Research on Computer Simulation Evaluation based on Risk Impact Analysis and Mitigation Strategy of Waste Disposal Reverse Supply Chain Disruption

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Abstract. The level of garbage treatment represents the development level of the city, which requires each city to deal with the garbage problem. At present, China has been promoting waste classification and recycling, which will gradually improve the waste treatment supply chain system. However, with the continuous improvement of the supply chain, garbage treatment will become a benefit chain, which will lead to the risk of supply chain interruption. With the gradual pursuit of profit and lean, the probability of disruption risk in waste treatment supply chain is gradually increasing. Firstly, this paper analyzes the modes and types of reverse supply chain disruption. Then, this paper puts forward some link strategies. Finally, this paper puts forward the mode of computer simulation.

Keywords: Waste Disposal, Reverse Supply Chain, Disruption Risk, Simulation Evaluation

1. Introduction
With the rapid development of society, a variety of life products greatly enrich people's life, which not only brings convenience to people's life, but also produces a lot of garbage. However, improper treatment of garbage will cause many adverse effects, such as environmental pollution, urban civilization, etc [1]. Therefore, garbage treatment has become an important industry, which has formed a gradually improved supply chain. However, supply chain disruption events occur in various industries every year. When the supply chain is interrupted, the upstream and downstream enterprises will bring huge losses, which is difficult to restore the original production capacity in a short time. Therefore, we need to build a complete risk management system, which can avoid interruption risk [2-4]. Through the classification of risk management, enterprises can more clearly understand the consequences of interruption risk. By adopting the corresponding link strategy, we can improve the anti risk ability of the supply chain, which will directly improve the method of urban civilized waste treatment. The treatment of urban waste products has always been an obstacle to the development of green cities [5, 6]. The traditional garbage treatment methods are extensive, such as burning, burying, etc., which will cause great waste of resources. However, garbage collection is a relatively simple
supply chain, which needs to study the value-added reverse supply chain. Therefore, the research on disruption risk of reverse supply chain of waste disposal has important social practice value [7].

2. Concept of reverse supply chain

2.1. Reverse logistics and garbage sorting and recycling
Reverse logistics was first proposed by Lamber and stock. Reverse logistics is a kind of logistics whose flow direction is opposite to traditional logistics. Reverse logistics is a transportation activity, which can realize many functions, such as product recovery, material recycling, waste treatment, maintenance, sorting and remanufacturing. Therefore, reverse logistics in the 1990s quickly attracted the attention of scholars.

2.2. Third party recycling mode
The third-party recycling mode is a large-scale enterprise specialized in garbage treatment. At present, there are two main third-party recycling channels, which are retailer cooperation and enterprise and institution cooperation. Through the third-party recycling, we can realize the recycling of reverse supply chain. The third party recycling mode is shown in Figure 1.

![Third party recycling mode](image)

**Figure 1.** Third party recycling mode.

3. Concepts related to disruption risk

3.1. Disruption risk
Supply chain disruption risk is a risk event that may interrupt the whole interest chain in the supply chain, such as product production, raw material production, distribution, consumers, etc. Disruption risk is an event that can not be repaired in a short time due to the damage of the node facilities in the supply chain. There are many sources of disruption risk across every level of the supply chain. Different sources of supply chain disruption risk will lead to the adopted strategies. The source of interruption risk is arranged in descending order of the random degree of risk occurrence.

3.2. Modes and types of supply chain disruption
Disruption risk has a huge adverse impact on the supply chain, which will far exceed the internal risk in normal operation. It can be seen that we can take targeted preventive measures against disruption factors, which will alleviate the supply chain disruption risk. Based on the impact of supply chain disruption risk, this paper summarizes five common supply chain disruption modes, as shown in Table 1. Among them, supply disruption, demand disruption and transportation disruption are the most representative risks, which will cause the focus of similar studies.
### Table 1. Five common supply chain disruption modes.

| {#mode} | Specific forms of expression |
|---------|-------------------------------|
| 1       | Disruption of supply          |
|         | The supplier delays the supply of materials or the related inventory shortage, which leads to the paralysis of downstream companies due to the lack of production materials; |
| 2       | Disruption of transportation  |
|         | The delay or unavailability of transportation organization leads to the failure of normal transportation of materials inside and outside the supply chain; |
| 3       | Device interruption           |
|         | Delay or unavailability of plant, warehouse and office equipment, which hinders the continuity of normal operations; |
| 4       | Comloss                       |
|         | The delay or unavailability of internal and external information and communication facilities makes it impossible for enterprises to operate, coordinate and execute transactions; |
| 5       | Demand disruption             |
|         | The delay or interruption of downstream enterprises' activities leads to temporary or permanent loss of demand, which affects all upstream enterprises |

### 4. Transmission path of disruption risk in reverse supply chain

#### 4.1. Chain conduction path

Chain conduction path is a transmission path that a node enterprise transmits the risk of supply chain disruption to the previous node enterprise. According to whether the conduction direction and business process direction are in the same direction, we can divide into forward conduction path, reverse conduction path and mixed conduction path. The positive conduction path is from upstream node to downstream node enterprise. The reverse conduction path is from the downstream node to the upstream node enterprise. The forward and reverse conduction paths are shown in Figure 2. The risk conduction direction of forward conduction and reverse conduction is single, and the interruption risk is easy to control.

![Figure 2. Chain conduction path.](image)

#### 4.2. Reticular radiative conduction pathway

Network radiative conduction is a way of interrupting risk conduction direction from core node enterprises to other related nodes, which can transmit to downstream nodes and upstream nodes at the same time. The interruption risk of conduction may be the same risk or different risk. Conduction risk can be multidimensional diffusion, superposition and variation, as shown in Figure 3.
4.3. Reticular pathway concentration

The network concentrated conduction path is the conduction direction of interruption risk, and the conduction mode from different nodes to a specific node, as shown in Figure 4. The conduction path of reticular concentration is opposite to that of reticular radiation. Interruption of risk transmission process is easily affected by the environment.

5. Evaluation of computer simulation model for reverse supply chain

5.1. Computer simulation model of reverse supply chain

This paper establishes a representative general supply chain model, which can realize the structure expansion. The structure of supply chain includes supplier, manufacturing plant, packing plant, DC and customer. The number and level of each node enterprise is unlimited, which can facilitate the structure expansion of supply chain. The operation process of supply chain includes four links: raw material supply, product assembly, product packaging and product distribution, as shown in Figure 5.
5.2. Evaluation index of influencing factors
According to the characteristics of the actual situation of waste recovery and treatment enterprises, this paper formulates the evaluation index of influencing factors, as shown in Figure 6.

![Diagram of reverse supply chain](image)

**Figure 5.** Computer simulation model of reverse supply chain.

**Figure 6.** Evaluation index of influencing factors.

6. Conclusion
With the gradual pursuit of profitability, the probability of disruption risk in waste treatment supply chain is gradually increasing. When the supply chain is interrupted, the upstream and downstream enterprises will bring huge losses, which is difficult to restore the original production capacity in a short time. Therefore, we need to build a complete risk management system, which can avoid interruption risk.

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