Suggestions on Implementation of Reverse Logistics for Construction Waste of Sustainable Development

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Abstract

Methods: This paper uses the method of combining qualitative analysis with quantitative analysis and Macro and micro combination. Contents: This paper reviews a lot of domestic and foreign literature on reverse logistics and construction solid waste disposal methods, and puts forward some suggestions on the reuse of solid wastes according to the actual situation of the current status of construction solid waste in China. Results and contributions: This paper puts forward the policy, the internal reform of construction related enterprises to promote collaboration of construction enterprise and third party logistics enterprises, strengthen the related public policy, make people clear the importance of building solid waste reverse logistics, the passive behavior of the participants for the initiative, gradually realize the goal of building waste recycling.

Keywords
Reverse Logistics; Solid Waste; Circular Economy; Suggestions

Introduction

Researchers at home and abroad have done a lot of qualitative and quantitative research on reverse logistics. For example: Fleischmann will be divided into reverse logistics network, recycling network and re-use network, this is the first time in the form of recycling based on reverse logistics network classification. Marin and Pelegrin establish the MILP model to solve the problem of the location of the two logistics facilities, including the distribution and recovery, and construct the heuristic algorithm. Finally, the Lagrange decomposition method is used to solve the model. However, the reverse logistics and the construction of solid waste, according to the special nature of the construction of solid waste reverse logistics system network research is relatively short. This paper will study from the perspective of the combination of these two aspects.

The Survey on the Construction Solid Waste

This paper mainly uses questionnaire, the survey object are the experienced backbone of architectural in the Pearl River Delta region. A total of 256 questionnaires were sent out and 256 questionnaires were recycled. The recycle rate was 100%. Among them, there were 6 questionnaires were invalid, 250 questionnaires were valid, and thus 97.7% were valid. The present disposing situation of construction solid waste in China is obtained through questionnaire.

1.1 The Disposal Situation of Construction Solid Waste

In the survey of solid waste disposal, the recycling rate of construction solid waste accounted for 24.9%, the rate of the outsourcing enterprises also accounted for 24.9%. In common condition, outsourcing enterprises would do sorting and recycling to the construction solid waste. The rate of dumping directly and did not undergo any
sorting and recycling accounted for 38.9% of the total.

**Table 1 Disposal of Construction Solid Waste**

<table>
<thead>
<tr>
<th>Way of disposal</th>
<th>Statistics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transportation and landfill</td>
<td>62</td>
</tr>
<tr>
<td>Transportation and dumping</td>
<td>41</td>
</tr>
<tr>
<td>Recycling</td>
<td>66</td>
</tr>
<tr>
<td>Subcontract</td>
<td>66</td>
</tr>
<tr>
<td>Others</td>
<td>30</td>
</tr>
</tbody>
</table>

After the construction solid waste is produced, only a small amount would undergo the process of selecting and recycling. Generally most construction solid waste is dumped directly into the environment or embedded at certain place, which is rather detrimental to the environment.

**1.2 Source of Construction Solid Waste**

According to the result of a questionnaire on the source of construction solid waste, about 36.78% informants agree that it is due to dismantlement, 29.7% think it is caused by construction, and the left 23.7% think the reason is house renovation.

**Table 2 Amount of Construction Solid Waste Produced during Construction**

<table>
<thead>
<tr>
<th>Source</th>
<th>Statistics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Foundation</td>
<td>28</td>
</tr>
<tr>
<td>Construction</td>
<td>98</td>
</tr>
<tr>
<td>Renovation</td>
<td>78</td>
</tr>
<tr>
<td>Repairing</td>
<td>4</td>
</tr>
<tr>
<td>Dismantlement</td>
<td>121</td>
</tr>
</tbody>
</table>

**1.3 Primary Factors for Recycling of Construction Solid Waste**

According to table 3, we can infer that immature recycling industry of construction solid waste appears as the main obstacle for recycling construction solid waste. Therefore relevant departments should make preferential policy based on local actual situation, and consistently guide enterprises to dispose construction solid waste.

**Implementation Suggestions to Reverse Logistics of Construction Solid Waste.**

**2.1 Reform Internal Policies of Construction Enterprises**

To the construction enterprises, they are the main producers of construction solid waste, and thus the main executors of reverse logistics. As a result, the attitude of the construction enterprises directly decides the recycling rate of construction solid waste.

