



# Case Study Research on Urban Logistics and Last Mile Delivery Processes in China

– A Case Study of Suzhou

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## Abbreviations

BSHT	A parcel delivery enterprise named Baishihuitong Express
B2B	Business-to-Business
B2C	Business-to-Customer
CFLP	China Federation of Logistics & Purchasing
C2C	Customer-to-Customer
DHL	A parcel delivery enterprise named DHL Express
EMS	A parcel delivery enterprise named Express Mail Service
FedEx	A parcel delivery enterprise named FedEx Express
GDP	Gross Domestic Product in RMB
MOT	Ministry of Transport of the People's Republic of China
OCR	Optical Character Recognition
RFID	Radio Frequency Identification
SF	A parcel delivery enterprise named Shunfeng Express
SPB	State Post Bureau of the People's Republic of China
STO	A parcel delivery enterprise named Shentong Express
UPS	A parcel delivery enterprise named United Parcel Service
US	United States
YD	A parcel delivery enterprise named Yunda Express
YoY	Year-on-year basis
YTO	A parcel delivery enterprise named Yuantong Express
ZTO	A parcel delivery enterprise named Zhongtong Express

## Terminology of Postal Industry

**Postal Industry:** Industry, which provides the posting and delivery services for the society as well as other services stipulated by the State, mainly including postal service and parcel service.<sup>1</sup>

**Postal Service:** Collective term for mail posting and delivery service, postal exchange service and other services provided by postal enterprises.<sup>1</sup>

**Parcel Service/Express Service/Courier Service:** Posting and delivery service fulfilled within the promised time limit.<sup>1</sup>

**Mail:** Posting and delivery by the postal enterprises, mainly including letter and postcard, parcel, remittance notice, newspaper and other printed matters.<sup>1</sup> Unit is pieces.

**Package:** Posting and delivery by the parcel delivery enterprises, mainly including letter and postcard, parcel, printed matter, etc.<sup>1</sup> Unit is pieces.

**Parcel:** Individually packaged item, its weight does not exceed 50 kg, the dimension of any side does not exceed 150 cm, and the sum of length, width and height does not exceed 300 cm. It is mainly delivered by postal enterprises and parcel delivery enterprises. Unit is pieces.

**Parcel Sorting Centre :** Site used for sorting, dispatching, exchange, transfer, delivery and other handling activities of package.

**Parcel Station/Express Station/Courier Station:** Station used for last mile delivery.

**Intelligent Parcel Locker:** Self-service device which is set up in the public place and is available for the delivery by parcel delivery enterprises and for the package pickup by the customers.<sup>2</sup>

**Box:** Independent minimum unit for package storage in the intelligent parcel locker.<sup>2</sup>

**Box-group:** A cabinet composed of a row or several rows of boxes. The intelligent parcel locker can contain multiple box-groups.<sup>2</sup>

**Notes:** The content of this report does not include the postal service, only the parcel delivery service.

(1). The postal service refers to the ordinary postal service provided by the postal company. At present, China's B2B, B2C and C2C do not use the postal service, but they are fulfilled through the parcel delivery service. The postal service is limited to some commercial letters, newspaper subscription and other contents.

(2). The parcel delivery service is the door-to-door commercial posting and delivery service with full market competition and deadline guarantee. The statistical data about "parcel delivery" in this report does not include "postal".

(3). In Germany, **parcel service** refers to the parcel delivery service in a broad sense, and **express service** refers to urgent "one-day express delivery". However, in China, **parcel service** not only includes the parcel delivery service, but also includes a part of postal service. Subject to the Chinese National Standard **Terminology of Postal Industry**, **express service** refers to the parcel delivery service in a broad sense, including "one-day express delivery". For the understanding consistency of Chinese and foreign readers, this report translates parcel service into express service in a broad sense. The relevant scope and data do not include postal service and data.

# 1. Development Status of Parcel Delivery Industry in China

With the constant acceleration of China's urbanisation process and accelerated transformation of the urban commercial circulation mode, especially the rise of e-commerce, China's parcel delivery industry maintains rapid development. The diversified and individualised logistics need grow continuously. Residents have increasingly high expectations for timeliness and convenience of urban logistics and last mile delivery service.

## 1.1 Development Status of E-Commerce in China

In 2019, the scale of China's e-commerce market was continuously leading in the world, and the service capacity and application level further improved. China's netizens exceeded 900 million and the internet penetration rate was 64.5%. China's e-commerce transaction amount reached RMB 34.81 trillion, and the online retail amount (including physical commodity and non-physical commodity) reached RMB 10.63 trillion, up by 16.5% on a year-on-year basis.<sup>3</sup> Figure 1-1 shows the scale of China's e-commerce transactions from 2011 to 2019.

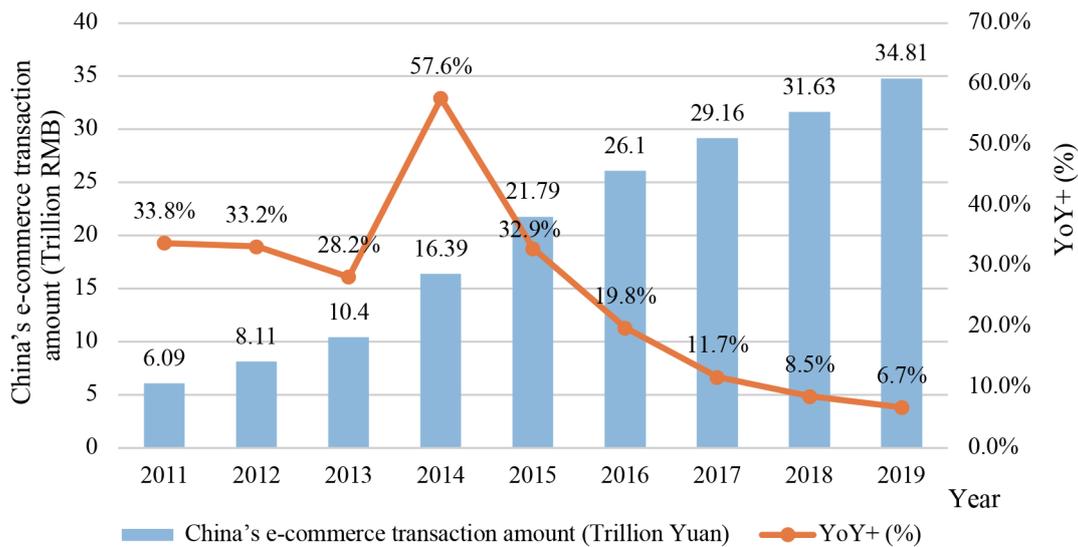


Figure 1-1: Scale of China's E-commerce Transactions from 2011 to 2019<sup>3</sup>

