

# A review of operational barriers and causes within industrial chain for construction waste recycling in China

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**Key words:** Construction waste; Resource; Industrial chain; Dilemma

**Abstract:** With the rapid development of urbanization, the disposal of construction waste has caused wide attention by scholars. This paper introduces the status of construction waste resource and relates studies in China and summarizes the construction waste resources of the industrial chain operation dilemma and the corresponding reasons. Finally, suggestions are put forward to.

## Introduction

The huge amount of construction and demolition wastes (CDW) has been generated from the increasing building of new structures, renovation, rebuilding, repair, demolition works, and infrastructure development projects, so construction waste recycling has become an important issue in the area of environment management since the reform and opening up. Over the past 50 years, 20 billion m<sup>3</sup> bricks were produced and most of them will be transformed into construction solid wastes in the next 50 years. 40% of the wastes are generated from construction activities. From the statistics of the “Report on the utilization of resources in China (2014)” released by the National Development and Reform Commission, the production of China’s wastes in 2013 was about 10 tons, of which the demolition wastes and the construction wastes occupied 7.4 tons and 2.6 tons, respectively. The recovery rates of construction wastes are less than 5%. Most of the construction waste is nonrenewable resources. High quality of aggregate is excessive used in the surrounding cities. Some areas even have become exhausted, so the question of resource shortage in our country is becoming more and more serious. At the same time, construction and demolition wastes (CDW) have increasingly become serious problems in environmental, social and economic realms. With the increasing of people’s environmental awareness, simple landfill of C&D waste cannot meet people’s demands, because waste landfill not only takes up valuable land resources, but also brings potential threat to the soil, water, air in the surrounding. In this respect, boosted recycling of C&D waste is required by the China’s *Twelfth Five-Year Plan*.

## The status quo of construction waste recycling

**The status quo of the chain of construction waste recycling.** Recycling is considered as the strategies in minimization of waste. Recycling is defined as the process where transforms the construction waste into valuable resources by some technology and management strategies. In 2013, about 50 million tons of construction waste was digested, in which 30 million tons was used to produce recycled materials, and 20 million tons was in another use. At present, the recovery rates of construction wastes are only 5%. Industrial chain operation pattern is shown in figure 1, which

consists of the contractor, the owner, the waste recycling plant, the supplier, the government and other stakeholders.

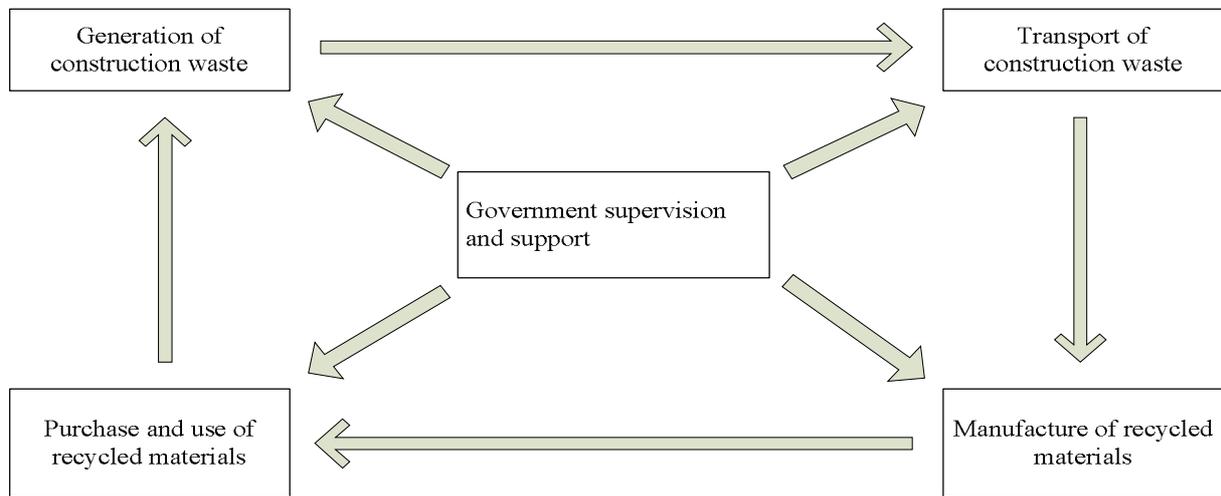


Figure 1 Industrial chain operation pattern of construction waste recycling utilization

**The application ways of construction wastes recycling.** Rather than the poor quality found from the recyclable materials, they found the high investment cost, lengthy demolition period and limited space caused the major barriers for them. The wastes can be used to produce new construction materials, which can reduce the demand upon raw materials and protect the natural environment, at the same time, some social, environmental and economic benefits could be achieved in recovery of construction wastes. The treatment process of construction and demolition waste recycling is shown in figure 2. The construction and demolition wastes characteristics are highly region-dependent and the construction waste industry chain includes large numbers of stakeholders, so the local government plays a decisive role. Beijing, Shanghai, Tianjin, Chongqing, and other provinces have been carried out the work of construction and demolition waste recycling. Because the supply of raw materials is not guaranteed, the disposal costs are too high, the product application channels are not smooth and other issues, the government is still necessary to state some policies for management.

