

## Design and Recycling System of Shared Express Box based on Circulation Mechanism

Changying Chen\*, Ying Fan

School of accounting, Anhui University of Finance and economics, Bengbu, Anhui, 233000, China.

\*1023986932@qq.com

### Abstract

The development of e-commerce economy has brought huge profits to the express industry, but the overwhelming express packaging has brought irreparable damage to the environment. China's express business volume has long ranked first in the world, but the recovery rate of express packaging is less than 20%. Based on this, the author analyzes the current problems of China's express packaging, discusses the development of green express, puts forward the design ideas of green, intelligent, modular and systematic express packaging, and provides creative thinking for the design of an intelligent recyclable express box; Combined with the shortcomings of the current sharing express recycling mechanism, through the integration and optimization of its structure, to promote the sustainable development of China's express packaging industry.

### Keywords

Sharing Express; Express Packaging; Intelligent Recyclable Express Box.

### 1. Introduction

The rise of e-commerce economy has driven the development of express industry. With the development of e-commerce economy, the environmental pollution caused by express packaging is becoming more and more serious. Express companies continue to buy one-time express packaging boxes. It takes a long time for the delivery personnel to scan the express. Due to the loss and damage of goods, they have to double the compensation. Such problems emerge one after another in the express industry. According to the data released by the State Post Office, as of 2020, China's total express delivery business has reached 2104.32 billion, and the postal delivery service business has reached 25.56 billion in 2020. Behind such a huge amount of data, we are faced with the environmental protection problem of less than 20% recovery rate of express packaging. All kinds of problems are springing up, making the express company exhausted. This obvious environmental protection problem also brings great challenges to the national and even global ecological civilization construction. As early as 2017, Suning has launched the shared express, but it has not been widely promoted. On November 30, 2020, the national development and Reform Commission and other departments launched "opinions on accelerating the green transformation of express packaging" and other documents, proposing to reduce the secondary packaging of e-commerce express and cultivate a new mode of recyclable express packaging, so as to urge the development of Green Express. All kinds of signs show that express green, environmental protection, express packaging reduction has been urgent.

At present, many designers and scholars are actively exploring new ways of shared express packaging design, and the research on express packaging is in the ascendant in the theoretical circle. The related research achievements mainly include the following viewpoints: green and modularization of shared express packaging [2-7], innovation of operation mode of intelligent express cabinet, customer satisfaction and development strategy [8-10], Based on the perspective of the whole life cycle, the design of shared express packaging [11], the design of logistics shared packaging based on database [12], and the optimization of distribution and recycling of express boxes based on recycling [13-16]. These studies provide ideas for reducing waste and pollution of express packaging and saving costs.

The rapid development of economy makes people's pursuit of spiritual life more enthusiastic, and the Green Express packaging may accelerate the development of express service industry, improve its service quality, and enhance the sense of customer experience. Based on this, the author analyzes the current problems of express packaging, discusses the development path of green express, puts forward the design ideas of green, intelligent, modular and systematic express packaging, and completes the design of an intelligent multi-functional recyclable express box to provide creative thinking; Combined with the shortcomings of the current sharing express recycling mechanism, through the integration and optimization of its structure, to promote the sustainable development of express packaging.

## 2. Problems in Express Packaging

### 2.1 The Recovery Rate of Express Packaging is Low, and Plastic Waste is Difficult to Degrade

According to CCTV news reports, at present, 80% of China's paper express packaging materials can be recycled, while 99% of plastic express packaging waste can not be effectively utilized because of its low recycling value. By 2019, the annual consumption of plastic bags has exceeded 4 million tons, and the annual consumption of express plastic packaging is about 1.8 million tons. Paper express packaging can be recycled, but the recovery rate of plastic material packaging is less than 1%. The environmental pollution of express packaging is increasing, at the same time, people's demand for online shopping is growing. The contradiction between the two directly leads to the collapse of the logistics industry in environmental protection. Industry development should not be at the expense of the environment. Similarly, the development of new formats will also be conducive to the practice of environmental protection.