## 1.2 Development Status of Parcel Delivery Industry in China

### (1) Overall Situation

In 2019, the business scale and business revenues of China's parcel delivery industry reached a record high. The parcel delivery business volume was 63.52 billion pieces, and the business income was RMB 749.78 billion, up by 25.3% and 24.2% on a year-on-year basis, and 17.3 times and 9.9 times of those in 2011 (Figure 1-2).<sup>4</sup> According to the annual global parcel delivery index of Pitney Bowes, China's parcel delivery business volume has ranked first in the world for five consecutive years, more than four times of the second place (US), accounting for more than 60% of global parcel delivery business volume.<sup>5</sup>

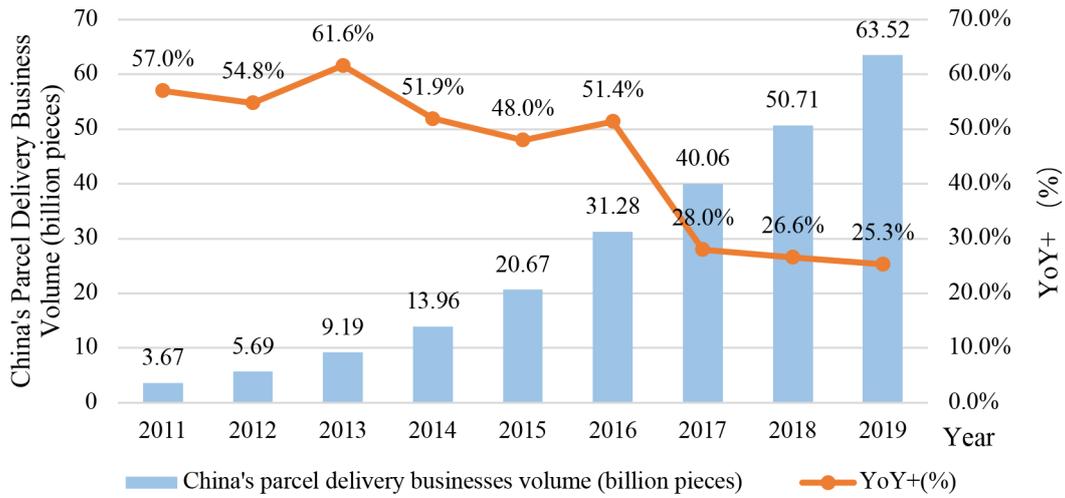


Figure 1-2: China's Parcel Delivery Business Volume from 2011 to 2019<sup>4</sup>

**(2) Business Structure Analysis**

From the scope of the parcel delivery business, in 2019, the average intra-city business volume was 11.04 billion pieces, the cross-region business volume was 51.05 billion pieces, and international (including Hong Kong, Macao and Taiwan) parcel business volume totaled 1.44 billion pieces. The intra-city, cross-region, international parcel business volume accounted for 17.4 %, 80.4 % and 2.2 % of the total respectively.<sup>4</sup>

From the perspective of regional development, a “more in the East and less in the West” development situation occurs. In 2019, the proportion of parcel delivery business in the Eastern, central and Western regions was 79.7 %, 12.9 % and 7.4 % respectively, and the proportion of parcel delivery business income was 80.2 %, 11.3 % and 8.5 % respectively.<sup>5</sup>

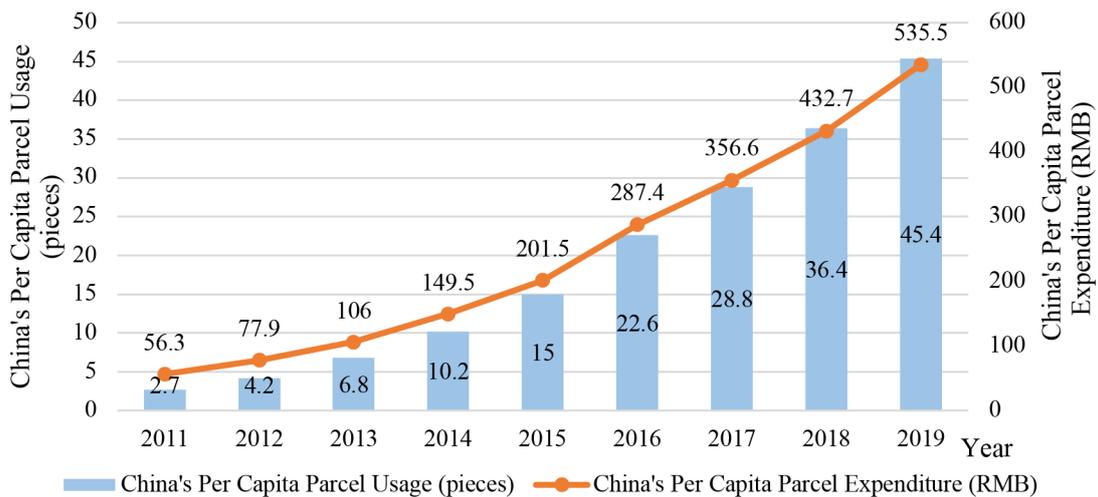


Figure 1-3: China's Per Capita Parcel Usage and Per Capita Parcel Expenditure from 2011 to 2019<sup>4</sup>

According to the analysis of per capita parcel usage, China's per capita parcel usage <sup>①</sup> in 2019 was 45.4 pieces/person, up by 24.7 % on a year-on-year basis, and 16.8 times of that in 2011. The per capita parcel expenditures were RMB 535.5, up by 23.7 % on a year-on-year basis, and 9.5 times of those in 2011. <sup>④</sup> Figure 1-3 shows China's per capita parcel usage and per capita parcel expenditure from 2011 to 2019.

### (3) Market Share Analysis of Major Parcel Delivery Enterprises

The service enterprises in China's parcel delivery market are mainly divided into three categories: 1) Private enterprises, including ZTO, YD, YTO, BSHT, STO, SF; 2) State-owned enterprise, namely, EMS; 3) Foreign-funded enterprises, including DHL, UPS, FEDEX, etc. The proportion of business volume of private enterprises, state-owned enterprises and foreign-funded enterprises in the market is 88.8 %, 10.8 % and 0.4 % respectively. <sup>④</sup> ZTO has the largest market share.

The China Parcel Service Brand Concentration Index (CR8) <sup>②</sup> was 82.5 % in 2019 (Figure 1-4), up by 1.3 percentage points on a year-on-year basis. The market share of top parcel delivery enterprises has thus further increased.