1) **Internal Policy of Construction Enterprises**

Construction enterprises are mainly responsible for implementing project, who play pretty important roles in
project construction. Therefore, the attitude of the construction enterprises directly decides the recycling rate of construction solid waste.

During the process of building construction, each stage would produce construction solid waste, so the reverse logistics would run through the whole process. To the enterprises, they should formulate the management plan of construction solid waste according to national laws while tendering the project. Once the enterprise wins the bidding, his management plan of construction solid waste would be examined by department of construction management, and the construction shouldn’t initiate unless the plan is approved. The plan should comprise following items: species and amount of construction solid waste produced at different stages; species that can be recycled; disposing facilities; way of disposal and transportation; inspection of relevant departments; etc. With the development of technology, advanced equipment and technique should be applied to building construction, which will enhance the usage rate of construction materials and decrease the amount of unnecessary construction solid waste.

Besides, enterprises should adopt scientific methods in daily management, strengthen the integration of forward logistics and reverse logistics, and establish certain regulations to cut down waste of construction materials. Meanwhile, enterprises should communicate regularly with relevant department, and utilize various ways to decrease solid waste.

2) Internal Policy of Equipment and Material Suppliers

To the equipment and material suppliers, they should ensure the integrity of the material used in construction and supply it according to construction progress. Through this way, we can avoid the problem of accumulating large amount of material at the construction spot and cut down the cost for conservation. Moreover, we should select recyclable material that is harmless to the environment. In order to lower down transportation cost, the suppliers should be close to the construction spot. During construction, suppliers should contact frequently with the construction enterprise to ensure the adequacy of the materials.

3) Internal Policy of Owner Organization

To the owner organization, as the employer of the project, they should dispose of construction solid waste properly to save resource and establish fine corporate image to the public. Generally the owner organization should work together with relevant organizations in the feasibility research, carry out environmental evaluation and formulate management plan for construction solid waste. Owner should make clear the ways of disposal of solid waste while tendering the project, and take it as an important standard in selecting construction enterprise. During the process of construction, owner should cast supervision to the construction enterprise, check whether they abide by the items on disposal of solid waste in the contract. If not, the owner should take effective measures to curb related activities.

4) Internal Policy of Design Organization

Normally the species and quantity of materials would be determined in the design stage, so the design level of design organization would affect the reverse logistics greatly. The design organization needs to evaluate the effect of construction to the environment systematically and communicates with owner and construction enterprise about the evaluation report.

5) Overall Promotion of Responsibility Extension System of EPR Manufacturer

Originally proposed by Swedish researcher Thomas, Responsibility extension system of EPR manufacturer is a kind of environmental protection system. It divides the manufacturer’s scope of responsibility, indicates that the manufacturer be responsible for each stage, from manufacturing to recycling, and ensure that each stage wouldn’t do harm to environment. Via this system, the disposal of scrapped products transfers from government to enterprise, which requires the enterprise to use environmental friendly and recyclable materials.

Overall promotion of responsibility extension system of EPR manufacturer doesn’t only comply with the principles of reduction, recycling, reclamation, but also conforms to ecological law. The manufacturer should be
responsible for each stage of product, especially the recycling. They should also shoulder the responsibility to protect environment, which both embodies their duty and right.

2.2 Advancing Cooperation Between Construction Enterprise and Logistics Enterprise

To the third-party reverse logistical enterprise, experience and equipment is a great advantage. Generally this kind of enterprise masters mature managerial process, owns a powerful team, and is able to grasp the market correctly. As a result, resorting to third-party logistical enterprise would help construction enterprise lower down cost and enhance competitive ability.

For most construction enterprises, they are unfamiliar with reverse logistics and lack related knowledge, experience and technique, therefore it gets difficult for them to accomplish reverse logistics of construction solid waste. Under the circumstances, cooperation with third-party logistical enterprise would be a better choice.

There are many ways of cooperation between construction enterprise and logistics enterprise. For example, construction enterprise can distribute the transportation and storage of materials to logistical enterprise, or subcontract procurement work to them. In return, construction enterprise can also acquire some value adder service. As third-party logistical enterprise is specified and experienced, construction enterprise will receive better quality logistical service, and increase economic benefit. Under the background of recycling economy, the strategic cooperation between construction enterprise and logistical enterprise would be mainstream trend in the future.