### 2.2 "Shared Express" is Difficult to be Widely Promoted in the Market

With the prevalence of the concept of sharing economy and the grim situation of express packaging, some enterprises take the initiative to assume social responsibility while promoting the development of express industry, launch the development strategy of "sharing express", and have achieved certain results. As shown in Table 1, according to the comparative analysis of various types of express packaging and traditional express packaging, it is not difficult to find out that traditional express packaging has low recovery rate, serious pollution of packaging waste and unreasonable utilization of resources due to its vulnerable materials, difficult degradation of sealing materials and waste of internal buffer resources. Although the optimization of materials and sealing methods of shared Express has improved the recovery rate of express packaging, it has been frustrated in the operation of the market due to its large production cost, less size selection and impractical characteristics. It is difficult to recycle, difficult to transport, or difficult to reproduce. Generally speaking, this kind of shared express box is obviously difficult to be widely promoted in the market.

Table 1. Comparison of various express packages and traditional express packages

Categories	Material	Type	Sealing method	Internal buffer
Traditional postal express packaging	Corrugated paper	16	Tape sealing	Material filled
Suning share express box 1.0	Plastic	2	Packing tape	Nil
Suning share express box 2.0	Environmental protection high tech materials	2	Disposable packaging buckle	Nil
SF share express box	Woven cloth and plastics	8	Zipper closure	Double box combination, telescopic belt fixation
Jingdong sharing express box	Thermoplastic resin	4	Disposable sealing buckle	Nil

### 2.3 The Process of Express Scanning is Cumbersome, and the Work of the Courier is Heavy

The mountain of express boxes not only brings trouble for customers to find the express, but also increases the difficulty for the courier to scan the express. Heavy mechanical scanning is an extremely important step in the process of express transportation, and consumers also track the express information through this step. However, due to the different scanning time and scanning amount, the

time and efficiency for consumers to obtain information are greatly different. This procedure not only destroys the consumer experience, but also increases the workload of the courier.

Although some cities have launched such intelligent express cabinets as Fengchao and Suyidi, they have solved the problems of slow delivery efficiency of couriers and inconvenient delivery for customers. But with its popularity and expansion, there are also new problems. For example, the acceptance of valuables, courier or can not avoid mechanical scanning procedures, still can not fundamentally solve the problem. At the same time, the intelligent express cabinet is self-service access at any time, customers get greater autonomy. However, with the continuous development of intelligent express cabinet companies and the introduction of Fengchao's "overtime charging" scheme, the contradiction between consumers and intelligent express cabinet enterprises becomes more and more serious for a while. Or because of the long detention time of some express delivery, the operating cost of the enterprise increases, but the overtime charge makes the consumers dissatisfied, and thinks that the cost of the express cabinet should be included in the express fee; Or because the express cabinet is put in the place with a large flow of people, it can not meet the needs of consumers in remote areas, which leads to the decrease of consumers' enthusiasm; No one is responsible for the loss or damage caused by the failure of face-to-face inspection.

With the rapid development of express industry, the amount of express packaging is increasing day by day, but this development has brought great pressure to environmental protection. When promoting the development of express packaging, our country puts forward that express packaging should be reduced and green. In order to achieve the balance between the two, it is necessary to promote the green and recycling of express packaging.

### **3. Design of Shared Express Box Based on Circulation Mechanism**

The problems of the current shared express in the market are obvious. To break this deadlock and make the shared express popular in the market, we should fundamentally solve the problem and optimize the structure of the shared express box. The cycle mechanism of express packaging includes the production and manufacture of express packaging, the sales and use of express packaging, the recycling and reuse of express packaging. In view of this production process, the author will combine the green development concept of express, put forward the design idea of new express box from the green, intelligent, modular and systematic aspects of express packaging, and complete the design of a shared express box.

