental benefits, institutional trust and institutional mistrust on residents’ willingness to be paid (WTA) and willingness to pay (WTP). Moreover, the research data from residents of four districts in Beijing in 2019 were employed for an empirical investigation to explain the changes in residents’ WTA and WTP based on urban environmental benefits and institutional trust, as an attempt to provide theoretical references and policy recommendations for improving residents’ participation in urban household waste management.

The rest of the present study is organized as follows. In Section 2, the literature is reviewed. In Section 3, a theoretical analysis and hypothesis are presented. In Section 4, the methods adopted in this study are introduced (e.g. survey design and the tobit method. In Section 5, the results and discussions are presented. Lastly, in Section 6, the conclusions are drawn. Figure 4 illustrates the structure of the whole study.

2 REVIEW ON EXISTING RESEARCHES

Residents’ willingness to participate is suggested to be the critical factor in the harmless treatment of MSW [23]. On the whole, the existing research on residents’ willingness to participate consists of e-waste recycling, residents’ behavior preference and WTP, community living willingness, urban public goods and infrastructure, etc. Wang et al. [24] determined the characteristics of residents’ recycling behavior and preferences for e-waste recycling modes by conducting a questionnaire survey of a large sample of Beijing residents. Kotchen et al. [25] analyzed information regarding residents’ general awareness of municipal wastewater treatment, disposal methods, WTP for disposal schemes and willingness to participate in disposal schemes by conducting a telephone survey of 105 residents in South America. Soga et al. [26] surveyed 255 Japanese students to analyze the impact of neighborhood and environmental perceptions on civic engagement. In addition, to determine the role of public infrastructure improvements on residents’ awareness of environmental participation, Yang and Long [27] conducted a questionnaire survey with a total of 520 residents in Xuzhou, Taizhou and Suzhou, China. Wang et al. [28] analyzed the willingness of Chinese urban residents to engage in the separated collection of household waste. However, the mentioned scholars only conducted the in-depth studies on the WTP, whereas the WTA was not discussed. It is
known that the willingness of residents to be paid is another vital consideration.

Residents’ willingness to participate in waste management comprises WTA and WTP [29]. Based on the contingent valuation method (CVM), Maghsood et al. [30] evaluated the public's WTP for water environmental management. By employing the WTA and WTP models, Sun et al. [31] proposed a bottom-up evolutionary framework for ecological compensation systems, with the Jiuzhou River in China as a typical case. By exploiting a sample of 427 respondents in Valencia, Spain, del Saz-Salazar et al. [32] reported that when governments invest more in low-carbon public transport, the public have more WTP to reduce air pollution. However, all the mentioned studies ignored the heterogeneity of respondents and the impact of key external factors on public willingness to participate.

According to Andersen [33], residents’ participation refers to a rational economic decision-making behavior, as well as an environmental protection behavior in MSW management. Thus, residents’ participation is affected by economic factors, as well as by their environmental perception and other factors in MSW management [34]. Since MSW treatment has the main body as the government, few numbers of residents pay a certain fee for waste treatment. Moreover, when garbage treatment facilities are built around the residential area, the government will pay a certain fee to economically compensate the surrounding residents. At present, under the increasing income levels of urban residents and increasing financial investment in MSW treatment, the effect of environmental benefits on the willingness of urban residents to participate in waste treatment should be more highlighted than economic factors (e.g. cost input).

The two decisive factors in people's WTA and WTP for transactions refer to the changes of environmental benefits and the opportunity cost of protecting the environment [35]. As indicated from existing studies, positive environmental benefits positively impact residents’ WTP for environmental protection [36]. The higher the environmental benefits, the more the residents will tend to adopt green behaviors and willingness to approach the environment [37]. Accordingly, the negative environmental benefits have, to a certain extent, reduced residents’ enthusiasm for engaging in waste management and also hindered residents’ willingness to participate in waste management. Subsequently, the relationship between environmental benefits and residents’ willingness to participate in MSW management should be explored in depth.

Besides, institutional policies will certainly impact residents’ environmental protection willingness and behaviors [38]. Since residents’ participation in MSW management refers to an autonomous decision-making behavior based on a certain institutional framework, the impact of institutional trust should be considered in the study on residents’ willingness to treat waste. Trust refers to the prerequisite and foundation of cooperation and its strength determines the depth and breadth of cooperation and participation [39]. It is also revealed that the implementation and effectiveness of the MSW treatment policy determine the degree of trust that residents have in the government.

The differences between this study and the relevant literatures are elucidated below. This study (1) fully considered the heterogeneity of the respondents; (2) considered residents’ WTP and WTA in the study on residents’ willingness to participate in MSW treatment; and (3) introduced environmental benefits and institutional trust into the analytical framework of residents’ willingness to participate in municipal waste management, as well as conducted a theoretical discussion and an empirical analysis.

3 A THEORETICAL ANALYSIS OF RESIDENTS’ WILLINGNESS TO MSW TREATMENT CONSIDERING INSTITUTIONAL TRUST AND ENVIRONMENTAL BENEFITS

3.1 Institutional trust and environmental benefits in MSW treatment

Institutional trust is commonly determined by the legal, political and other institutional contexts. It is a trust triggered by a social phenomenon based on ‘impersonal’ relationships, and as society progresses, it will turn out to be a vital mechanism [4]. In MSW treatment, two critical factors determine the level of residents’ trust and their expectations of the effectiveness of waste management, i.e. the implementation and effectiveness of the relevant institutional policies. It exerts a direct or an indirect impact on residents’ WTA and WTP [40]. As reported by existing studies, residents are willing to participate in MSW treatment when decision-making procedures are legal [41], construction standards are authoritative, residents have the opportunity to engage in decision-making [42] and information is transmitted smoothly and promptly [43]. As opposed to the mentioned, when residents are not engaged in the siting decision, a perception of exclusion from the siting process can be caused, thereby increasing their rejection of MSW treatment facilities. During the construction and operation of MSW treatment facilities, the government closed information on the MSW treatment, which can also arouse more fear and anxiety among residents. For this reason, the environmental risks can be magnified, the level of trust can be reduced and a crisis of institutional mistrust is easier to fall into.

