

# Investigation and Strategy Research on Recycling and Utilization of Express Packaging

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**Abstract:** With the rapid development of internet technology, online shopping has brought great convenience to people's lives. As an important group of online consumption, college students bring a large amount of express packaging waste. However, colleges and universities lack an effective express packaging recycling mechanism, which results in a double waste of economic and environmental benefits. We collected relevant data from some universities in Wuhan through interviews and questionnaires, and analyzed consumers' wishes, express packaging disposal measures and influencing factors through Logistic regression and SWOT methods. Finally, it summarizes the existing problems in the recycling and utilization of express packaging in colleges and universities in Wuhan and puts forward feasible suggestions. We have proposed an efficient dual-track express packaging recycling system for colleges and universities, which includes an information platform and smart recycling boxes to achieve environmental protection and recycling, and it is expected to be promoted in the whole society.

**Keywords:** Express packaging; SWOT analysis; Logistic regression; Recycling; Dual-track mode

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## 1. Introduction

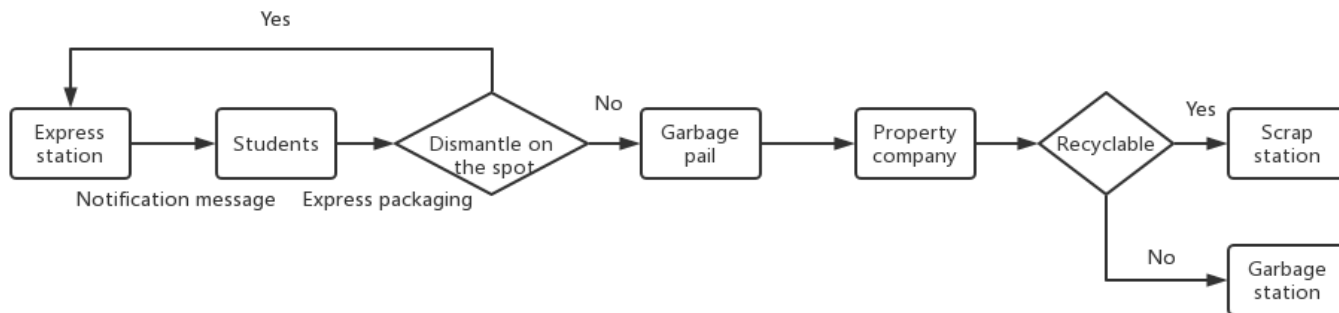
The rapid development of express delivery industry brought a significant increase in the volume of express packaging. It is reported that the number of express deliveries in China in 2019 increased by billions over the previous year, with a growth rate of 18.3%, which exceeded the total annual express delivery in the United States. In 2020, despite the impact of COVID-19, the total amount of social logistics in China still maintained a growth rate of 3.0% from January to November, reaching 266.2 trillion pieces in total.

This year, the national Post promoted the "9571," the green development of the express industry gradually systematic, which has become an inevitable trend. College students are undoubtedly the major group of online shopping. At the same time, there is a lack of effective express packaging recycling system in express delivery station of colleges and universities, resulting in a double waste of economic benefits and environmental benefits<sup>[2]</sup>. Under the environment of e-commerce, people pay more attention to the environmental situation, when seeking to develop the economy. Based on the policy guidance of circular economy and intelligent logistics, it is imperative to conduct strategic research on the recycling and utilization of express packaging<sup>[5]</sup>.

## 2. The importance of express packaging recycling

At present, the general process of express recycling in colleges and universities is shown in **Figure 1**. The recycling process is relatively simple, but it costs a lot of human resources and the express packaging

recycled from the garbage is generally affected a certain degree of deformation and pollution, resulting in not being directly secondary use. By comparison, it is more environmentally friendly if the more intact express packaging recycling can realize the production mode of the circular economy from “resource-product-packaging waste” to “resource-product-renewable resource.” It also helps to optimize the national economic structure and ownership structure, and protect the environment. In addition, it can improve students’ awareness of environmental protection and provide feasible suggestions for the government departments to better carry out environmental control and waste resource utilization [3].