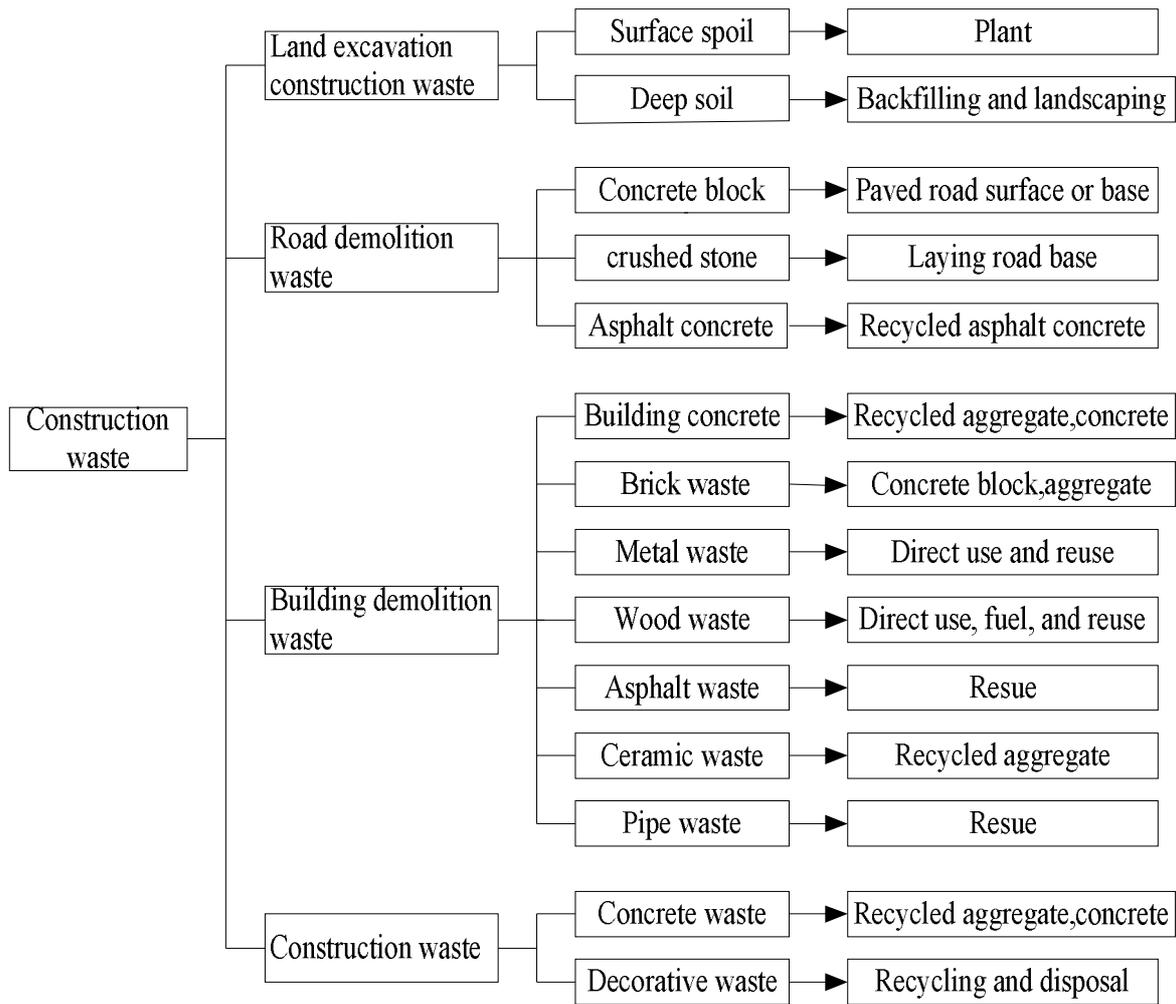


Figure 2 Ways of utilization of construction waste recycling

**To demonstrate the construction waste recycling based on the literature analysis approach.**

**The result of the literature analysis approach.** The government has stated many policies from different angles to promote the development of the recycling industry. Because the policies can't support each other, they failed to form the industrial policy which can foster the industry development. In the theory of industrial chain, resources, market, technology and coordination are the four essential elements<sup>[1]</sup>. This paper tries to study the dilemma of the industrial chain in three aspects of technology, management and law. First of all, the use of literature analysis, in the China National Knowledge Infrastructure (CNKI) in accordance with the "theme+ the theme" as search terms to search, "+" means parallel relationship, the source journals selected SCI source journals; EI source journals; core journals; CSSCI, building waste utilization literature search results are shown in table 1.

Table 1 Summary table of literature Chinese in CNKI database. [units: articles]

Theme	The year										Total
	06	07	08	09	10	11	12	13	14	15	
building garbage + recycle	15	18	27	38	40	40	42	58	79	80	455
construction waste + recycle	6	3	8	7	13	16	16	21	21	14	131
building garbage + recycle +technology	6	4	11	13	6	11	16	16	23	20	134
construction waste + recycle + technology	1	1	3	3	3	3	5	6	4	5	37
building garbage + recycle + management	3	5	4	6	12	8	7	22	21	20	110
construction waste+ recycle + management	3	2	7	5	5	13	21	19	14	7	101
building garbage + recycle +regulations	1	0	0	1	0	1	2	4	4	4	17
construction waste + recycle + regulations	0	0	0	1	0	0	2	1	2	3	9

Note: the 06 refers to the 2006, and so on.