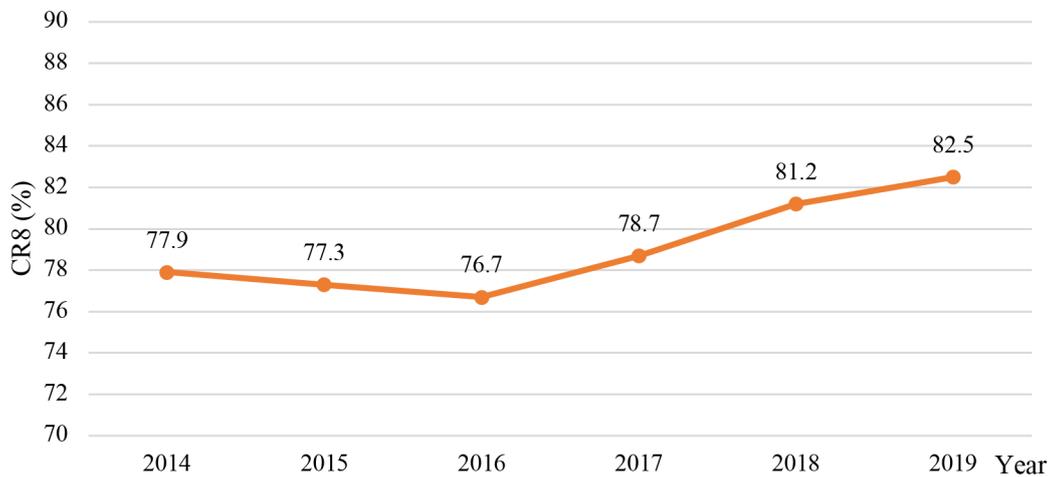


Figure 1-4: Changes in China Parcel Service Brand Concentration Index (CR8) from 2014 to 2019

### (4) Parcel Delivery Vehicles

As for China's parcel delivery, the intercity trunk line transportation is achieved through roadway primarily. It can be divided into two main development stages: The first stage is from 2011 to 2016. With the high-speed growth of parcel business volume, the parcel transportation vehicles grew accordingly. The second stage is from 2017 to 2019. The development strategy of parcel delivery enterprises shifted from expansion of vehicle scale to optimisation of stock. Through the optimisation of the organisational mode, the transportation efficiency has improved. New energy freight vehicles are actively used, and the model structure is constantly optimised. In 2019, China's express parcel delivery vehicles volume was 237,000 vehicles, notably 2.5 times of that in 2011 (Figure 1-5).

<sup>①</sup> China's per capita parcel usage =  $\frac{\text{China's parcel business volume}}{\text{China's total population}}$

<sup>②</sup> China Parcel Service Brand Concentration Index (CR8): the proportion of sum of business volume of Top 8 parcel delivery enterprises in China's parcel business volume (unit is %). It is used to reflect the changes in the concentration of China's parcel delivery market.

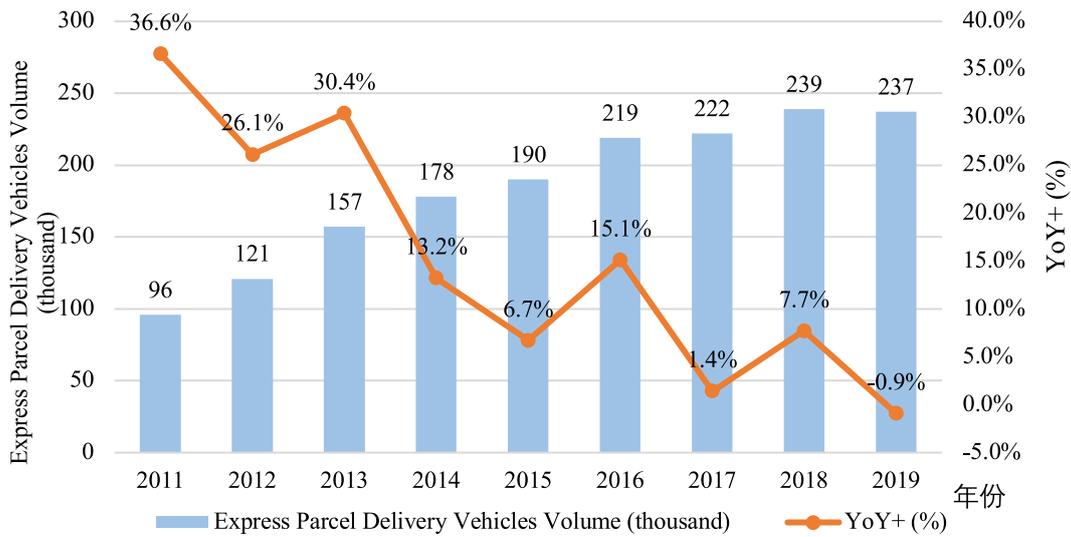


Figure 1-5: China's Parcel Delivery Vehicles Volume from 2011 to 2019<sup>6</sup>

### 1.3 Status of China's Parcel Delivery Industry Governance System

The development of the parcel delivery industry involves many stakeholders. From the perspective of government responsibilities (Table 1-1), it mainly involves the postal administration department (directly responsible for the administration of the parcel delivery industry), the transportation management department (mainly responsible for construction and operation of transportation infrastructure), the public security department (mainly responsible for vehicle management and traffic management) and the commerce department (mainly responsible for business circulation, warehouse logistics).

Table 1-1: Relevant Regulatory Departments and Main Responsibilities of China's Parcel Delivery Industry

Government Department of the State	Relevant Main Responsibilities
State Post Bureau of the People's Republic of China	The State Post Bureau of the People's Republic of China vertically manages the postal administration of provinces. The provincial postal administration vertically manages the postal administration of cities, and the municipal postal administration is the direct supervision subject of local postal and parcel delivery business. Main responsibilities include: ① Implementation of postal laws and regulations, guidelines, policies and postal service standards of the State; ② Research and formulation of postal development planning and relevant policies; ③ Supervision and management of the postal and parcel delivery market; ④ Responsibility for the industrial work safety supervision, statistics; ⑤ Other matters.
Ministry of Transport of the People's Republic of China	① Implementation of relevant transportation guidelines, policies, laws and regulations of the State; ② Research and formulation of transportation related development planning and policies; ③ Supervision and management of road transportation enterprises; ④ Operation of transportation infrastructure construction; ⑤ Other matters.
The Ministry of Public Security	Responsibility for the road public security management, traffic safety, traffic order, vehicle, driver management and traffic management.
The Ministry of Commerce	① Promotion of the development of commerce and trade logistics; ② Promotion of green circulation development; ③ Other matters.