Environmental benefits fall to positive and negative benefits. Waste incineration has still been identified as the main method of waste disposal in China. Compared with landfill technology, it is a more efficient way to solve the ‘waste siege’ crisis, besides generating a high level of revenue through incineration. The Gaoantun waste incineration plant in Chaoyang District, Beijing is taken as an example. It has a capacity of nearly 1600 tons per day, 530 000 tons per year, generates 200 million kWh of electricity per year, 160 million kWh of electricity online, as well as earning 104 million yuan from electricity sales [44]. The main benefits of MSW disposal are suggested as city environmental fees and subsidized electricity tariffs for residents, as well as improving the appearance of the city, the physical and mental well-being of residents; the mentioned are beneficial to society and local
people, which are termed as environmental positive benefits [45]. Moreover, the waste disposal facility will cause some nuisance to the neighboring residents, which is termed as negative environmental benefits. For instance, the flue gas, fly ash and wastewater from waste incineration can constitute secondary pollution. In particular, it produces a highly toxic substance, dioxin, thereby causing irreversible environmental pollution and endangering the lives and health of the population. Besides, compared with recycling and converting it into resources, burning all the garbage is recognized as the biggest waste of material resources.

As mentioned above, both institutional trust and environmental benefits impact residents’ willingness to MSW treatment. However, residents’ willingness to participate in treatment consists of the WTA and WTP. Thus, the present study incorporated institutional trust and environmental benefits into the WTA and WTP analytical framework for residents (Figure 5). The mechanism of their influence on WTA and WTP was theoretically explored, and then the specific impact of institutional trust, positive environmental benefits and negative environmental benefits on them were econometrically analyzed.

3.2 Mechanisms of institutional trust and environmental benefits on WTA/WTP

This study complied with the idea of controlling variables and discussed them in three cases, which illustrated the influence mechanism of institutional trust and environmental benefits on WTA/WTP. First, a certain level of institutional trust was assumed and how positive (negative) environmental benefits affect WTA/WTP was analyzed. Second, with constant environmental benefits assumed, how institutional trust affects WTA/WTP was analyzed. Lastly, the results of institutional trust and environmental benefits on the joint WTA/WTP were comprehensively investigated.

Discussion 1. Under certain institutional trust, the impact of environmental benefits on WTA/WTP.

It was assumed that before the planned construction of the MSW treatment facility, the comprehensive income of residents’ production and life in this area is $T_0$ and the environmental condition is $E_0$, with the resident located. The initial utility level is $U_0$, $U_0 \equiv V(T_0, E_0, x)$, where $x(x_1, x_2, \ldots, x_n)$ denotes the residents’ basic characteristic variable. After MSW treatment, the comprehensive income of residents’ production and life in this area is expressed as $T_1$, the environmental condition is assigned as $E_1$, with the resident located. On that basis, the utility level of the residents is $U_1$, $U_1 \equiv V(T_1, E_1, x)$, where $x(x_1, x_2, \ldots, x_n)$ represents the residents’ basic characteristic variable.

With a certain attitude of trust, the compensation variable is set to $CV$. This variable refers to the minimum WTA for negative environmental benefits. It is recognized as an economic compensation that compensates the inhabitants for the combined economic losses, when the environment changes, i.e. $T_0 - T_1 = CV$, to ensure that the environment is as good as before the planning and construction of MSW facilities after the residents have been compensated, i.e. $U_0 = U_1$, so the utility function is expressed as

$$V(T_0, E_0, x) = V(T_1, E_1, x) = U_0 = U_1. \quad (1)$$

The inverse function of Eq. (1) is solved to derive $T_0$, $T_0 = z(E_0, U_0, x) = z(E_1, U_1, x) + CV$, with the results of

$$\text{WTA} = CV. \quad (2)$$

Likewise, the equivariant variable is set to $EV$. This variable is the maximum WTP to improve the environment, aiming to compensate for the loss of combined benefits from the changes in environmental conditions, i.e. $T_1 - T_0 = EV$. To ensure that the state of the environment is as good as that before the planning and construction of MSW facilities after residents have paid a certain amount of money, i.e. $U_0 = U_1$. Thus, the utility function is defined as

$$V(E_0, T_0, x) = V(E_1, T_0 + EV, x) = U_0 = U_1. \quad (3)$$

The inverse function of Equation (3) is solved to derive $T_0$, $T_0 = z(E_0, U_0, x) = z(E_1, U_0, x) - EV$, so the utility function

\[
\text{WTP} = EV.
\]
funds (maximum $EV$) to engage in waste management, in the case of MSW treatment facilities do not change the residents’ comprehensive income and increase environmental benefits. Besides, $CV$ is when the environmental benefit shifts from $E_0$ to $E_1$ and the residents are willing to give up compensation for the reduced utility level; it is distance $AD$ and $CV < 0$. As suggested accordingly, positive environmental benefits reduce residents’ WTA and increase their WTP (maximum WTP as $EV$).

Figure 6b presents the marginal analysis of WTA/WTP. After MSW treatment, when the environmental benefit moves from $E_0$ to $E_1$, residents are willing to give up compensation for reduced utility level as $AD'$ (i.e. $CV'$). When the benefit moves from $E_0$ to $E_1''$, the compensation waived by residents is $AD''$ (i.e. $CV''$). Figure 2b indicates $|CV'| < |CV''|$, suggesting that the more positive benefits of MSW treatment, the greater the improvement will be in residents’ utility levels and the less willing residents will be to accept compensation.

