Contactless Distribution mode based on Circular Express Box

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Abstract. During the outbreak of new coronavirus, the traditional way of distribution has many disadvantages, such as wide contact with people and wide range of activities. These disadvantages will not only cause cross infection between distribution personnel and customers, but also increase the difficulty of epidemic prevention and control to a certain extent. As a new distribution mode, contactless distribution is widely used under special outbreaks due to the advantages of fewer contact personnel and high distribution efficiency. In view of this situation, we have carried out a study on the problems arising from the express delivery process, put forward the "Contactless distribution mode based on circular express box" point of view, namely, the establishment of express delivery station shipping station in the community. All express delivery companies are placed in the designated location, in order to solve the shortcomings of the traditional delivery process.

1. Introduction
In recent years, the rapid development of express logistics has brought broad development space and profit space to the logistics industry, which makes all businesses focus on express logistics. However, due to the different express distribution systems and distribution vehicles of different companies, express delivery cannot deliver express goods to the community post station in the shortest time.

At the same time, the rapid development of express industry has also caused great environmental pressure. China's consumption of all types of express packaging materials increased from 206,000 tons in 2000 to 941.23 million tons in 2018. If effective measures are not implemented to control, according to the current development trend of express delivery, China's express packaging material consumption in 2025 will reach 41.2705 million[1]. In such a large environment, the community expresses its unique market demand and living environment to develop rapidly, but the recovery of express packaging has become a common problem in the express industry.

In 2020, the outbreak of the new corona pneumonia outbreak has had a profound impact on the development of China's logistics industry. Since the outbreak of the new coronavirus pneumonia outbreak, the State Post Office has repeatedly stressed the need to try to avoid direct contact between couriers and recipients, as far as possible, self-pickup and self-delivery, intelligent express box delivery and other modes are used to perform the last kilometer of distribution. Consumers have to accept the transformation of "delivery to the station" and "delivery to the cabinet", which not only has a great promoting effect on the formation of "self access habit", but also has a positive impact on the efficiency improvement and cost optimization of the last kilometer of the logistics company[2]. "Contactless distribution" has almost become the standard in the logistics industry, and intelligent express cabinets also benefit from it[3].
In summary, the transformation of the express logistics industry to a green, low-carbon, contactless operating model is imminent.

2. There is a problem with express mode

- Heavy use of non-environmental packaging materials
  In the process of packaging, express uses a lot of plastic bags, packing boxes, woven bags, roll tapes, bubble films and express bills. Among them, roll tape, plastic bags, and other plastic products need nearly a hundred years to degrade, roll tape packaging courier box cannot be used again, which caused great damage to the environment.

- The low packaging recovery rate
  At present, in China's express industry, the actual recovery rate of cardboard and plastic is very low, even less than 10%. The overall structure of Express online shopping consumer group in China has tended to be younger. On the one hand, due to the lack of awareness of resources and low awareness of environmental protection among young online shoppers, the recovery of express packages has not attracted too much attention. On the other hand, the recovery system of express packages in China is not perfect. At present, the disposal methods of express waste in China are basically landfill or incineration. Express packaging has become the main force of new garbage in the city. Therefore, it is difficult to recycle to express waste.

- Last kilometer distribution inefficient
  Courier delivery time conflict, low-efficiency delivery, China's laws and regulations are not perfect, low level of logistics infrastructure, high cost, cargo security is difficult to ensure, pick-up convenience is low, received express delivery types and miscellaneous problems become the bottleneck of the last kilometer of delivery so that the safety and accuracy of express delivery are difficult to ensure.

- Slow development of contactless distribution
  At present, the relevant documents of contactless distribution are not perfect. The level of logistics infrastructure is low and the ability to deal with problems is insufficient. For example, in contactless distribution, once the goods are damaged, lost, or sent incorrectly, how to deal with the problem still exists. It is difficult to guarantee the security and accuracy of express delivery.

3. No contact distribution mode construction

Contactless distribution mode is composed of the following processes. After sorting and packing by the express company, the delivery personnel will deliver the goods. After the car is loaded with the mobile storage cabinet of the unit, it will run along the pre-planned path and arrive at the predetermined interactive terminal. After passing the background information system, it will realize the docking of the unit storage cabinet. The interactive terminal will read the cabinet information through the RFID system, complete the downloading of the goods information in the cabinet, and send a notice to the owner to pick up the goods. In addition, customers can send goods directly through the delivery counter and recycle the circular express box. When the goods in the cabinet are emptied or arrive at the present time,
the information system informs the distributor to return them and re-enter the packing process. The "contactless logistics" is carried out to avoid direct contact between the courier and the receiver.

