

# Current State, Shortcomings, and Strategies to Improve China's Waste Recycling Network: Optimization of Regional Site Selection for Waste Disposal Systems Based on Supply Chain Management

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**Abstract:** Based on the basic supply chain model, the status quo of waste recycling in China is examined by analyzing and comparing the changes in the waste recycling network and the problems of siting in relation to China's waste disposal system.

**Keywords:** China; Waste recycling; Supply chain management; Siting of waste transfer stations

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## 1. Introduction

With the deepening of urbanization and the maturation of industrialization, environmental resources are in deficit worldwide. Against this background, environmental protectionism, as opposed to developmentalism, has received unprecedented attention and favor from the public, focusing on issues such as the allocation of scarce resources, the reuse of resources, and the protection of ecological civilization. In China, environmental protection has become an important issue for the nation; the rational allocation of natural resources and the construction of an environmentally friendly society are priorities for the government. Waste recycling is an important way to protect the urban environment, and the establishment of a comprehensive waste recycling and disposal mechanism can effectively and continuously maintain the cleanliness of the land and environment. However, in its concrete practice, the weak awareness of waste separation among citizens, the lack of supporting facilities for waste separation, and the lack of involvement of relevant administrative departments have led to frequent planning problems in waste recycling and processing in recent years. At present, landfilling and incineration are still the most common waste disposal methods in China, with a low rate of recycling. Not only that, but the whole recycling process is riddled with problems. China's waste recycling management experience and technical capacity are lacking; hence, the waste recycling network needs to be completed and improved. <sup>[1]</sup>

## 2. Current state

The siting of waste treatment stations in China is a major problem. Due to the scarcity of financial and human resources as well as the limited management techniques, the siting of waste disposal stations in China in the early days lacked systematic regulations, which led to environmental problems, such as land

and air pollution, as well as conflicts of interest among local residents, partner companies, and relevant government departments. At present, the development of environmentally friendly cities is being hampered by the fact that a comprehensive waste recycling network has yet to be established. Therefore, optimizing the siting strategy of waste disposal stations, improving their architectural quality, and building a new communication platform for the benefit of the public can effectively improve the traditional image of waste disposal stations and raise the public's awareness of environmental protection.

### 3. Shortcomings and implications

The siting of refuse collection points (RCPs) is an important stage in the establishment of a waste treatment system. In this stage, the selection of the site should be scientifically planned, transparent, and open. Two-way communication between government departments and the public should be ensured after the site survey in order to determine the Pareto optimality for residents, enterprises, and the government based on meeting the nominal needs and fundamental interests of residents. However, the current layout of waste disposal stations, which is confusing and arbitrary, and the obvious orientation toward targets have led to several problems, such as uneven spatial layout, confusion in the division of the areas under their jurisdiction, and the degradation of the city's image, all of which affect the quality of life of the residents and the development index of the city (Figure 1).