#### **3.1 Greening of Express Packaging**

The Green of express packaging starts from the manufacturing process of express packaging. Compared with the traditional post delivery plastic which is difficult to degrade and has low recovery rate, in order to realize the green packaging of express delivery, it is necessary to reduce the damage of materials to the environment as far as possible [5]. The reduction of express packaging is also reflected in the rational use of resources, trying to produce high-quality and sustainable express boxes with less or the same amount of materials. On the one hand, in the selection of materials, consider whether the materials are easy to process and whether they are resistant to pressure and moisture during transportation; On the other hand, in terms of safety, we should choose materials that are not harmful to internal commodities, but also reduce the harm to the environment when recycling. The author inquired about the information when choosing the packaging materials, and selected polypropylene materials after comparative observation. Polypropylene material has high chemical stability, heat resistance and corrosion resistance, strong and durable physical properties, light weight, non-toxic and harmless. Packaging materials have no pollution to internal goods and no damage to the environment, which can effectively improve the environmental pollution of traditional express delivery, and realize the Green Express packaging.

#### **3.2 Intelligence of Express Packaging**

The intelligent of express packaging starts from the process of express packaging sales and put into use, and optimizes the structure of traditional express and shared express. In the process of traditional

express delivery, the information of both the sender and the receiver is pasted on the express box. Every time it arrives at an express diversion point, it needs to scan one by one for a long time. This lengthy and complicated process is an indispensable step in the express transportation process. In order to realize the high speed and simplicity of express transportation, we must optimize this process. On the other hand, after purchasing goods, the owner of goods can't get the express information in time. Only when the express company scans the express can the logistics status be updated, and the experience is very poor. In order to improve this phenomenon and simplify the process of scanning express in express industry, the author improves the structure of express box to increase its function, makes full use of data media, adds intelligent chip and display screen in express box, and uses it for background interactive processing, so as to realize the real-time positioning of Express box and display the basic information of three parties, It directly skips the process of the express personnel scanning the express, realizes the efficient and fast express transportation, and then realizes the intelligent express packaging.

The author thinks that the intelligent express box has the advantages of easy operation and fast identification. After doing a good job in the background data processing, in order to facilitate the use of express companies, it can also carry out front-end development, equipped with relevant app. After the express distribution points of express companies register, they can query the express location in real time through app. If you want to arrange the delivery in this area, you can use the screening conditions and the express box positioning system. If the two phases match and meet the requirements, the screen will be on to facilitate the staff to find; Or after entering the market, create a new Internet industry, provide greater development space for the market, and promote the improvement of service quality and employee efficiency of express companies.

### **3.3 Modularization of Express Packaging**

According to the comparison between all kinds of express packaging and traditional express packaging, the author found that the existing shared express did improve the recyclability, but did not provide buffer material. Even if some measures were taken to reduce the shock, according to the protection method of large boxes with small boxes, the essence is still a waste of resources, which is the same as the material filling of traditional postal express [8]. In addition, the size and style of shared express are few, and many goods can't be transported with the exact matching express box. Therefore, in order to be able to use normally, we have to add boxes or use other materials to fill in the express box. The design of such shared express undoubtedly ignores its practicability, and the problem of rational utilization of resources has not been solved. When designing express boxes, we should consider the protection of internal items. In order to improve its practicability, it is possible for the same size express box to meet the loading of different sizes of goods. According to this design purpose, the author boldly puts forward the modularization of express packaging box. The specific content is to install different thickness, different materials and removable fillers inside the express box. For example, in the face of fragile items, TPU bubble pad can be used for six side packaging; In the face of fresh products, high molecular polymer preservation module can be used for packaging, and with other damping materials. The modularization of this packaging lies in the fact that these fillers can be disassembled. When the fillers are damaged, polluted or the type of internal goods changes, they can be quickly disassembled for repackaging, which effectively solves the problems of the internal goods of express packaging are not in line with the size of the box, and can not safely shock absorption, etc., and realizes the modularization of express packaging.