## Results

From the table 1, we can know that with the development of the research on the construction waste recycling, the problem of the construction waste recycling has caused scholars more and more attention. At the same time, the understanding of the construction waste is not enough, most of the scholars are still called construction waste as "building garbage", which gives citizens a false signal and people have doubts about the quality of the construction waste recycling products. Secondly, a great many of the researches is about the technology of building waste resource while the technology of building waste resource is mature. In real society, the technology has little influence on the operation of the construction waste recycling. Thirdly, even more research is on the construction waste resource management, but most of which is the introduction of foreign advanced construction waste management methods,. Domestic individual cities in the construction waste management is quite good, most of which still need to increase the construction waste management. Finally, fewer researches are about the construction waste, and the law of the operation of the construction waste resource is very little. It is undoubtedly a major obstacle to the operation of the construction waste recycling industry chain.

## Research conclusions

From the point of view of managers and investment managers, construction waste recycling industry implemented separate government functions from enterprise management. As the industry operation supervisor, manager, coordinator and guide, the government how to regulate and control the stakeholders is the key to promote the effective operation of the industrial chain. To ensure the integrity of the industry chain, the government should insist the principle that will benefit more stakeholders who bear the burden on the waste processing. This article summarizes the management dilemma of the construction waste recycling by collecting the literatures and showing it in table 2 in order to provide a better basis for government governance. It is not difficult to find the main difficulties of the stakeholders reflect in the two aspects: one is the transportation costs and processing fees and the other one is the sale of construction waste.

Table 2 The description of the predicament of construction waste resource management

The dilemma	The author
Free dumping of construction waste.	Chen Jialong <sup>[2]</sup> 、 Li Jingru <sup>[3]</sup> 、 Wang Xin <sup>[4]</sup> 、 Hu Mingpeng <sup>[5]</sup>
The Waste Treatment Charge is unreasonable.	Chen Jialong <sup>[6]</sup> 、 Qi Dandan <sup>[7]</sup>
the imperfect relative laws and regulations.	Chen Jialong <sup>[6]</sup> 、 Gao Qingsong <sup>[8]</sup> 、 Wang Zhixian <sup>[9]</sup> 、 Yuan Hongping <sup>[10]</sup> 、 Shi Jianguang <sup>[11]</sup> 、 Zhai Baohui <sup>[12]</sup> 、 Leng Faguang <sup>[13]</sup> 、 Tan Xiaoning <sup>[14]</sup> 、 Wei Xiuping <sup>[15]</sup> 、 Fan Weiguo <sup>[16]</sup>
Consumers have doubts about the recycled building materials with the concept of "building waste".	GaoQingsong <sup>[8]</sup> 、 Wang Yanqiang <sup>[17]</sup> 、 Wu Fangfei <sup>[18]</sup>
Low efficiency of the recycling enterprise	Chen Jialong <sup>[2]</sup> 、 Fan Weiguo <sup>[16]</sup>

Compared with natural materials, the recycled materials exists the transportation costs. According to the distance between the materials of construction waste to the disposal of enterprises, transportation costs are a huge economic burden. The enterprises prefer to dumpling the construction wastes directly in order to reduce the transportation costs. For waste treatment fee, construction waste does not have the advantage, because natural material can be used directly while the construction wastes not only to be classified, but also for other processing. Construction enterprises are not only the producer of the construction waste, but also the users of the building waste recycling materials. Usually, the owner is responsible for the freight transportation of the construction waste, and the owner can determine the proper demolition blasting company or shipping company. This will cause two problems. One is that, the owner and the transportation company act in collusion and both decide to dump the construction waste. The other one is following: the transport team will take the profit as the guide to select the construction waste disposal method, secretly dumping of construction waste. No matter what kind of situation occurs, the owner can be exempted from the construction waste disposal fee, so there is no supervision mechanism between the two sides.

### Suggestions

How to solve the problem of transportation and handling charge? All over the country need to be based on the actual situation to study and solve the problem where is how to spread the cost of transportation and how to effectively supervise the construction enterprises and transportation enterprises.

At present, there is no special law of construction waste utilization in China and the operability of the relevant is not strict and few mandatory policies and related implementation details in our country. There is no system security to the use of construction waste recycling products. The government is still need to state preferential policies and incentives about using the construction waste recycling materials. If they have construction waste recycling products, the construction companies are still using natural resources products, and then they must pay for the cost of resources protection. If the government increases the cost of natural resources and raises the market

price of natural products, the relative price of resources is reduced.

At the same time, the government should do more to promote the construction of garbage resource products and remove the misunderstanding of the public to the construction waste recycling products. Government departments should formulate the quality standards for resource products, which is the product sales passes, with which resource products will be recognized by the community and then occupy the market.

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