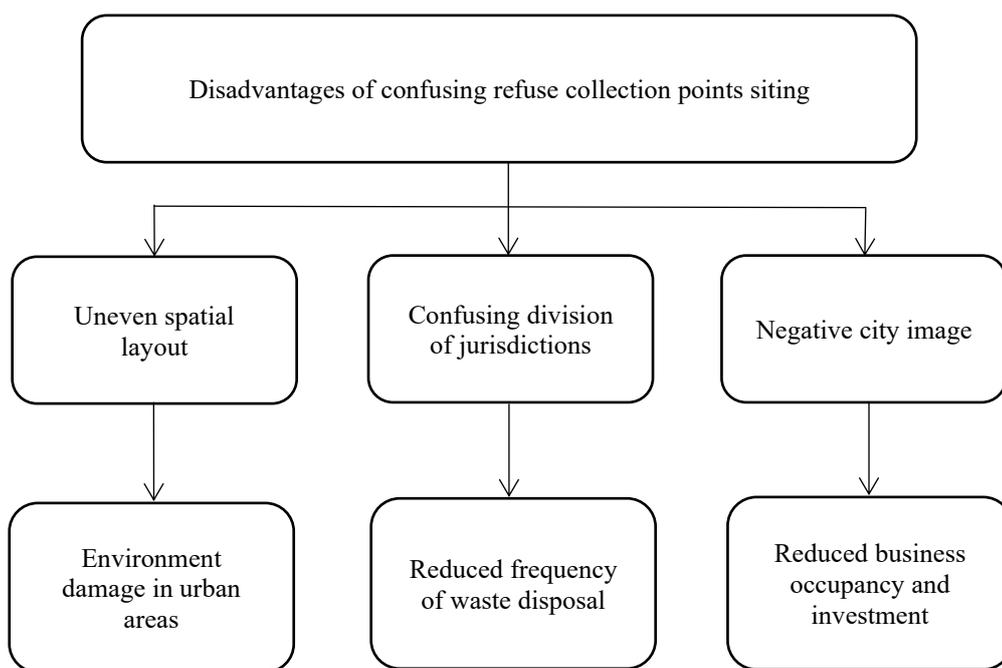


Figure 1. Disadvantages of confusing refuse collection points siting

#### 3.1. Environmental damage and uneven spatial layout

The spatial layout of waste disposal stations is closely related to the quality of the urban living system. A balanced and appropriate layout structure can effectively reduce the cost of waste transfer. However, the current spatial layout of RCPs is uneven, and the public is pleased to see areas without RCPs around them. When RCPs converge in a certain area, all kinds of dangers are superimposed in a multiplicative manner. On the one hand, this chaotic layout perpetuates the odor in the urban environment, and while the quality of life of the residents is not ideal, the operation and maintenance costs for community streets and the implicit cost of living will rise as a result. On the other hand, the call for the continuous existence of RCPs

has made a huge psychological impact on the citizens and compromised the livability of urban life, the happiness index of the citizens, their trust and satisfaction with the local government, and their sense of belonging to the city <sup>[2]</sup>.

### **3.2. Reduced frequency of waste disposal due to confusing division of jurisdictions**

As urban industries continue to develop and the spending power of residents grows, the amount of waste produced per unit time in cities is increasing, thus posing a challenge to China's urban waste disposal system. The confusing division of jurisdictions and the lack of clarity in the departments responsible for waste disposal stations have, to some extent, led to a reduction in the frequency of waste disposal and potentially impacted the quality of life of residents and urban development indicators. The consequence of the reduction in the frequency of waste disposal is not only the impact on the urban landscape, but also the pollution of the environment, water, and soil, which threatens the health of residents, and consequently the phenomenon of rubbish siege, which increases the number of infectious diseases that may spread to people and animals via air, dust, mosquitoes, *etc.*, thus leading to disease outbreaks.

Rubbish has become an urban development problem, which not only causes public nuisance, but more importantly, a waste of resources. The occurrence of "rubbish siege" is an indication of the unreasonable division of waste disposal stations, resulting in cumbersome waste collection routes, insufficient relative capacity, which in turn lowers the frequency of waste disposal, and the accumulation of the remaining unprocessed waste. Improving the efficiency of waste disposal in the short term would be difficult due to the high cost of capacity enhancement and the layout of waste disposal stations being a fixed cost. Therefore, as the total volume of waste increases, it is difficult to release its processing capacity, the operating space is continuously squeezed, and pressure is built due to the negative feedback. The waste disposal system constitutes a cycle when the volume of waste does not change, in which the total volume and processing frequency will continue to decrease. If the volume of waste is greater than the dangerous threshold, the whole system is paralyzed, and urban waste disposal will stop, thus falling into a vicious circle <sup>[3]</sup>.

### **3.3. Reduced business occupancy and investment due to negative city image**

City image is the sum of people's perceived impressions of a city's natural and built attributes. The level of community management, the aesthetics of buildings, the quality of life, and the behavior of residents are all important evaluation criteria and influencing factors of the city's image. City image construction is an important part of urban development strategy. It directly affects the layout of the region in terms of attracting and accommodating investments. A good city image is conducive to attracting enterprises and business investments as well as facilitating the improvement of local infrastructure and the rapid growth of the city's industrial chain. Conversely, a poor city image will inevitably lead to a reduction in the number of external companies and investments. In urban construction practice, the confusing siting and layout of waste disposal stations has led to increased difficulties in community management and reduced aesthetic comfort of buildings, affecting the quality of daily life and behavior of residents, which in turn has resulted in the collapse of the city's image and the diversion of external and internal investments from the city. At the same time, its impact on a city's basic services, consumer industries, and even education at a macro level reduces opportunities for urban development, leading to uneven urban development and exacerbating the siphoning effect of "big city disease."

As mentioned above, the chaotic siting of waste disposal stations threatens the quality of life of residents and directly leads to the destruction of ecological indices. In terms of economic decision-making, it manifests itself in negative value judgements made by companies, leading to a double loss involving corporate capital investment and preferential policies for private investment. As a city's development potential decreases, the administration will struggle to maintain the old urban planning strategy and talent

introduction plan, and the development of the city will fall into a circular dilemma. Therefore, in order to effectively play the role of investment in supporting people's livelihood, it is necessary to focus on city image construction to solve the confusion in the siting of waste disposal stations from the root, enhance the city's social evaluation, and improve the external impression of the city<sup>[4]</sup>.