According to the in-depth analysis of the changes in $EV$, when the level of utility of the population is $U'$ and $U''$, the optimal consumption mix is expressed as $B'(E_1', T_0)$ and $B''(E_1'', T_0)$, respectively. According to Figure 6b, $|EV'| < |EV''|$, revealing that the more positive benefits increase with the planning and construction of MSW treatment facilities, the greater the improvement in the level of utility for residents, the more willing they will be to spend some of their money to engage in MSW treatment.

Discussion 2. The effect of institutional trust on WTA/WTP, when environmental benefits are constant.

Assuming that the impact on environmental benefits before and after the waste treatment is not considered, the environmental benefits remain unchanged $E = E_0 = E_1$, the main factor of the participation of residents in MSW treatment refers to the level of agreement and trust in the planning, construction, and operation of MSW treatment facilities. When residents are willing to trust the institutional policy, their willingness to participate in MSW management is significantly high and they are willing to pay a certain amount of money to engage in the management. When they do not trust institutional policies, they hold fearful and anxious attitude toward the future. Moreover, they magnify environmental risks, reducing their trust in regulators and making them more prone to ‘NIMBY’ and more significantly willing to be paid. It is assumed that WTA and WTP do not occur simultaneously when looking at the institutional trust. WTP exists for residents when the system is trusted; WTA exists for residents when the system is not trusted. Quantified as $\Delta T = T_1 - T_0$ or $\Delta T = T_2 - T_1$.

Prior to the planned construction of the MSW treatment facility, the initial utility level is $U_0$, and $U \equiv V (T_0, E, x)$; the utility level of residents is $U_1$ when the institution is trusted. In addition, after the planning and construction of MSW treatment facilities, $U_1 \equiv V (T_1, E, x)$. When the institution is not trusted, the utility level of the residents is $U_2$, $U_2 \equiv V (T_2, E, x)$. It is required to ensure that after residents receive compensation, the environmental conditions are as good as before, i.e. $U_0 = U_1$. Thus, the utility

\[
\text{WTP} = EV. \tag{4}
\]

As illustrated by Equations (2) and (4), before and after the planning and construction of MSW treatment facilities, institutional trust is a certainty and WTA/WTP is based on initial utility. Then, the change in environmental benefits $E$, resulting in a change in the combined benefits to residents, should be calculated, as presented in Figure 6.

Figure 6a illustrates the equilibrium analysis of WTA/WTP. The $x$-axis represents environmental benefits $E$, and the $y$-axis denotes the combined earnings of residents $T$. Pre-planning and construction of MSW treatment facilities, the utility level of residents is expressed as $U_0$. In addition, under the constraint of comprehensive income, the optimal consumption combination point of environmental benefits and market goods is $A(E_0, T_0)$. After the planning and construction of MSW treatment facilities, effectiveness is improved up to $U_1$, optimal consumption mix moves from $A$ to $B(E_1, T_0)$, thereby contributing to the increase in environmental benefits from $A$ to $B$, which results in a change in the combined benefits to residents, i.e. $EV > 0$. It is therefore suggested that residents are more willing to pay a part of the utility level as $EV$.
function is defined as

\[ V(E, T_0, x) = V(E, T_1 - \Delta T, x) = V(E, T_2 + \Delta T, x) = U_0 = U_1 = U_2. \]  

Equation (5)

The calculation procedure is identical to above, which is written as

\[ WTA = WTP = \Delta T. \]  

Equation (6)

Figure 7a illustrates the equilibrium analysis of WTA and WTP. Before the planning and construction of the MSW treatment facilities, the utility level of the residents is \( U_0 \). After the planning and construction of the facilities, and when the residents trust the institutional policy and the environmental benefits remain unchanged, the residents’ right to information and participation is fully ensured, thereby elevating the level of effectiveness \( U_1 \). When residents lose trust in the institutional policies, residents doubt and fear exacerbate NIMBY, causing utility levels to fall to \( U_2 \). Their optimal consumption mix points include \( B(E_0, T_0) \), \( A(E_0, T_1) \) and \( C(E_0, T_2) \). Given these results, the positive value of the \( AB \) distance in the graph indicates that the combined benefits to residents increase under institutional trust and they are willing to pay a certain amount to participate in MSW treatment. (Maximum is \( \Delta T \).) When the negative \( BC \) (\( \Delta T < 0 \)) distance, the failure of the system is indicated to have caused a reduction in the combined benefits and residents require some compensation to cover their losses. (The minimum value is \( \Delta T \).

Figure 7b presents the marginal analysis of WTA and WTP. When the system is trusted, and the environmental benefits are constant, the combined benefits to residents refer to \( T'_0 \) or \( T''_0 \).
Table 2. Waste treatment centers and concerns.

| Name                        | Neighborhoods                                                                 | Project status       |
|-----------------------------|-----------------------------------------------------------------------------|----------------------|
| Liulitun Waste Incineration Plant | Hai Feng Lian Villa, Qiu Lu Yuan, Biaiwang Jasmine Garden, and other communities | Re-location          |
| Aso Wei Waste Disposal Centre | Beichijia, Huilongguan, Tian tongyuan and other districts                   | In operation         |
| Xierqi Kitchen Waste Treatment Centre | Vanke Golden Valley Mansion, Lixiu New Silicon Valley, Long Xing Yuan, and other neighborhoods | Re-location          |
| Highampton II Waste Treatment Centre | Poly Garden, North Star Fortuna, Full Sunshine Beauty Park, and other communities | Construction completed |
| Tongzhou Kuo County waste incineration power generation project | Anping Township, Xianghe                                     | Project suspension   |
| Beijing Haidian Baoshan Comprehensive Waste Treatment Centre | Randall’s Court, Golden Jade House Subdivision                         | Construction in progress |
| Nanadong Waste Disposal Centre | Jimnao Mansion and other neighborhoods                                      | In operation         |
| Fengtai Waste Disposal Centre | Fufeng Garden Community, Xincun Street                                     | In operation         |