In addition to government departments, China has established the China Express Association, China Federation of Logistics & Purchasing (CFLP), and other national non-profit social organisations to enhance the exchange and cooperation between enterprises and between enterprises and the government, and promote self-discipline in the parcel delivery industry.

In terms of the policy system, China has promoted the standardised and healthy development of China's parcel delivery industry through multiple dimensions such as laws, regulations, development plans, and policy standards. The representative documents are shown in Table 1-2.

Table 1-2: Content and Interpretation of Typical Documents in China's Parcel Delivery Industry

Category	Document Name	Year	Printed and Issued by	Content and Interpretation
Laws and regulations	The Postal Law of the People's Republic of China	2015	Standing Committee of the National People's Congress	<p>The current version is the version after the amendment was passed on April 24<sup>th</sup>, 2015.</p> <p>Only the enterprise which obtains the parcel operation license can carry out relevant business. Besides, the requirements for applying for the parcel operation license are specified.</p>
	The Interim Regulations for Parcel	2018	The State Council	<p>It is China's first specific administrative regulation for the parcel delivery industry.</p> <p>The supervision and management matters in the parcel delivery industry are put forward, mainly including development guarantee, business entity, parcel delivery service, parcel delivery safety, supervision and inspection, legal liability. This document provides guarantee for the safety of parcel deliveries, and protects the legitimate rights and interests of parcel users.</p> <p>Regarding the last mile delivery service, the enterprise which operates the parcel delivery service should deliver the package to the specified receiving address, and inform the addressee or the agent of conducting the acceptance personally; the addressee or the agent has the right to conduct the acceptance personally. The service rights and interests of consumers to enjoy door-to-door delivery are guaranteed.</p>
Development planning and policy	The Outline of Comprehensive National Transport Network Planning	2021	The Central Committee of the Communist Party of China, the State Council	<p>Such document is an action guide for China's transportation sector to accelerate the construction of transportation power and serve the comprehensive construction of a socialist modernisation country at present and for a period of time in the future</p> <p>By 2035, the energy consumption per unit of transportation turnover is expected to constantly decrease, CO2 emission intensity will decline remarkably compared with 2020, and the traffic pollution prevention and control will reach the advanced level in the world.</p>

	The Action Outline for Building a Powerful Postal Country	2020	State Post Bureau of the People's Republic of China	<p>By 2035, the posting and delivery time limit of "1 day for key city in China, 3 days for main city in the surrounding country, and 5 days for main city worldwide" will be achieved.</p> <p>The quality of service for people's livelihood will be improved, and the development of new forms and models of business will be accelerated. The scientific and technological innovation will be accelerated, the application of key technologies (such as artificial intelligence, block chain, etc.) will be expanded. The construction of green postal service will be accelerated, and the green development level will be promoted.</p>
	Several Opinions of the State Council on Promoting the Development of Parcel Delivery Industry	2015	The State Council	<p>Such document is the first national programmatic document for comprehensively instructing the development of the parcel delivery industry.</p> <p>After the implementation of the document, the business environment has been further optimised, the growth of national parcel delivery enterprises has accelerated, and the market scale has continued to expand.</p>
	The Opinions on Boosting the Coordinated Development of E-commerce and Parcel Logistics	2018	The General Office of the State Council	<p>Such document aims to improve the coordinated development of e-commerce and the parcel delivery. The parcel delivery infrastructure, delivery traffic management, service capacity, standardisation and intelligence, green and ecological development and other aspects are further optimised to promote the development of parcel delivery enterprises.</p>
	Three-year Action Plan for "Green Postal Service"	2018	State Post Bureau of the People's Republic of China	<p>The development paths and work measures for energy saving and emission reduction in the postal parcel delivery industry are specified, mainly including laws, regulations, standards, packaging product and production operation.</p>
	The Opinions on Accelerating the Green Transformation of Parcel Packaging	2020	8 departments, including the National Development and Reform Commission, and State Post Bureau of the People's Republic of China	<p>By 2025, e-commerce packages will achieve no secondary packaging, and the application scale of recyclable parcel packaging will reach 10 million pieces. New forms and models of business of packaging reduction and green recycling will make significant progress, and the parcel packaging will advance the green transformation.</p> <p>Based on the actual situation of China's parcel packaging industry, this document further strengthens the green governance of parcel packaging, it enhances the standard management of e-commerce parcel delivery, increases the green product supply, cultivates the new mode of cyclic packaging, and overall carries forward the "green revolution" of parcel packaging.</p>

Standards and specifications	The Opinions on Enhancing the Implementation Supervision of National Standard for Electric Bicycle	2019	The State Administration for Market Regulation, the Ministry of Industry and Information Technology, the Ministry of Public Security	Subject to the Safety Technical Specification for Electric Bicycle (GB17761-2018), the parcel delivery and takeaway service enterprises are driven to uniformly design and purchase special electric bicycles for delivery. The special electric bicycle should meet the new standard, use the widely recognised special paints, and have a formal license.
	Recommended Standards for Production and Operation in the Postal Parcel Delivery Industry during the Period of Prevention and Control of the Pandemic	2020	State Post Bureau of the People's Republic of China	Such document stipulates the production operation process of the postal parcel delivery industry during the epidemic prevention and control period, mainly including prevention work, prevention management of parcel stations, the zone-based and hierarchical prevention, etc.  It ensures that China's parcel delivery services continue to operate normally during the epidemic.
	The Standard for Green Packaging of Mail and Package	2020	State Post Bureau of the People's Republic of China	The selection and standard operation requirements of envelope, packaging box, packaging bag and other packages are detailed. The explicit provisions are laid down for eliminating mail and packages with heavy metal and specific substance exceeding the standard, and for enhancing plastic pollution control in the industry.

## 2. Case Study—Social and Economic Development of Suzhou

### 2.1 City Profile

Located in the middle of the Yangtze River Delta Region of China, and Southeast of Jiangsu Province (Figure 2-1), Suzhou covers an area of 8,657.32 km<sup>2</sup>, with 4 county-level cities and 6 administrative districts under its jurisdiction (Table 2-1).<sup>7</sup>



Figure 2-1: Location Map of Suzhou

Table 2-1: Administrative Divisions of Suzhou<sup>7</sup>

Area	Level	Land area (km <sup>2</sup> )
Downtown	-	4652.84
#Gusu District	administrative district	83.42
#Industrial Park	administrative district	278.19
#High-tech Zone	administrative district	332.37
#Wuzhong District	administrative district	2231.46
#Xiangcheng District	administrative district	489.96
#Wujiang District	administrative district	1237.44
Kunshan	county-level city	931.51
Taicang	county-level city	809.92

Changshu	county-level city	1276.32
Zhangjiagang	county-level city	986.73
Total		8657.32

## 2.2 Population Size

At the end of 2019, Suzhou's permanent population was 10.75 million (Figure 2-2), an increase of 0.3 % over the previous year, and the population density reached 1,241 inhabitants/km<sup>2</sup>. The permanent population in the urban area of Suzhou was 5.577 million, up 0.3 % over the previous year, and the population density reached 1,972 inhabitants/km<sup>2</sup>.<sup>7</sup> The current population density distribution of Suzhou is shown in Figure 2-3.