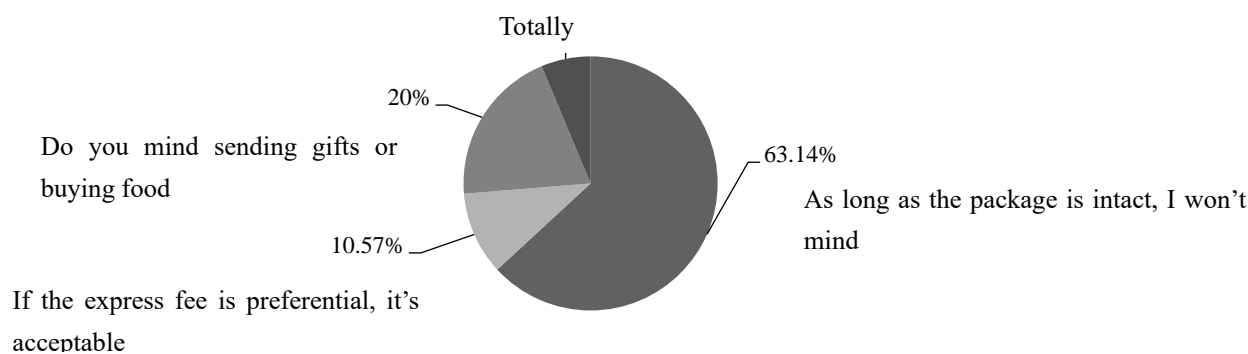
**Figure 1.** Current college express packaging recycling process

### 3. Data analysis

#### 3.1. SWOT analysis

##### Part 1: Investigation on the advantages of express packaging recycling (S)

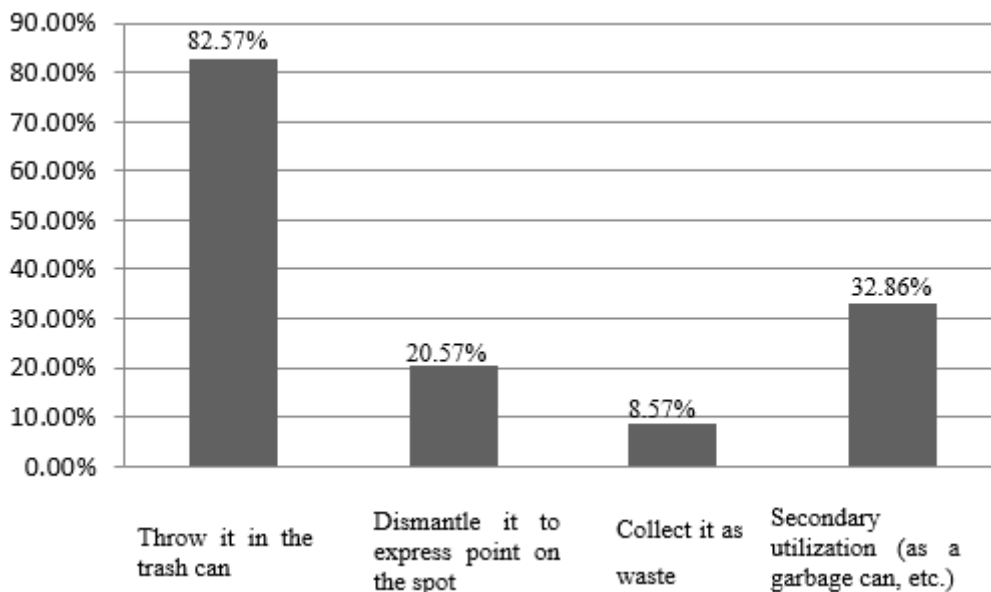
As shown in **Figure 2**, 63.14% of the students said they would not mind the packaging of logistics process is secondary utilization if the express package was intact. 20% of the student’s mind using secondary use of packaging among them when they send gifts to friends or buy food. Therefore, we can see that college students have a strong willingness to recycle express packaging.