and \( T''_0 > T'_1 \). The optimal consumption mix is \( B(E_0, T'_{1}) \) or \( B'(E_0, T''_{1}) \). According to Equation (5), the distance of \( AB' \) or \( AB'' \) is WTP, indicating that the more residents trust the institutional policy, the more they will be willing to pay a certain amount to participate in MSW treatment (\( \Delta T'' > \Delta T \)). Likewise, the residents’ comprehensive income is \( T''_2 \) or \( T'_{2} \) and \( T''_2 < T'_{2} \), the optimal consumption mix is \( B(E_0, T''_{2}) \) or \( B'(E_0, T'_{2}) \). As defined by Equation (5), the distance of \( AC' \) or \( AC'' \) is WTA. It is therefore suggested that when the institution breaks trust, residents are required to accept a certain amount of compensation to compensate for lost earnings, and the higher the level of breach of trust, the greater the number of compensation residents will seek (\( |\Delta T''_1| > |\Delta T'_{1}| \)).

**Discussion 3.** The joint impact of institutional trust and environmental benefits on WTA/WTP.

Assuming that institutional trust and environmental benefits act on residents’ utility functions simultaneously, residents’ WTA/WTP should satisfy

\[
V(E_0, T_0, x) = V(E_1, T_1 + WTA - WTP, x) = U_0 = U_1. \tag{7}
\]

WTA denotes the difference between the compensating variable and the composite return, while WTP represents the difference between the equivalent variable and the composite return:

\[
\begin{align*}
WTA &= CV + \Delta T \tag{8} \\
WTP &= EV + \Delta T. \tag{9}
\end{align*}
\]

In Figure 8a, after MSW treatment, residents have received positive environmental benefits (\( E_1 > E_0 \)) and institutional trust (\( \Delta T > 0 \), \( EV > 0, CV < 0 \)) indicating that residents are not affected by any adverse effects, do not require compensation and are willing to pay a certain amount to participate in MSW treatment (\( WTP = \Delta T + EV \)), which is the optimal case. In Figure 8b, after the planning and construction of MSW treatment facilities, residents are plagued by negative environmental benefits (\( E_2 < E_0 \)) and the system (\( \Delta T < 0 \)) is not trusted. Accordingly, it (\( EV < 0, CV > 0 \)) shows that the process of the MSW treatment exerts a huge adverse impact on the production and life of residents, and it is prone to NIMBY conflicts and trigger a strong WTA (\( WTA = \Delta T + CV \)), which is the worst case. In Figure 8c, after the planning and construction of the MSW treatment facilities, though residents have received positive environmental benefits (\( E_1 > E_2 \)), they do not trust institutional policy (\( \Delta T < 0 \)). Thus, it is only necessary to compare \( EV \) and \( \Delta T \). When \( |EV| < \Delta T \), residents have the WTP (the minimum compensation value as \( WTA = \Delta T - EV + CV \)); when \( |EV| > \Delta T \), the residents have the WTP (the maximum payment value as \( WTP = EV - \Delta T \)), which is the most sophisticated scenario.

3.3 Institutional trust and environmental benefits affect WTP/WTA hypotheses

As indicated from the theoretical analysis, institutional trust and environmental benefits significantly impact residents’ WTA and WTP. When institutional trust and positive environmental benefits increase, residents decrease their WTA and increase their WTP. As opposed to the mentioned, when the system is not trusted and the environment has negative benefits, residents will achieve increasing WTA and decreasing WTP. Given the theoretical analysis of the present study, the hypotheses are as follows.

**H1:** Environmental benefits will impact WTA and WTP. Positive environmental benefits weaken WTA and strengthen WTP; negative environmental benefits strengthen WTA and weaken WTP. MSW treatment contributes to the healthy and stable development of cities and improves the level of public services. The improved environmental benefits for residents are accompanied by several problems, which can increase the negative benefits for residents (e.g. pollution, radiation and devaluation of surrounding properties). The impacts of positive and negative environmental benefits on WTA and WTP are empirically tested in a separate manner.

**H2:** Trust in the institution decreases WTA and increases WTP; as opposed to this, a lack of trust in the institution increases WTA and decreases WTP. In MSW management, the lower the WTA of the residents and the higher the WTP of cooperating with the government in MSW treatment, when the EIA stabilization assessment and related materials released by the government can
gain the trust of the residents. In contrast, residents will be distrustful of the government; their rebellion will be evident, WTA will increase and WTP for participation in MSW treatment will decrease noticeably.

**H3**: When institutional trust and environmental benefits are incorporated in WTA and WTP, WTA decreases and WTP increases when institutional trust and positive environmental benefits turn out to be significant. As opposed to this, when the institution is discredited, and negative environmental benefits are evident, the WTA is considerably higher and the WTP is significantly lower.

## 4 METHODOLOGY

### 4.1 Study area

The present study examined the factors of the WTA and the WTP of residents around the MSW facilities in Beijing, with the 6th Ring Road and its vicinity as the study area. Moreover, the focus was on the impact of institutional trust and environmental benefits on residents’ willingness to participate in MSW treatment around Beijing’s MSW treatment centers.

This study unified clustered waste disposal facilities as a waste disposal center. Statistics on large waste disposal centers in the 6th Ring Road of Beijing are listed in Table 2. The waste disposal centers it listed have all been subject to strong resistance from the surrounding residents. To be specific, the Aso Wei waste disposal center has been a hotspot for residents in the Beichijia, Huilongguan and Tiantongyuan areas; Liulitun waste incineration plant suffers fierce protests from residents of Hai Fenglian Hills, Qiu Lu Yuan and Baiwang Jasmine Garden; Residents of Vanke Jinweihua Mansion, Lixiu New Silicon Valley, Longxing Park and other neighborhoods around the Xierqi kitchen waste treatment center staged petitions and written letters.