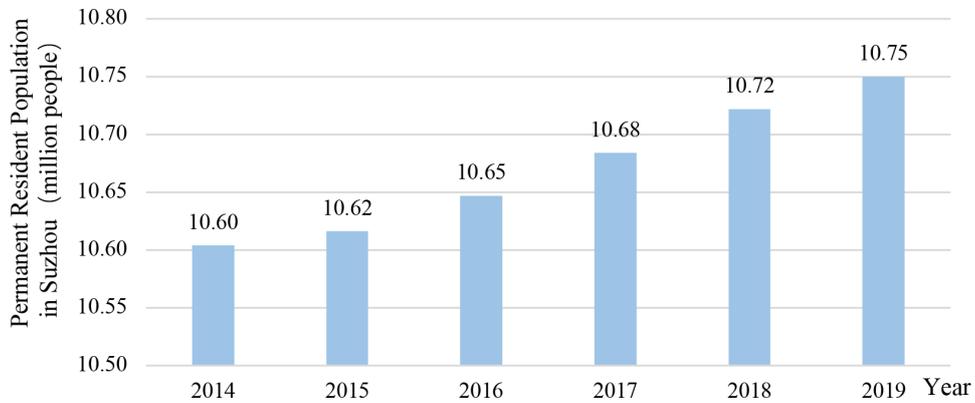


Figure 2-2: The Development of Permanent Resident Population in Suzhou from 2014 to 2019<sup>7</sup>

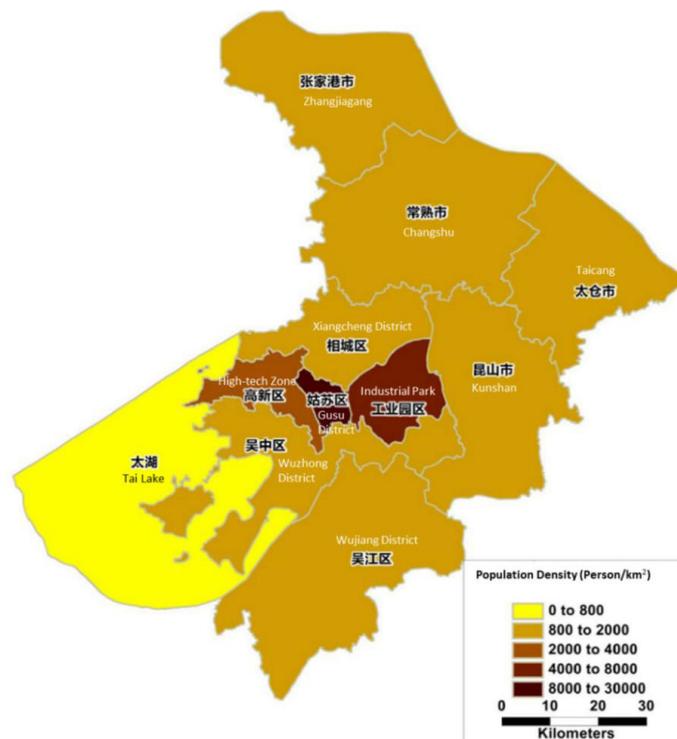


Figure 2-3: Current Population Density Distribution of Suzhou (inhabitants/km<sup>2</sup>)<sup>7</sup>

## 2.3 Social Economy

At the end of 2019, Suzhou achieved a regional GDP of RMB 1.92 trillion (Figure 2-4), ranking the sixth among Chinese cities and first in Jiangsu Province. In terms of comparable prices, it increased by 5.6 % on a year-on-year basis. The annual import and export volume of Suzhou reached 319.1 billion US dollars, accounting for 7 % of China's total foreign trade value, 51 % of Jiangsu Province's total foreign trade value, and ranking fourth among Chinese cities. The total industrial output value above designated size of Suzhou was RMB 3.34 trillion, and the industrial value-added rate increased by 0.5 %, ranking third among Chinese cities.<sup>7</sup>

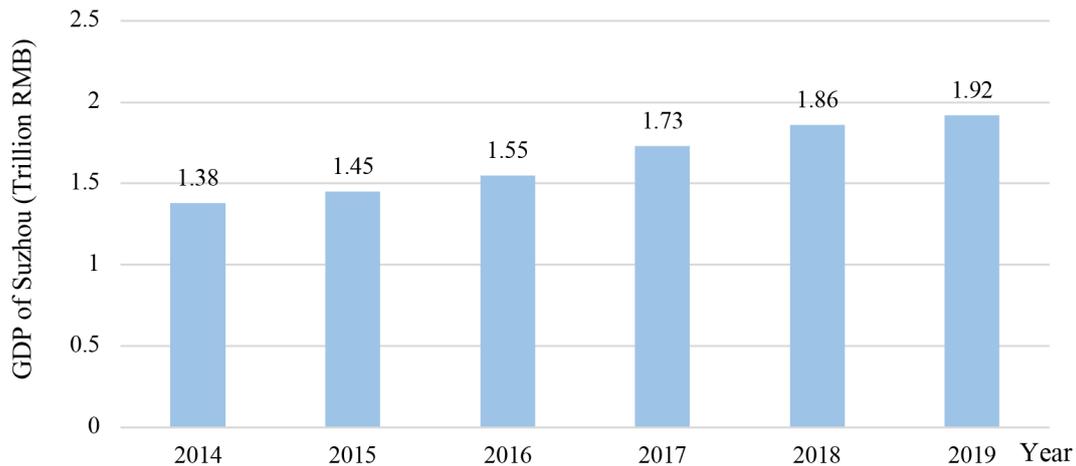


Figure 2-4: Changes in Suzhou's GDP from 2014 to 2019 (Trillion RMB)<sup>7</sup>

According to the sample survey, the average disposable income per capita of permanent residents in Suzhou was RMB 60,100 (Figure 2-5), an increase of 8.4 % over the previous year. The per capita consumption expenditure of residents was RMB 35,400, an increase of 6.3 % over the previous year.<sup>7</sup>