**Figure 2.** Do you mind using secondary packaging

##### Part 2: Investigation on the disadvantages of express packaging recycling (W)

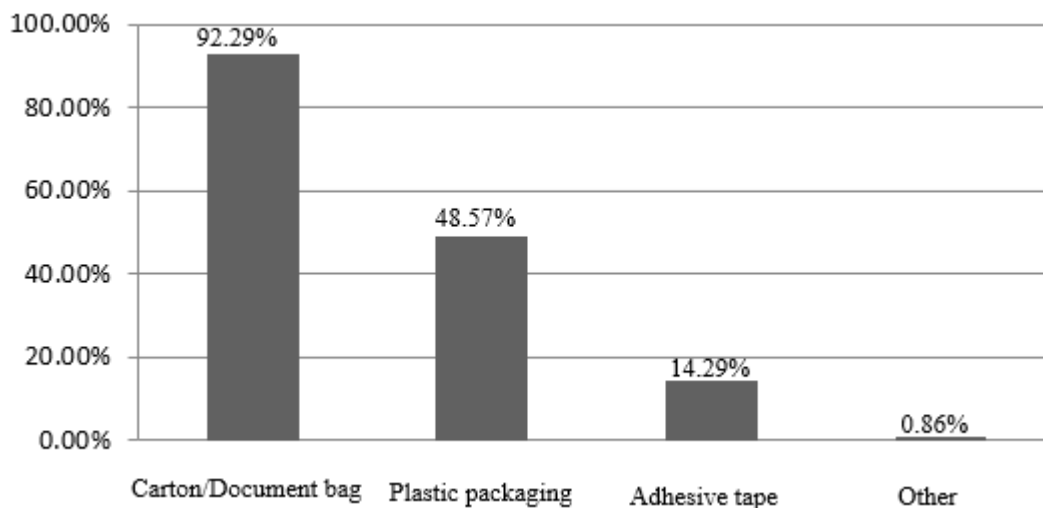
According to the survey results (as shown in **Figure 3**), the vast majority of college students will throw express packaging directly into the *garbage* cans, the proportion is as high as 82.57%, 32.806% of students will use express packaging for secondary use, of which only 20.57% of the students will put the express package into the recycling box at the express delivery station, so a large number of express packages thrown into the trash can causes serious waste at present.



**Figure 3.** General handling method of express packaging

### Part 3: Survey of express packaging recycling opportunities (O)

According to the questionnaire survey (as shown in **Figure 4**), 92.92% of the students usually receive express cartons and the types of paper bags are the most, followed by plastic packaging accounting for 48.57%. In fact, transparent tape, a kind of packaging material that is difficult to degrade, will appear in each carton or plastic package. Therefore, there are also a lot of tapes in express packaging. Overall, the type of express packaging materials is relatively one-flod, mainly based on paper and plastic material.

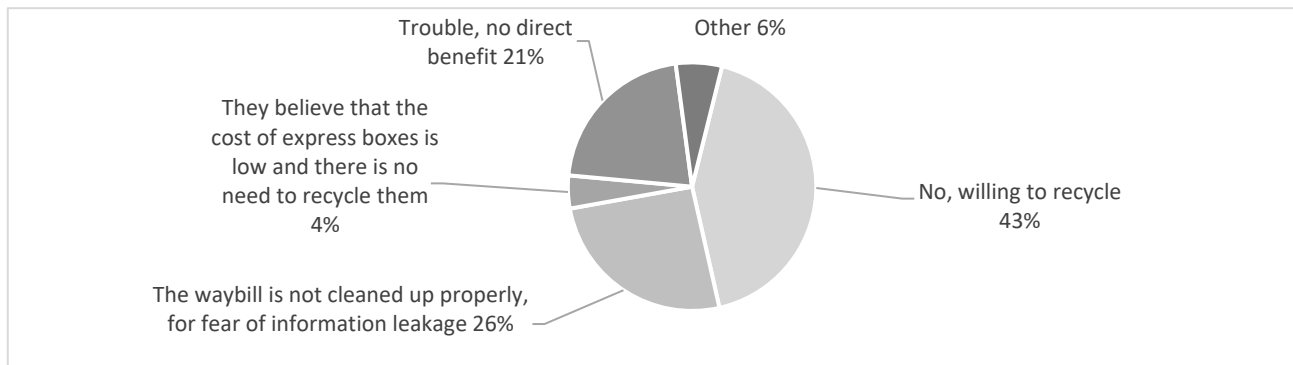


**Figure 4.** Main types of express packaging materials

### Part 4: Investigation of the threat of courier packaging recycling (T)

As can be seen from Figure 2, as long as the express package is intact, 63.14% of students do not mind that the package in the logistics process is reused. As can be seen from Figure 3, 82.57% of students are used to throwing express packages directly into trash cans. It can be concluded that although students have a strong willingness to recycle express packages, they have not put them into action. According to the survey of students (as shown in **Figure 5**), 25.71% of the students worry that the express bill is not cleaned properly and their personal information is leaked. 21.43% of the students think that the express package recycling is

troublesome and has no direct benefit. These two factors are the main reasons that hinder the recycling of express packages.