## **4. Optimization paths**

### **4.1. Redistribution of waste transfer stations**

The government and outsourcing companies need to redefine the horizontal distribution between transfer stations and residential buildings to ensure spatial separation between them. At the same time, the size of the transfer stations, the degree of containment, and the level of facilities should be strictly controlled in order to reduce the spatial footprint and the degree of influence. In terms of personnel, relevant departments should cultivate professionalism among their staff, improve the system of relevant laws and regulations, as well as increase supervision and inspection efforts. On the non-personal side, in order to improve the level of harmless waste treatment and to guarantee the safety of personnel, safety prevention and control standards should be upgraded, with a sound emergency mechanism established. It would be crucial to procure technologically advanced facilities, improve the enclosed nature of transfer vehicles, and strictly implement the full closed treatment of waste by setting up a green barrier and regularly checking and verifying it.

In practice, raising the project threshold for transfer station projects is an effective means of ensuring a reasonable layout for transfer stations. On-site inspections and technical analyses allow for the optimal size of the transfer station, the area of influence, and the number of personnel to be determined; the prevention of "non-negotiable" effects; and the inquiry of professional advice from third-party organizations as required. Based on this, the administration is able to make an effective and reasonable long-term systematic urban plan that offers spatial flexibility for complex future urban development.

### **4.2. Optimizing the administrative agenda for siting decisions**

The administrative agenda for site selection decisions should be optimized, and the introduction of public participation should be considered in order to truly realize public involvement and safeguard the public's right to make decisions. The Environmental Impact Assessment (EIA) system is a credible guarantee for administrative decision-making. For engineering construction and development activities that may affect the environment, investigations, predictions, and evaluations are carried out in advance, followed by reports on environmental impacts and prevention as well as control options. A good, transparent, and credible EIA system would increase public support for site selection decisions and facilitate public participation and multilateral consultation. In practice, the government should strictly select third-party EIA organizations to ensure their independence, professionalism, authority, and public acceptance.

At the same time, information disclosure is a guarantee of efficiency in administrative decision-making and can significantly enhance the effectiveness of the EIA system. The government should set up a special column to publicize all information on the draft site of the refuse transfer station, the authority and responsibility for it, and the agenda; subsequently, a comparative analysis of the alternatives should be conducted so that residents may be able to understand the reasons for the re-location. This will alleviate conflicts and pressures as well as ensure the practical usefulness of the re-location.

Similarly, the regulatory mechanism is an administrative guarantee of the EIA system and information disclosure. An upward feedback mechanism should be opened up to encourage the public and businesses to take up the responsibility of monitoring. At the same time, each management should organize regular downward monitoring and parallel self-inspection internally. Complete monitoring and evaluation indicators specified by the government, along with a scientific, legal, and compliant monitoring mechanism

can provide legitimacy for this.

Compensation mechanisms are the last line of defense. Waste transfer stations themselves have negative externalities and can cause psychological, physical, and economic damage to residents. Once the damage has been confirmed, the relevant authorities will have to clarify the scope of compensation, identify the person liable for compensation, and assume responsibility for environmental damage <sup>[5]</sup>.

### **4.3. Actively changing traditional attitudes**

At present, the public generally believes that transfer stations will bring serious harm to the environment and health of the surrounding residents, thus escalating the public's rejection of transfer stations. Only by changing the public's one-sided view of waste transfer stations and helping them gain a comprehensive and objective understanding of transfer stations and other treatment facilities can the construction of waste transfer stations be carried out smoothly. It is therefore important that the government and society as a whole undertake cultural, educational, and practical activities to imperceptibly change the public's perception. First and foremost, the prejudice toward waste transfer stations should be changed, and people should be made aware of the facilities in a positive way. It is also important to promote waste segregation and encourage the public to participate in waste segregation initiatives to raise awareness of environmental protection among the public. Last but not least, education for the next generation should be directed toward the concept of environmental protection and a proper understanding and awareness of waste transfer stations <sup>[6]</sup>.

## **5. Conclusion**

As an important part of urban and rural waste disposal, waste transfer stations play an important role in transferring urban and rural waste and improving the urban environment. The location of waste transfer stations, in terms of distance, spatial layout, and the city image they represent, has many shortcomings and has been an issue of concern and reflection for the public. This paper explains how the shortcomings of waste transfer stations can be addressed through careful advance planning, a more rigorous site selection process, and a change in public stereotypes, thus further rationalizing and enhancing waste transfer stations and bringing about significant environmental benefits.

## **Disclosure statement**

The author declares no conflict of interest.

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