### **3.4 Systematization of Express Packaging**

The systematization of express packaging starts from the recycling process and focuses on solving the problems of express packaging recycling. At present, in the process of recycling, the shared express box is still collected by the express personnel. Due to the lack of publicity and the uneven quality of citizens, some people are willing to return the boxes, but some people are not willing to. They even think that this is packaging and should be obtained. This makes the recycling of express boxes a big problem. Even if the express delivery personnel carefully explain when they come to

collect, this way will hinder the promotion of sharing express boxes after all, and is not suitable for the long-term recycling mechanism. Therefore, in order to promote the promotion of shared express box, the GPS positioning system at the bottom of express box is very important. The first thing to do is to post posters at express delivery points, rookie post stations and other places for publicity, so that the public can understand that this is not product packaging when taking express delivery. In order to promote the intelligent express service, we should make full use of its smart screen to regulate the public. In the express delivery points, rookie post stations and other places, we should reasonably set up the shared express delivery recycling points, implement the incentive policy for the citizens who return the express boxes to reach the number of times, and encourage more people to participate in the shared express delivery recycling mechanism. The location system of express makes it easy to query its location, and it is convenient for the recovery personnel to recover, repair or put into use again when it is not put into use for a long time.

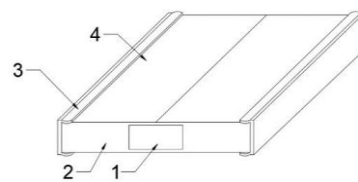


Figure 1. Schematic diagram of external structure of intelligent recyclable express box

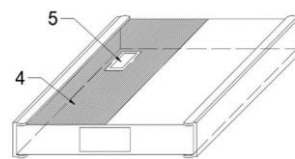


Figure 2. Schematic diagram of internal structure of intelligent recyclable express box

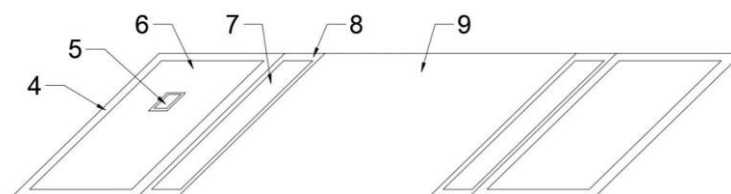


Figure 3. Connection diagram of the bottom plate of the intelligent recyclable express box

Notes: 1. Intelligent screen, 2. Installation base plate, 3. Slide rail, 4. Box door, 5. Intelligent chip, 6. Filling area 1, 7. Filling area 2, 8. Side plate, 9. Bottom plate.

#### 4. The idea of Shared Express Box Recycling System under Circulation Mechanism

In many cases, the optimization of express box can not completely solve the problem that it is difficult to widely promote the current shared express. If we can not get through the circulation mechanism between consumers and shared express, the best intelligent express is just a fantasy. Therefore, the author has formed a variety of recycling mechanism analysis, optimization design, in order to throw a brick to attract jade, help the promotion of intelligent express.

##### 4.1 Current Recycling System

The current recycling mechanism is mainly composed of consumers, express companies and factories. The three complement each other and are indispensable. But in practice, there is no simplified



structure between users and express companies. And users are not actively involved in this mechanism. The work efficiency of recycling express boxes is low, and the public lacks initiative, so it is not feasible (as shown in Figure 4). To achieve the coordination of the three in the process of express transportation, express companies should first do a good job in the recycling of express boxes for users. As mentioned above, in the recycling of express boxes, due to the insufficient publicity of express boxes and the uneven quality of citizens, many citizens do not know much about it, making it difficult for the whole recycling work to continue, The author has optimized the current recycling mechanism. Because the express company and the production factory still have the process of repairing the damaged express box in the recycling project, the express company is in a very important position in the recycling process, and providing a sound recycling mechanism is an important part.