**Figure 5.** Reasons for not wanting to express packaging recycling

### 3.2. Express packaging recycling willingness

According to the data in **Table 1**, we can get the following conclusions:

- (1) The vast majority of students (88.86%) are willing to participate in the recycling of express packages, which indicates that is a ripe time to implement the recycling policy and take measures.
- (2) 70.29% of the students think that they are willing to use biodegradable materials if the express delivery cost is not increased, while only 2.86% do not support the use of biodegradable materials, which shows that the most of consumers do not care about the material of the package, but care more about the cost. Therefore, the use of degradable materials will be an effective way to avoid the environmental pollution caused by express packaging <sup>[1]</sup>.
- (3) 92% of students agree to simplify express packaging, which shows that on the condition of ensuring the goods are not damaged, we can accept the proper simplified express packaging and reduce excessive packaging. We can control the waste of express packaging from the headstream.

## 4. Statistical analysis

### 4.1. Model test

Based on the above research conclusions and the analysis of the preliminary research, this paper selects 8 factors that are most likely to affect the participation intention of express packaging recycling. Since “Whether you are willing to participate in the recycling” is a type 0-1 variable, a binary Logistic regression model was chosen.

In this study, -2 logarithmic likelihood and H-L test were selected to judge whether the model could effectively fit the data. In the model test results, the chi-square statistic of -2 logarithmic likelihood is 177.832, which is less than the critical value 215.294. The test of H - L’s chi-squared statistic is 6.468, less than the threshold 15.507, Therefore, the chi-square statistics of these two methods meet the requirement of being less than the critical value. In addition, the significance sig of -2 logarithmic likelihood value should be as small as possible and close to 0, with the test result less than 0.001; the fitting degree P of H-L test should be greater than the given significance level test result, which is 0.595. The above results show that the model fits the data well and there is no significant difference.

### 4.2. Regression result

**Table 2** shows the assignment and regression results of the influencing factors on the participation willingness of express packaging recycling. From the perspective of practice, only the key parameters are given, namely, explanatory coefficient B, significance sig and advantage ratio Exp(B). The influencing

factors in the table are based on the results of the analysis of the problems. For example, the strength of “environmental awareness” is based on students’ cognition of the harm to the environment caused by express packaging, rather than directly asking students whether they have strong environmental awareness.

**Table 1.** Descriptive statistics of recycling willingness

Category	Topic	Options	Frequency	Percentage
Participation willingness	Whether you are willing to participate in the recycling	A. Like	3110	88.86%
		B. Indisposition	390	11.14%
Action willingness	Willingness to use biodegradable materials for packaging	A. nonsupport	100	2.86%
		B. If the delivery fee doesn’t go up, support	2460	70.29%
		C. Support	940	26.86%
	Willingness to simplify packaging	A. Like	3220	92%
		B. Indisposition	280	8%
	Willingness to use secondary packaging	A. If the delivery is in good condition, support	2210	63.14%
		B. If there is a discount for express delivery, support	370	10.57%
		C. Reluctance to send gifts or buy food	700	20%
D. Indisposition		220	6.29%	

**Table 2.** Binary logistic regression results of participation willingness

Influence factor	Symbol	Assignment instructions	B	Sig.	Exp(B)
Gender	X <sub>1</sub>	1=Man, 2=Woman	0.957	0.034	2.603
Grade	X <sub>2</sub>	1=Freshman, 2=Sophomore, 3=Junior, 4=Senior, 5=Graduate student or above	-0.185	0.345	0.831
Environmental awareness	X <sub>3</sub>	1-5, hardly to very strong	0.216	0.307	1.241
Past recycling habits	X <sub>4</sub>	1-5, not used to very used to	0.359	0.024	1.432
Monthly average express volume	X <sub>5</sub>	1=1 piece or less,2=2-5 pieces,3=6-9pieces,4=10pieces or more	0.288	0.291	1.334
The importance of recycling payment	X <sub>6</sub>	1-5, indifference to make much account of	0.607	0.017	1.836
The recognition of recycling value	X <sub>7</sub>	1-5, valueless to very valuable	0.903	0.000	2.466
The importance of personal information security	X <sub>8</sub>	1=indifference,0=make much account of	0.404	0.356	1.497
Constants in the model			-5.707	0.000	0.003