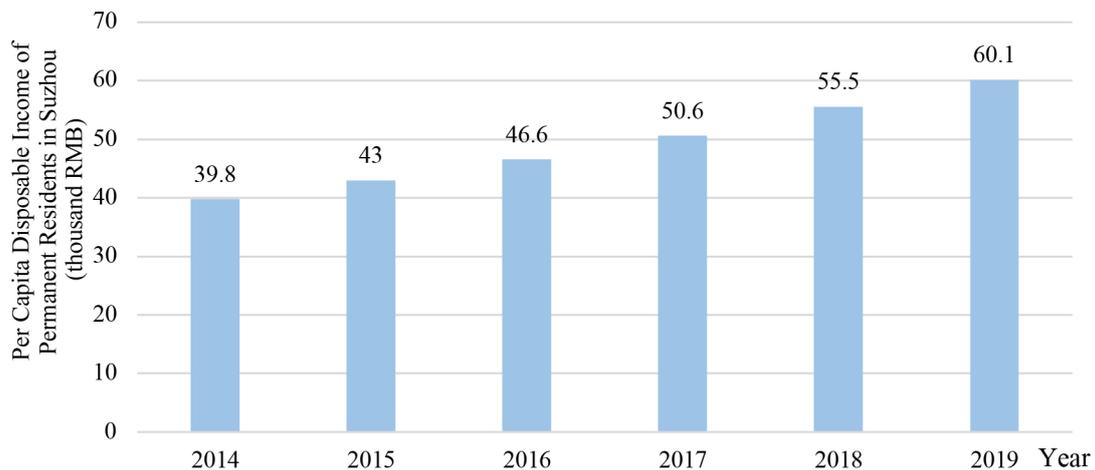


Figure 2-5: Changes in Per Capita Disposable Income of Permanent Residents in Suzhou from 2014 to 2019 (Thousand RMB)<sup>7</sup>

## 2.4 Transportation Infrastructure

By the end of 2019, the total roadway mileage of Suzhou has reached 11,818 kilometres, with highway density of 139.2 kilometres per 100 square kilometres. The total mileage of freeway reached 608 kilometres, which allows for rapid external collection and distribution transportation of transit freight, cities and ports.

There are 21 general national and provincial trunk highways in Suzhou (as shown in Figure 2-6), with a total mileage of 1,210 kilometres. These corridors connect the urban and surrounding areas and meet the external freight transportation demand.<sup>7</sup>



Figure 2-6: Current Layout of Suzhou's Road Freight Corridor

## 2.5 Travel Mode

Driven by population and economic growth, the travel demand continues to grow. In 2018, the average daily travel volume of residents in Suzhou reached approximately 16.17 million trips, a year-on-year increase of 1.68%. On average residents undertook 2.42 trips per day, an increase of 0.5% on a year-on-year basis.<sup>8</sup> The proportion of flexible trips for entertainment, leisure and catering increased. The travel vitality of residents has continuously improved. Figure 2-7 shows the proportion of travel modes of Suzhou's urban residents in 2018.

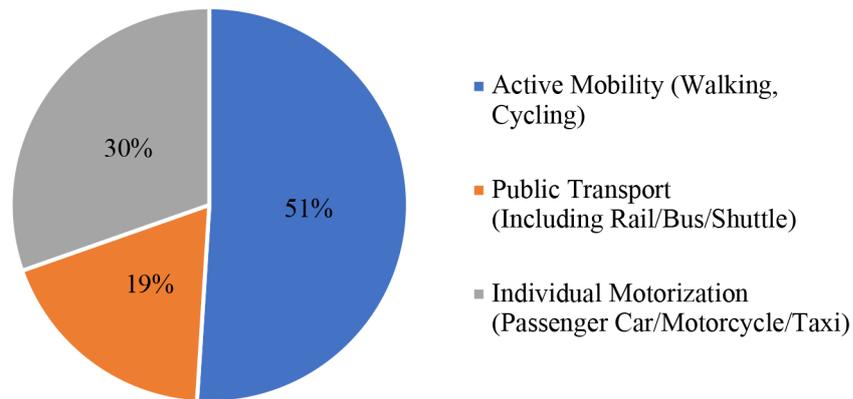


Figure 2-7: Proportion of Travel Modes of Suzhou's Urban Residents in 2018<sup>8</sup>

## 2.6 Development of Internet and E-commerce

By the end of 2019, the mobile internet subscribers of Suzhou reached 16.595 million, including 9.492 million in urban areas. Meanwhile, fixed broadband subscribers reached 6.457 million, including 3.301 million in urban areas.<sup>7</sup>

In 2019, Suzhou achieved online retail sales of RMB 262.57 billion, a year-on-year increase of 26.6%. The online retail volume of Suzhou was 8.74 billion pieces, a year-on-year increase of 23%.<sup>7</sup> At the same time, a new type of retail is booming, represented by RT Supermarket and Auchan Supermarket. For the new retail, customers use APPs as the online portal. After ordering, the products are delivered from nearby stores as soon as possible. In 2019, there were 44 new retail stores of Alibaba Group in Suzhou, ranking fourth among Chinese cities. The new retail scale of Alibaba Group in Suzhou accounts for 7.3% of the retail sales of Alibaba's new retail network nationwide, ranking second among Chinese cities.

During the COVID-19 pandemic, consumer intent to shop online has continued to increase, as the demand for "intelligence", "innovation" and "health" has soared. New types of personalised and customised consumption (such as live streaming e-commerce, online education, and Internet medical services) have greatly expanded the consumption scenario and contributed to the further development of the platform economy.