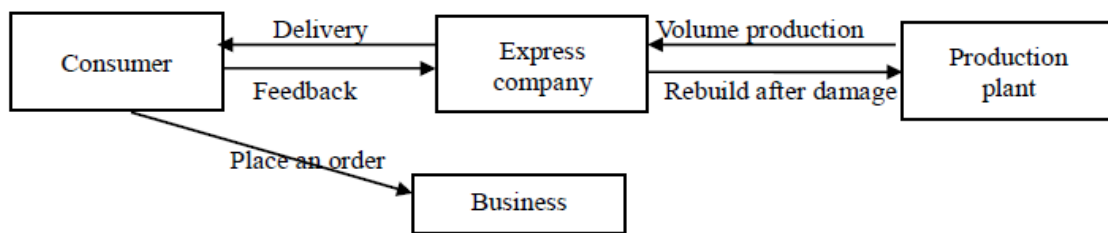


Figure 4. Current recycling mechanism of express delivery

### 4.2 Optimized Recycling System

The optimized system design has established a good cooperative relationship between users and express companies. By setting up a collection point within a certain range, the user who has used the express box will put the express box at the collection point, and will get accumulated points. Every time a certain point is reached, the express company will offer love to the people who need help in the name of the user. In this way, it not only solves the problem of door-to-door collection of express boxes, but also allows users to participate in the recycling mechanism, enhances the sense of participation of users, and improves their enthusiasm to participate in activities. At this time, the express company can focus on the repair of the damaged express box, which greatly improves the work efficiency and reduces the production cost. Specifically, between consumers and express companies, from the initial commodity transportation process and recycling process is indispensable to the optimized only delivery process, which simplifies the communication between the two and improves the behavior efficiency. In order to achieve recycling, we should not start from express companies, but rely on middlemen to coordinate. The consumer returns the express box to the express recycling point. When the recycling is successful, the background system will automatically enter the data (only virtual identity, protect consumer privacy). The points platform will feed back the data to the express company, and the express company will analyze the points. After the points are accumulated to a certain amount of data, the corresponding reward can be obtained.

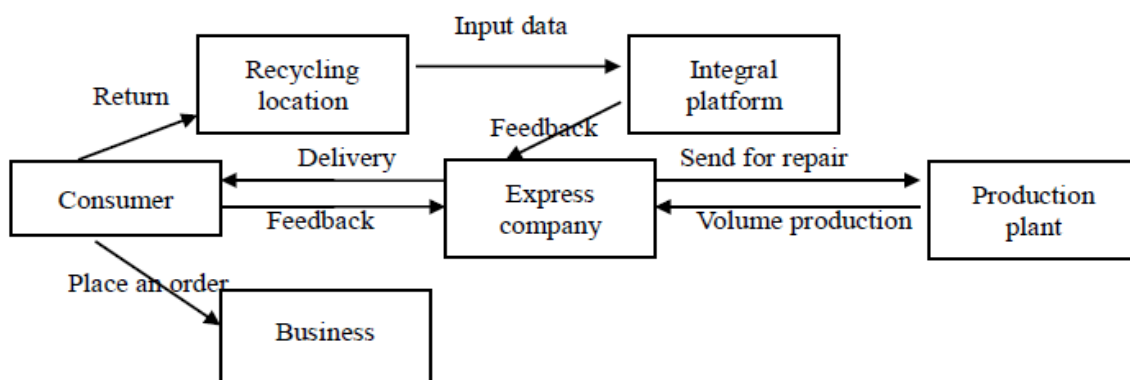


Figure 5. Optimized express delivery recycling mechanism

This method starts from the process of express delivery recycling mechanism, breaks the situation of less interaction between consumers and express delivery companies in the current market, not only brings enthusiasm to consumers, but also provides feasible alternatives for express delivery companies to help the recycling of express delivery recycling system.

## 5. Conclusion

Green Express is still difficult to widely promote. With the development of e-commerce economy, the environmental pollution caused by express packaging is becoming more and more serious. On the one hand, we need to deeply realize the urgency of Green Express packaging; on the other hand, we should also see that the existing shared Express has shortcomings in cost and resource utilization. In view of these problems, the author combined with the concept of green express, put forward the concept of intelligent recyclable express box from four aspects of green, intelligent, modular and systematic express packaging, which has made great improvements in the aspects of non pollution of materials, diversity of functions, high efficiency of information reporting and the feasibility of recycling. In the end, the author puts forward some optimization measures to make users participate in the recycling mechanism, so as to improve the enthusiasm of users for this activity. However, the concept of Green Express still has a long way to go, which needs the support of the government and other sectors of society, the understanding of consumers and the cooperation of express companies, in order to truly realize the green and recycling of express packaging and build an environmental friendly express environment.

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