The study lastly selected four waste treatment centers where residents’ resistance to avoidance has been more intense from 2006 to the present: the Aso Wei Waste Treatment Centre, the Gao Antun Waste Treatment Centre, the Baoshan Integrated Waste Treatment Centre and the Fengtai Waste Treatment Centre. First, we attended some hearings and joined the WeChat group of property owners in the neighborhood of the MSW treatment facility to keep abreast of residents’ attitudes and wishes regarding MSW treatment. Second, the community was visited, in-depth interviews were conducted with random residents and a 100 000-word transcript of the interviews was compiled. Lastly, relevant materials were collected and collated (e.g. EIA stability assessment materials, video materials, government announcements, relevant corporate credit materials and public letters). This study attempted to gain insights into the residents’ willingness to participate in MSW treatment from a comprehensive and multi-faceted perspective and eventually placed 500 questionnaires in preparation for the subsequent econometric analysis.

### 4.2 Survey design

The CVM is considered one of the most effective methods to evaluate the non-market value of resources and the environment.
in domestic and international studies on the determination of ecological and environmental compensation standards [46]. By complying with the utility maximization principle, the economic value of an environmental good is derived by building a hypothetical market and asking people directly about their WTA and WTP for a public good [47]. This study employed the CVM to estimate surrounding residents’ WTA and WTP for willingness to participate in waste management. To measure the WTA and WTP of the neighborhood residents concerned with MSW treatment, the collection method was first determined. Subsequently, a questionnaire was designed that surveyed residents’ WTA/WTP and other factors. Lastly, the specific area was delineated and the questionnaire was placed (Figure 9).

Based on the actual situation in the selected area in Figure 9, a questionnaire survey and in-depth interviews were conducted, which choose residents in the surrounding communities of Asuwei Waste Treatment Center, Gaonantun Waste Treatment Center, Baoshan Waste Comprehensive Treatment Center and Fengtai Waste Treatment Center in June 2019. The questionnaire falls to six parts: attitude, willingness, subjective norms, reasons for not participating in MSW treatment, trust and the basic situation of the interviewee. Table 3 lists the specific problem settings.

This survey aimed to find out WTA of Beijing residents on MSW treatment, as well as WTP of assisting the government to complete the MSW treatment. To make the sample more representative, the sample was selected with a 3-km radius from the origin of the MSW treatment facilities and over 500 households were surveyed in the communities of Huilongguan, Tiantongyuan, Poly Garden, Jinmao Mansion, as well as Fufeng Garden. The survey fell to pre-survey and formal survey. The pre-survey lasted for 3 days (2–4 June 2019). To ensure the reliability of the data, 32 residents were randomly selected in the 5 survey areas and 30 valid questionnaires were returned, marking a valid return rate of 93.75%. Subsequently, the usefulness of the questionnaire was tested. The questionnaire was iteratively revised by complying with surveyor feedback, so a formal questionnaire was achieved. The official survey phase lasted for 1 week (10–16 June 2019). First, five researchers from the project team were selected as investigators to conduct field surveys in the communities of Huilongguan, Tiantongyuan, Poly Garden, Jinmao Mansion and Fufeng Garden. Second, a random sample of residents in the community aged 18 years and above acted as the respondents. To ensure the quality of the survey, the questionnaires were completed in conjunction with brief interviews. The survey returned 450 valid questions, marking an effective rate of 90%.

### 4.3 Econometric model

To investigate the impact of institutional trust and environmental benefits on urban residents’ MSW treatment WTA and WTP, an econometric analysis was conducted to verify the effectiveness of institutional trust and environmental benefits on residents’ WTA and WTP and an important basis was laid for formulating MSW treatment compensation policies. In the empirical analysis of CVM to determine environmental governance criteria, multiple linear regression [63], correlation analysis [64] and logistic regression [65, 66] have been primarily adopted to investigate

| Variable                              | Question                                                                                     | Sources                                      |
|---------------------------------------|---------------------------------------------------------------------------------------------|----------------------------------------------|
| Attitude                              | MSW treatment facilities significantly impact nearby house prices                            | Das et al. (2017) [48]                       |
|                                       | MSW treatment facilities can impact the quality of life of residents                         | Yan et al. (2018) [49]                      |
|                                       | Residents around the MSW treatment facilities will choose to relocate                        | Semple et al. (2012) [50]                    |
|                                       | The MSW treatment facilities can endanger your health and that of future generations        | Tang et al. (2020) and Gong et al. (2017) [51, 52] |
| Willingness                           | There is an MSW treatment facility near my home and I would like to be compensated by the government | Cai et al. (2018) [53]                      |
|                                       | I am willing to pay a certain amount to help the government optimize the environment          | Sun et al. (2016) [54]                      |
|                                       | The amount of compensation I would like to receive                                          | Muradian et al. (2013) [55]                 |
| Subjective norms                      | If neighbors write a joint letter opposing the construction of an integrated MSW treatment plant nearby, I will sign it too | He et al. (2016) [56]                      |
|                                       | When you object to an MSW treatment facility being built nearby, you will defend your rights through the law | Bustos et al. (2017) [57]                  |
| Reasons for not participating in MSW treatment | What are the reasons for not accepting financial compensation?                              | Swofford et al. (2010) [58]                 |
|                                       | Reasons for not being willing to pay a certain amount to help the government optimize the environment | Shao et al. (2018) [59]                    |
| Trust                                 | The credibility of EIA/STA reports from EIA experts and technical agencies                   | Keller (2010) [60]                          |
|                                       | Whether the MSW treatment facility is operated based on international/national standards   | Zhang (2010) [61]                           |
|                                       | Government to be open and transparent about MSW treatment projects                           | Johnson (2011) [62]                         |
|                                       | The government proactively discloses all information, which is related to MSW treatment facility projects |                                           |
| Disposable income                     | Average annual income                                                                       |                                              |
were truncated, then waste siege, and then WTP was zero. In such a scenario, the data are not complete for MSW treatment even if they suffer from a daily reluctance to pay a certain amount of money to assist the government facilities close to their living areas even if the government results to be overestimated.