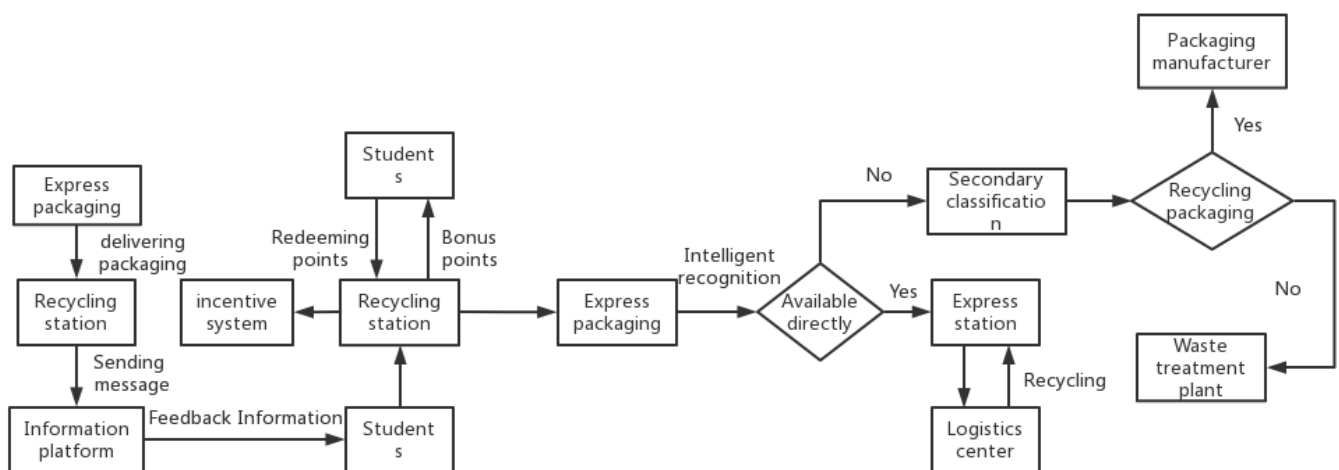
**Table 2.** shows that the following factors have a significant impact:

- (1) Gender: women are more willing to participate in package recycling than men.
- (2) Past recycling habits: consumers who have formed good recycling habits in the past are more willing to participate in recycling.
- (3) The degree of attention to the recycling reward: the higher the recycling benefit, the more willing to participate in the recovery.
- (4) The degree of recognition of the value of recycling: the higher the degree of recognition of the value of recycling, the more willing to participate in recycling.

## 5. Analysis conclusion

### 5.1. Dual-track recycling system

Based on the information platform of the antidromic logistics recycling mode, the following basic recycling process is determined. As shown in **Figure 6**, the express delivery station obtains information by scanning the packaging and send the data to the intellectual recycling station. The station uses a preset algorithm to obtain the packaging value, and then returns a receipt information which sent to the student terminal, such as recycling QR code, bonus points<sup>[4]</sup>. After the students receive their packages at express delivery station, they can send it to the intellectual recycling station that achieve light-weight management of personnel. The intellectual equipment mainly performs a series of automatic processing including scanning, sorting, storage and other operations on the collected packages, and uploading the information to the network platform by scanning QR code on the packages. Students can view bonus points accounts through the mobile app<sup>[3]</sup>. The recycled packages can be transported to the packaging manufacturer as the raw material for the production of new one, and intact packaging can be directly used for secondary utilization.



**Figure 6.** An optimized recycling process

When the express packaging recycling system is in operation, it is necessary to consider the cost of equipment R&D and manufacturing, equipment operation and maintenance, express packaging transportation. For the operation and maintenance of the equipment, the recycling team organized by the school volunteer association can be responsible, which can reduce its cost to a certain extent<sup>[2]</sup>. In addition, in the initial stage of establishing the express packaging recycling system, the benefits and costs of recycled express packaging will be definitely not equal. However, as the recycling system continues to operate and the business of the express industry grows, the recycled express packaging will bring the increasingly

apparent economic and environment benefits.

## 5.2. Application outlook

The optimized express packaging recycling system adopts a dual-track design. On the one hand, the traditional express packaging should be strengthened by classification and recycling management. Professional recycler should cooperate with consumers and organically connect with the domestic garbage recycling system. On the other hand, in terms of strengthening the recycling of packaging materials, it is mainly recycled by express delivery companies. For instance, the United States and Japan are promoting “zero packaging” and using express recyclable boxes to deliver to the consumers. This recycling system is not only suitable for school, but also has application prospects for residential communities and some public places, and its recycling objects can also be extended from express packaging waste embodies the idea of circular economy. This innovative economic solution for waste treatment has a wide range of application prospects in economically developed countries in the world. For developing countries, as garbage treatment is in its infancy and development stage, it still needs make extensive efforts to establish a similar dual-track system<sup>[5]</sup>.

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## Disclosure statement

The authors declare no conflict of interest.

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