2.3 Establish Reverse Logistics Network of Construction Solid Waste

To the reverse logistics network, it is the combination of forward and reverse logistics. The reason for establishing the network are as follows: we transport solid waste to the logistical center via optimized way, then logistical center sorts the solid waste and transit to processing center, after being processed, the recyclable materials are sent back to logistical center, and then to the material suppliers to be recycled. Detailed network diagram is shown below as fig.1.

![FIG.1 REVERSE LOGISTICS NETWORK DIAGRAM OF CONSTRUCTION SOLID WASTE](image)

(The full line stands for forward logistics and the dotted line stands for reverse logistics)

2.4 Improvement of Relevant Public Policy

For the incumbent government, they should not only supervise and promote the establishment of reverse logistics network, but also should formulate relevant policy to guide enterprises. Therefore, mature public policy will play important role in disposal of construction solid waste.

1) Establish and Improve Management System

Compared with developed countries in Europe and north America, laws and regulations on construction solid waste in China are still imperfect, and some are even unreasonable, so relevant departments should consistently improve related laws and regulations according to current situation. Construction solid waste may cause great harm to environment, so necessary management is acquired through the producing, transportation and disposal. We should alter our thinking angle from traditionally the change of urban image to currently the recycling of resources. Start from source of producing, resort to sorting and collecting, we can gradually boost the utilization rate of construction solid waste.
2) **Improve Related Institutions**

(1) Improve institutions at design stage of project

At the design stage of project, we have related institutions. The environmental influence assessment system is aiming at assessing influence to the environment after the project is initiated, and taking effective measures coping with the influence. This system can help us consider solid waste at design stage of project.

(2) Improve institutions at construction stage of project

Institutions at construction stage of project comprise two parts: quota management system and cleaner production system. The cleaner production system works as follows: to use current science and technology, to adopt advanced technique and equipment, to fully utilize clean resource, to avoid causing pollution, and to decrease the harm of solid waste to the environment. With the development of technology, enterprises are required to cut down amount of solid waste in the future, and ensure the solid waste is harmless to environment while transportation and storage. Quota management system is the standard for cleaner production, which sets quota for material, water, energy consumption and solid waste production, and thus make sure all the standards are under control during project construction.

(3) Improve institutions at operation and retirement stage of project

Institutions at operation and retirement stage is a kind of manufacturing responsibility extension system, which requires the embodiment of manufacturer’s responsibility at each stage, including production, recovery, recycling and effect to environment. Whereas, construction pattern of project differs from production pattern of product. Construction patterns, such as overall contract, designing scheme, agent-construction system, way of scrapping, are managed by the owner, so we should establish manufacturing responsibility extension system covering material, scheme, recycling of solid waste to normalize the manufacturer of the project.

3) **Establish and Improve Related Laws**

The government should establish related laws and regulations to enhance support on processing construction solid waste. Our country shall take certain measures, such as releasing policy, adjusting price, alter tax, etc, to guide the disposal and recycling of construction solid waste. For instance, the government can change rubbish landfill plant to rubbish processing plant in order to advance recycling; provide great support and guidance to the enterprises which process solid waste. Besides, government could establish more perfect norm and specification for construction solid waste, require the enterprise to sort and collect solid waste, and prohibit indiscriminate discharge of construction solid waste.

In addition, it’s clearly pointed out in law that landfill of solid waste is illegal, and related regulations have been released. Developed countries have already carried out related research on processing construction solid waste and issued relevant laws. The government will cast rigorous punishment to enterprises who discharge construction solid waste indiscriminately, and to those who have established reverse logistics and processed construction solid waste properly, the government will reward them with favor of reducing tax or providing preferential loans.

In conclusion, the cyclic utilization of construction solid waste doesn't only need the effort from enterprise and government, but also should be under the supervision of public. Relevant official departments should do propaganda to the public, and make sure the public establish overall acknowledgement of construction solid waste, which is not a kind of social rubbish, but a kind of recyclable resources. After the propaganda and education, we can help the public change the traditional thinking mode, realize the significance of reverse logistics of construction solid waste and finally achieve the goal of cyclic utilization of construction solid waste.

**REFERENCES**