and causing sampling bias, which tends to cause the estimation of observation samples removed, thereby reducing the sample size due to arbitrarily selected residents (sum of multiple-choice frequencies)? The severity of the impact the MSW facility will have on the surrounding house prices and the health of the residents. (No effect = 5, a lesser impact = 4, Moderate impact = 3, Higher impact losses = 2, Great impact = 5)

In the actual survey, some residents refused to have MSW treatment facilities close to their living areas even if the government gives financial subsidies. Then, WTA was zero. Besides, they were reluctant to pay a certain amount of money to assist the government to complete MSW treatment even if they suffer from a daily waste siege, and then WTP was zero. In such a scenario, the data were truncated, then $WTA \& WTP \in [0, +\infty]$. If ordinary least squares (OLS) is employed for estimation, the parameters will be largely biased and inconsistent. The tobit model, combining a logistic regression model and multiple linear regression, is a standard censored model suitable for regression analysis where the observations of the dependent variable are approximately continuously distributed over positive values and contain a proportion of observations that are missing due to certain restrictions.

The tobit model [67] acts as the typical regression method that deals with the scenario when the dependent variable is zero, and it is the most common alternative to OLS regression. Indeed, the use of open-ended questions here would have caused respondents with zero WTA and WTP. Based on the research results of existing scholars, this problem can be properly solved by using the tobit model to deal with the interpretation of zero observations. The basic formula is written as follows:

$$Y^* = \beta^T X_i + \epsilon_i \quad (i = 1, 2, 3 \cdots, n)$$
$$Y = \max (0, Y)$$
$$\epsilon_i \sim N(0, \delta),$$

where $Y^*$ denotes the latent variable; $Y$ represents the dependent variable; $X_i$ is the constant term; $\beta$ is the parameter to be estimated; and $\epsilon_i$ expresses the random disturbance term, abiding by a normal distribution $\epsilon_i \sim N(0, \delta)$. When $WTA \& WTP \in [0, +\infty]$, the tobit model is designed as

$$WTA^*/WTP^* = \beta_0 + \beta_1 PosEn_i + \beta_2 NegEn_i + \beta_3 Tru_i + \beta_4 Base_i + \mu.$$  

Table 4. Variable descriptive statistics.

| Variable                        | Value                                | Average  value | Standard deviation | Minimum value | Maximum value |
|---------------------------------|--------------------------------------|----------------|--------------------|---------------|---------------|
| WTA                             | Residents’ WTA (yuan/year)           | 17845.74       | 7817.827           | 1500          | 22 500        |
| WTP                             | Residents’ WTP (yuan/year)           | 295.31         | 246.196            | 50            | 750           |
| Positive environmental benefits | Benefits of MSW treatment facilities to neighboring residents (sum of multiple-choice frequencies) | 3.06 | 1.201 | 1 | 5 |
| Negative environmental benefits | The severity of the impact the MSW facility will have on the surrounding house prices and the health of the residents. (No effect = 5, a lesser impact = 4, Moderate impact = 3, Higher impact losses = 2, Great impact = 5) | 2.18 | 1.251 | 1 | 5 |
| Institutional trust             | Government information is open and transparent and residents trust the situation. (Totally convinced = 5, Trust = 4, General = 3, Don’t believe = 2, Totally unconvinced = 1) | 3.07 | 0.985 | 1 | 5 |
| Gender                          | Male = 1, Female = 2                  | 1.42           | 0.494              | 1             | 2             |
| Age                             | Age of Respondents (1–4)              | 1.81           | 0.685              | 1             | 4             |
| Occupation                      | Occupation of respondents (2–7)       | 2.78           | 1.484              | 1             | 7             |
| Residence                       | Renting a home = 1, Ownership of property = 2, Others = 3 | 1.88 | 0.652 | 1 | 4 |
| Level of education              | The education level of respondents (3–6) | 4.21 | 1.203 | 1 | 6 |
| Family                          | Respondents’ family status Unmarried and childless = 1, Married with no child = 2, Married with children = 3, Others = 4 | 2.35 | 0.884 | 1 | 4 |
| Household status                | Non-agricultural household registration in the city = 1, Agricultural household registration in the city = 2, Non-agricultural residence outside the city = 3, Agricultural residence in other cities = 4, Others = 5 | 2.40 | 1.133 | 1 | 5 |
| Average annual income           | Respondents’ annual income (1–5)      | 3.58           | 1.278              | 1             | 6             |
5. RESULTS AND DISCUSSIONS

5.1. Descriptive statistics

The descriptive statistics of the explanatory and explained variables for the overall sample of this survey are listed in Table 4. In total, 20.8% of the residents surveyed were willing to accept financial compensation; the average amount they were paid reached 17,845.74/year, with a maximum of 22,500/year and a minimum of 1,500/year. Of the mentioned, 79.2% of the residents surveyed were reluctant to accept financial compensation, and the main reasons for not accepting financial compensation are presented in Figure 10. In total, 14% of the residents surveyed were willing to pay a certain amount to help the government with MSW treatment; the average payment was 295.31/year, with a maximum of 750/year and a minimum of 50/year. Moreover, 86% of the residents surveyed were reluctant to pay money to assist the government, with the main reasons for not paying presented in Figure 11.