### 3. Development of Parcel Delivery Industry and Last Mile Delivery Service in Suzhou

#### 3.1 Overview of Suzhou's Parcel Delivery Industry

With the rapid growth of e-commerce business of online shopping, consumer spending continues to increase, and the scale of parcel delivery industry in Suzhou expands constantly. In 2019, the parcel business volume of Suzhou was 1.73 billion pieces (Figure 3-1), increased by 39 % on a year-on-year basis, and ranking seventh among Chinese cities. The parcel business revenues were RMB 21.68 billion, and increased by 39 % on a year-on-year basis.<sup>9</sup>

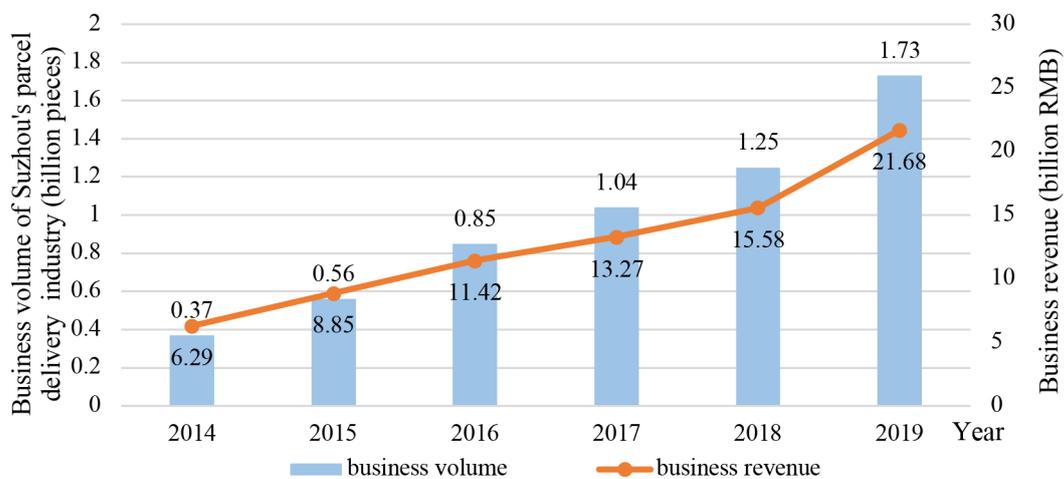


Figure 3-1: Business Volume and Revenue of Parcel Delivery Industry in Suzhou from 2014 to 2019<sup>9</sup>

The annual per capita parcel usage of Suzhou was 161.1 pieces, which doubled from 80 pieces in 2016. The annual per capita parcel expenditure of Suzhou was RMB 2,017.2.<sup>9</sup> CR8 index was 79.76. The top eight parcel delivery enterprises in terms of business volume are YTO, JD, ZTO, YD, SF, BSHT, EMS and STO.<sup>10</sup>

According to the statistical analysis of the Suzhou Post Administration, the proportion of parcel collection and delivery volume per day is mostly concentrated in 51-200 pieces/day (Figure 3-2), among which 101-150 pieces/day account for the highest proportion.<sup>11</sup>

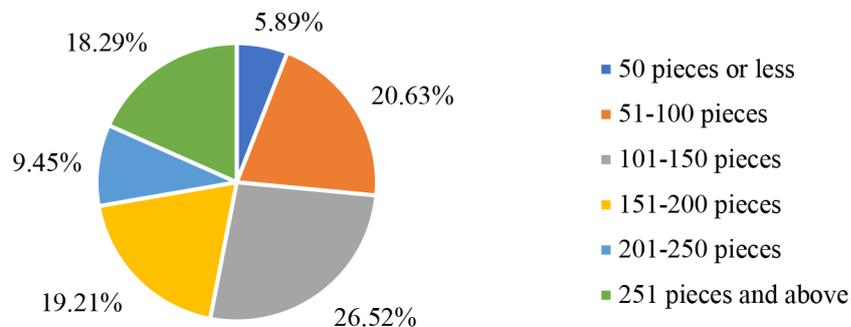


Figure 3-2: Proportion of Daily Parcel Collection and Distribution Volume for Courier<sup>11</sup>

At present, Suzhou couriers dispatch is on average more than two times a day (Figure 3-3), and the quantity of packages each vehicle loads is mostly more than 40 - 120 pieces (Figure 3-4).<sup>11</sup>

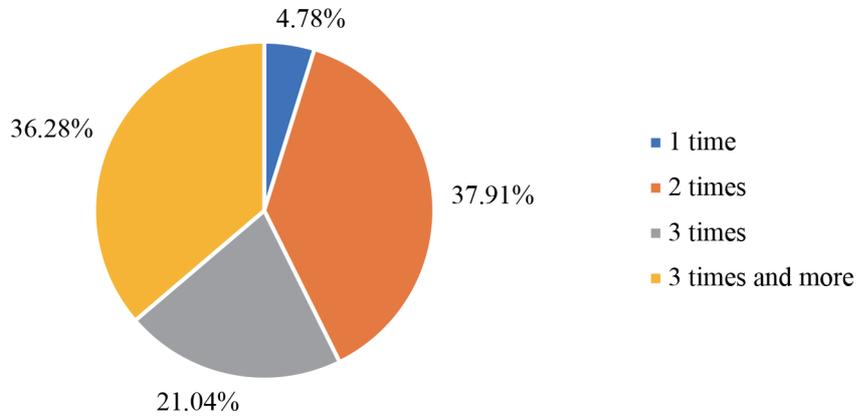


Figure 3-3: Proportion of Daily Packages Delivery Frequency for Courier<sup>11</sup>

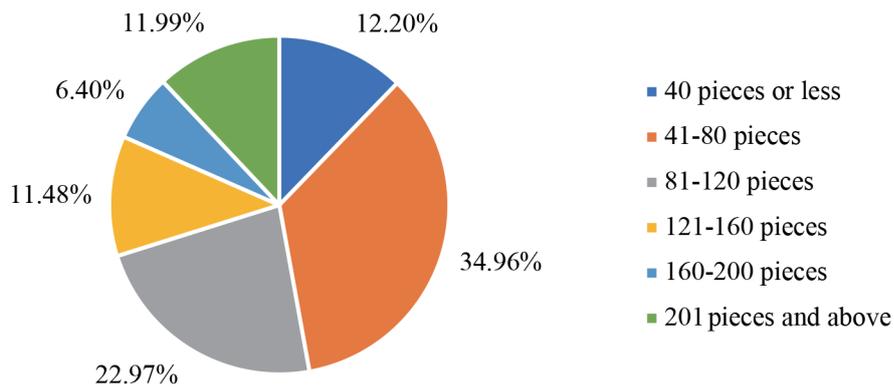


Figure 3-4: Proportion of Loading Quantity for Each Delivery for Courier<sup>11</sup>

In addition, effected by the COVID-19 epidemic, “contactless delivery” has been developing rapidly. Real-Time Delivery has shifted from catering delivery dominated to fresh food, fruits, flowers, office supplies, medicines, housekeeping, home maintenance, etc. In the future, following the accelerated layout of central warehouses, front warehouses, mini stores and offline stations of parcel delivery enterprises, retail enterprises and Internet enterprises, there will be a huge market space for the development of Real-Time Delivery.

### 3.2 Policies of Suzhou’s Parcel Delivery Industry

In accordance with the requirements of the “Postal Law of the People’s Republic of China” (Revised in 2015) and the “Interim Regulations on Parcel delivery”, Suzhou has strengthened the supervision and management of the parcel delivery industry. Both compulsory and encouragement policies are launched to promote the standardised development of the parcel delivery industry in Suzhou, and to further create a good business environment. Table 3-1 shows the relevant policies for the development of the parcel delivery industry in Suzhou.