Figure 2 flow chart of contactless distribution mode

3.1. Pick-up Mode

When the goods are sorted by the automatic sorting system to the designated location, the information management platform automatically sends information to the customer according to the cargo information, the customer reaches the designated receiving location, the verification code is entered into the interactive terminal or scans the two-dimensional code for pickup\cite{6}.

3.2. Delivery Mode

When the customer sends the goods, first click the delivery function on the interactive terminal, select the express company, input the basic information such as the sender's recipient, receiving address, telephone number of both parties, etc., the customer puts the goods into the "weighing and measuring" device on the side of the interactive terminal to automatically measure the length, width, height, and weight, and automatically record the data, and then the customer pays the fee and deposit through the interactive terminal to pay the price. After the function, the corresponding empty cabinet will open automatically, and the customer can put the goods into the closed cabinet door. The delivered goods will pass the inspection of the staff in the post station, and then the delivery list will be printed and sent out.

Customer

Input basic information at the interactive end

Measure weight

Payment of fees

Put the goods in the cabinet

Figure 4 The Sending Process
3.3. Recycling Cycle Express Box

After customers pick up the goods, they can put the recycling express box into the cabinet for recycling. First, select the recycling button on the interactive terminal, input the relevant information, and put the box into the "weighing device". The system will automatically select the appropriate empty cabinet according to the size of the box. Customers only need to put the box in.

- Reward mechanism for recycling
  When the customer delivers the box for recycling, the background information management system will automatically establish the "environmental protection honor" file according to the information filled in when the customer delivers the box. When the customer accumulates to a certain number of times, the system will reduce the deposit or the delivery fee when delivering the goods.

- Deposit refund function
  When the circular express box is transported back, the staff will check the goods sent by the customer. If the information is the same as that filled in when the customer sends the goods, the staff will print the express document, send the goods and return the deposit to the customer’s account. If the information does not match, the staff will make up the price of the excess part from the deposit, send the information to the owner, and return the remaining deposit.

4. Smart delivery cabinet design

Intelligent "delivery cabinet" is mainly composed of the interactive terminal, unit locker and base.

- Interactive terminal. The interactive terminal is connected with the background information system to count and record the cargo information in the unit locker. The user extracts and sends the cargo through the interactive terminal. There is a "weighing and measuring" device on the side of the exchange terminal, which automatically weighs the cargo weight and measures the length, width and height of the cargo through the internal sensor. In addition, there is a reader inside, which is realized with the unit locker through RFID technology Information docking.

- Unit locker. The unit locker can be transferred between the post station and the pick-up point in the community, and the internal electronic tag can be connected with the exchanger through RFID technology.

- Base. The base is mainly used to complete the connection between the unit locker and the interactive terminal, and to charge the unit locker.

5. Circular Folding Express Box Design

5.1. Express box design

The main body of the express box is a rectangular structure, with a transparent card slot for placing the express bill on the front, and the box cover is equipped with an intelligent tag, which is composed of GPS interface and RFID tag It is composed of network interface, which can read and locate the data range of the box in real time[7]. The express box adopts the design of the "plug-in" ring lock, which does not need to be packed with tape. It not only realizes the safety management of the whole process of goods delivery but also saves resources. The box cover is serrated and closely matched. The box adopts a foldable design and can be formed without any auxiliary tools.

5.2. Size Design

Combined with the express market demand for express packaging specifications, we will express a small box design for three specifications[8],360 x 300 x 250MM, 530 x 320 x 230MM, 700 x 400 x 320MM. Customers can choose the corresponding express box according to their own needs. The courier box is interspersed with a connecting rod on six sides, the connecting rod perforates in the middle, and the card pin is secured. This design makes the courier box structure firm and not loose.

5.3. Express box materials

The function of express packaging is mainly to protect the items from damage and safety. The courier
box will use a PP honeycomb plate material.

6. Conclusions
Based on the current situation of the development of the express industry in China, this paper studies the efficiency of express delivery and the problems in the development of community green ecological logistics. This paper puts forward the view of "community postal mode and the circular express box", that is, to set up an express station in the community and put all express companies' express into the intelligent express cabinet, in order to realize contactless distribution, and green recycling of express packages. The study responds to the call of the state post office during the outbreak, avoiding direct contact between couriers and recipients and reducing the risk of personal contact. Through the establishment of recycling system and the use of corresponding recycling equipment, the recycling of express packaging in the community can be realized to save social resources and protect the social environment.

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