The maximal number of options for positive environmental benefits from MSW treatment was 5, while the lowest number was 1, marking an average of 3.06 options. Positive environmental benefit options offered for the selection in the questionnaire and their frequency: provide employment opportunities for neighboring residents (0.5), provide more convenient services (e.g., medical check-ups for residents and holiday gifts) and develop community neighborhoods (0.76), effectively solve the environmental situation of ‘rubbish siege’ (0.96), restoration of the ecological environment and increase in green ecological areas (e.g., green spaces, parks and fitness areas) (0.89), create new industrial tourism attractions and drive the prosperity of the surrounding service industry (0.66) (Figure 12). As revealed from the example of ‘providing employment opportunities for neighboring residents’ (0.5), 50% of the respondents consider that MSW treatment facilities can provide employment opportunities for neighboring residents.

However, the adverse effects of MSW treatment cannot be ignored. In total, 58.2% of the respondents considered that MSW treatment facilities will significantly impact neighboring house prices. In addition, 82.3% of the respondents considered that MSW treatment facilities have affected their quality of life, 54% of the respondents considered that waste disposal facilities will impact his/her and their offspring’s health status and 61.3% of the respondents considered moving away from the area around the waste disposal facility (Figure 13).

Whether the government is transparent and trusted to disclose information regarding waste management, the mean response was 3.07 between ‘believe’ and ‘average’. The main reasons for the low level of trust in government-published information are presented below. The first is the potential threat of health hazards and property damage. Though the government has been committed to international/national standards and backed up by EIA Assessment materials, residents are still concerned about the
future impact on health and property. Second, though government agencies promise compensation, residents consider that the harm they have suffered is not measurable in monetary terms, so they have low trust in the government.

Furthermore, 57.8% of respondents were male and 42.2% were female, with an average age of 30.76 years. The family status was mostly married, and the general education level was a college degree or above. The employment situation was mainly for enterprises and private owners. The living conditions were mostly property rights. The household registration was mostly non-agricultural accounts, and the average annual income was 90,000–120,000 yuan or above.

Note: 1.18–30 years old = 1, 31–45 years old = 2, 46–60 years old = 3, 60+ years old = 4.2. Government jobs = 1, companies = 2, private owners = 3, farmers = 4, students = 5, unemployed = 6, others = 7.3. Primary school and below = 1, junior school = 2, high school = 3, college = 4, Bachelor's degree = 5, Master's degree and above = 6.4. Under 25,000 yuan = 1, 25,000–60,000 yuan = 2, 60,000–90,000 yuan = 3, 90,000–120,000 yuan = 4, 120,000 yuan = 5.

5.2 Tobit regression analysis

In the tobit regression model, WTP and WTA act as the dependent variables. The independent variables comprise key explanatory variables and control variables. Vital explanatory variables consist of positive environmental benefits, negative environmental benefits and institutional trust. The eight control variables involve gender, age, occupation, housing status, education level, family status, household registration and average annual income. Moreover, two interaction terms were also considered, i.e. positive environmental benefits and institutional trust, negative environmental benefits, as well as institutional trust. All variables were measured with 5-point Likert scales as presented, and the regression results are listed in Table 5.

5.2.1 Test of Hypothesis 1

In regression A, positive environmental benefits passed the test at the 5% level of significance, and the regression coefficient of positive environmental benefits was negative, demonstrating that an increase in positive environmental benefits helps reduce WTA. In regression B, positive environmental benefits passed the test at the 10% significance level, and the regression coefficient for positive environmental benefits was positive, proving that an increase in positive environmental benefits increases WTP. In the marginal effect of positive environmental benefits, the regression coefficient in regression A was −0.53, demonstrating that for each unit increase in positive environmental benefits, the WTP decreases by 0.53%. Subsequently, the regression coefficient in regression B was 0.37, proving that for each unit increase in positive environmental benefits, the WTP increases by 0.37%.

In regression A, negative environmental benefits passed the test at the 1% significance level, and the regression coefficient for negative environmental benefits was positive, demonstrating that an increase in negative environmental benefits increases the WTA. In regression B, negative environmental benefits passed the test at the 10% significance level, and the regression coefficient for negative environmental benefits was negative, proving that an increase in negative environmental benefits makes reduce WTP. In the marginal effect of negative environmental benefits, in regression A, the regression coefficient was 0.50, demonstrating that for each unit increase in negative environmental benefits, the WTP increases by 0.5%. Next, in regression B, the regression coefficient was −0.03, proving that for each unit increase in negative environmental benefits, the WTP decreases by 0.03%.

The above results significantly support H1’s conclusions.

5.3 Test of Hypothesis 2

In regressions A and B, the institutional trust passed the test at the 5% level of significance. In regression A, the negative regression coefficient suggests that institutional trust is negatively related to willingness to be reimbursed. As revealed from the results, the higher the credibility of the policy system, the more the residents will be involved in MSW treatment, and the less they will care about receiving a certain amount of compensation. In the marginal effect of institutional trust, the regression coefficient was −0.45, with each unit increase in the institutional trust displaying a relationship to a 0.45% decrease in willingness to be reimbursed. In regression B, the regression coefficient of institutional trust was positive, suggesting that the higher the institutional trust, the stronger the residents' WTP will be. Moreover, with the increase in each unit of institutional trust, the WTP is improved by 0.49%.

This complies with existing research. Residents are more resistant to participating in environmental governance when they have insufficient knowledge of the policy system or consider that the system is not being implemented effectively. According to Figure 11, when the system is not trusted, 75% of residents considered that ‘environmental protection is the business of government departments’ and ‘residents should not pay for the government’s MSW treatment facilities since they have not been effectively evaluated’.

The above results support H2’s conclusions very well.

5.3.1 Test of Hypothesis 3

In regression A, the interaction term between positive environmental benefits and institutional trust passed the test at the 5% level of significance. The coefficient of the interaction term was negative, demonstrating that an increase in environmental positive benefits and institutional trust contributes to a reduction in WTA. Moreover, each unit increase in environmental positive benefits and institutional trust reduces the WTA by 0.18%. The interaction between negative environmental benefits and institutional distrust passed the test at the significance level of 10%. The coefficient of interaction was positive, suggesting that the increase of negative environmental benefits and institutional
distrust increases WTA. Furthermore, each unit increase in environmental negative benefits and institutional distrust increases the WTA by 0.03%. In regression B, the interaction term between positive environmental benefits and institutional trust passed the test at the 5% level of significance. The coefficient of the interaction term was positive, proving that an increase in environmental positive benefits and institutional trust contributes to an increase in WTP. In addition, each unit increase in environmental positive benefits and institutional trust improves the WTP by 0.12%. The interaction between negative environmental benefits and institutional distrust passed the test at the significance level of 10%. The coefficient of interaction was negative, proving that the increase of negative environmental benefits and institutional distrust leads to the reduction of WTP. Furthermore, each unit increase in environmental negative benefits and institutional distrust decreases the WTP by 0.09%.

The above results support H3’s conclusions very well.

### 5.3.2 Relationship of other characteristic variables to WTA/WTP

In regression A, age passed the test at the 10% significance level; education, domicile and income passed the test at the 5% significance level. It is therefore revealed that older age, lower education, lower income and being non-native all contribute to an increased WTA. The marginal effects of the variables are elucidated below: (1) the WTA increases by 0.27% for each unit increase in age; (2) the willingness to be reimbursed decreases by 0.19% for each unit increase in educational level; (3) the willingness to be reimbursed decreases by 0.19% in terms of the respective additional unit of household registration; and (4) specific to each unit increase in average annual income, the willingness to be reimbursed decreases by 0.21%.

In regression B, education passed the test at the 5% significance level; income passed the test at the 1% significance level. It is therefore suggested that higher education and higher income both contribute to an increased WTP. WTP increases by 0.17% for each unit increase in educational level and by 0.28% for each unit increase in average annual income.

### 6 CONCLUSIONS

The willingness of urban residents to participate acts as a vital factor for the effective treatment of MSW. It is important for residents, as micro-individuals practicing MSW treatment, to understand their WTA and WTP influences to efficiently facilitate the project to be implemented. Based on the cost-benefit perspective of residents and to fill the gaps in the existing literature, the present study explores the role of environmental benefits and institutional trust on residents’ willingness to participate in MSW treatment. In the present study, residents’ willingness to participate is divided into the WTA and WTP; environmental benefits are divided into positive and negative environmental benefits, and the interactive effects of environmental benefits and institutional trust are considered.

By introducing environmental benefits and institutional trust into the utility function of residents, the present study discusses their impact on WTA and WTP by scenario, based on the idea of controlled variable analysis, and the hypothesis was proposed. By exploiting micro-survey data from 500 residents in four districts of Beijing, the tobit model was adopted to empirically test the
effects of positive environmental benefits, negative environmental benefits and institutional trust and the interaction between environmental benefits and institutional trust on residents’ WTA and WTP. The conclusions are drawn as follows: positive environmental benefits can significantly decrease WTA and increase WTP. Negative environmental benefits significantly increase WTA and decrease WTP. As revealed from the measurement results, for each unit increase in positive environmental benefits, the WTA decreases by 0.53% and the WTP increases by 0.37%. For each unit reduction in negative environmental benefits, WTA decreases 0.5%, and WTP increases by 0.03%. Thus, the positive environmental benefits can reduce WTA and improve WTP; negative environmental benefits have a reinforcing effect on WTA and a weakening effect on WTP.

Institutional trust is capable of significantly decreasing WTA and increasing WTP. As revealed from the measurement results, for each unit increase in institutional trust, WTA decreases by 0.45% and WTP increases by 0.49%. It is therefore suggested that institutional trust significantly contributes to residents’ willingness to participate.

When positive environmental benefits and institutional trust are combined, residents’ WTA is significantly lower and WTP is significantly higher. When negative environmental benefits and institutional trust are incorporated, WTA of the population significantly increases and WTP decreases remarkably. As revealed from the measurement results, for each unit increase in the environmental positive benefits and the institutional trust interaction term, WTA decreases by 0.18% and WTP increases by 0.12%; specific to each unit increase in the negative environmental benefits and system failure interaction term, WTA increases by 0.03% and WTP decreases by 0.09%.

As indicated from this study, as the standard of living of urban residents continues to rise, they are placing greater emphasis on improving their living environment. Thus, the government should respect the wishes of residents and guide them to proactively engage in MSW treatment. On that basis, the urban environmental problems can be solved and the living environment of residents can be improved to the greatest extent, and their participation in MSW treatment can be promoted. On the other hand, the more the government elevates the level of trust in policies and regulations, local norms, incentives and penalties, and other MSW governance systems, the higher the residents’ expectations of the effectiveness of MSW governance will be, as well as the greater their willingness to participate. Accordingly, as a quasi-public good, the creation of a good institutional environment can effectively reduce the ‘tragedy of the commons’ and the ‘free-rider’ phenomenon, and the failure of such institutions can increase the incentive for residents to participate in the disposal of household waste. The mentioned results will help increase residents’ willingness to participate in MSW treatment and provide a valuable reference for institutional policies to improve MSW treatment.

Lastly, there were some limitations to the research in the present study. First, the fact that a sample of Beijing residents was used means that the conclusions drawn from the analysis conducted are not generalizable, since they cannot be extrapolated to the population as a whole. Thus, based on the findings presented in the present study, the next step is to increase the sample coverage and place stress on its representativeness. In this context, estimates capable of explaining the willingness of Chinese urban residents to participate in MSW treatment can be obtained. Second, the coefficients of the econometric analysis were significant, and the Tobit model performed quite moderately, partially due to the small sample size. Accordingly, in the follow-up study, the sample size should be improved to yield more meaningful solutions.

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