Table 3-1: Relevant Policies for the Development of Parcel Delivery Industry in Suzhou

Type	Document Name	Year	Department of Printing and Issuance	Content and Interpretation
Compulsory	The Implementation Opinions on Standard Management of Special Electric Tricycle of Postal Parcel Delivery	2017	The Public Security Bureau, the Transportation Bureau, and Postal Administration of Suzhou	For the purpose of improving the traffic order of delivery vehicles of urban posting and delivery, the filing system of special electric tricycle of postal parcel delivery is implemented.
	The Working Opinions on Further Enhancing the Safety Management of Posting and Delivery Channels of Suzhou	2017	The Public Security Bureau and Postal Administration of Suzhou	This document aims to enhance the safety management of postal and parcel delivery enterprises in Suzhou, to guarantee the posting and delivery safety of mail and package, and to establish the long-acting supervision mechanism for the safety of posting and delivery channel.
	The Announcement on Traffic Management of Diesel Truck of National III and Below Emission Standard	2019	The People's Government of Suzhou	To reduce the environmental pollution, the diesel trucks with National III and below emission standard are banned from entering the ancient town all day.
Encouragement	Several Opinions of Suzhou on Boosting the Coordinated Development of E-commerce and Parcel Logistics	2019	The Office of the People's Government of Suzhou	Financial and land support are provided, mainly including the parcel end facilities, standardised outlets, rural parcel demonstration projects, intelligent equipment, safe equipment and green recycling bin devices, to further optimise the development environment.
	The Measures for Reward and Subsidies on Green Freight Vehicle Operation of Suzhou	2019	The Transportation Bureau and the Finance Bureau of Suzhou	Subsidies are provided to Suzhou urban green freight delivery enterprises with qualified new energy delivery vehicles. The subsidies will be given according to different models, and travel distance. The maximum amount of rewards and subsidies for single vehicle reaches RMB 28,000.
	The Guiding Opinions on Accelerating the Postal and Parcel Cooperation of Suzhou in the Countryside and Village	2020	Postal Administration of Suzhou	With the goal of establishing a parcel joint delivery system, this document encourages the integrated utilisation and planning of parcel delivery infrastructure, to build a high-quality, efficient and smooth delivery service network, reduce delivery costs, better meet rural consumer demand, and promote the development of rural e-commerce.

The development strategy of Suzhou's parcel delivery industry focuses on four main aspects.

### 3.2.1 Promoting the Integrated Warehouse and Distribution Service

Integrated warehouse and distribution refer to providing integrated supply chain solutions and overall logistics services for warehousing, transportation, delivery, packaging and other links of trade circulation enterprises and manufacturing enterprises. The integrated warehouse and distribution pattern simplify logistics operations in the process of commodity circulation, shorten delivery cycles, improve logistics efficiency, promote seamless connection of entire business processes, realise real-time tracing and positioning for commodities, and reduce error rates of logistics operations. Meanwhile, the integrated warehouse and distribution pattern can diminish procedures of cargo turnover

processes, to reduce the logistics fees and cargo damage rates. The service processes can be customised according to the nature and demand of the supply chain.

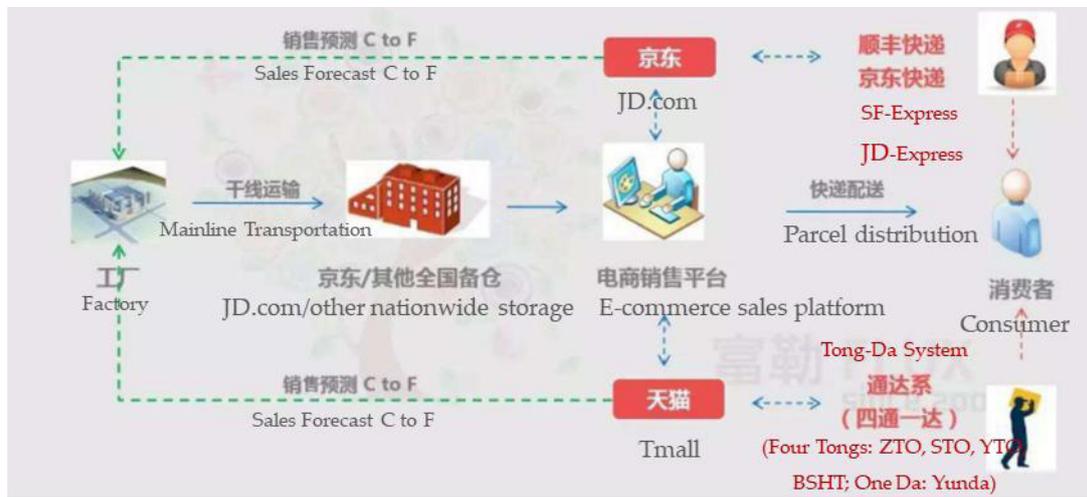


Figure 3-5: Schematic diagram of Integrated Warehouse and Distribution Service

Through the issuance of the “*Implementation Opinions on Promoting the Coordinated Development of E-commerce and Parcel Delivery Logistics*” and the “*Implementation Opinions on Promoting the Deep Integration of the Parcel Delivery Industry and Manufacturing Industry*”, Suzhou Government actively pushes integrated warehouse and distribution, encourages and supports the development of collaborative integration and mutual benefit between the parcel delivery industry, e-commerce and manufacturing industry. By the end of 2019, there were 52 key projects of integrated warehouse and distribution, including 2 projects with an annual volume of more than 30 million pieces and 8 projects with an annual volume of more than 5 million pieces, with a cumulative annual service volume of 180 million pieces and the output value of RMB 43.3 billion.<sup>12</sup> The integrated warehouse and distribution greatly reduce the cost of warehousing and logistics operations.

### 3.2.2 Promoting the Urban and Rural Joint Distribution

Urban and rural logistics distribution focuses on solving the problem of two-way collection, allocation and delivery for industrial products, agricultural materials, mass consumer products and agricultural products between the city and countryside.

Suzhou actively explores and builds the “county-township-village” three-level logistics system based on joint distribution of Transportation-Postal cooperation, Parcel-Parcel cooperation, Parcel-Postal cooperation, Parcel-Agriculture cooperation and other cooperation modes.

(1) The Transportation-Postal cooperation mode means to solve the problem of last mile delivery in rural areas by integrating the resources of the transportation industry and the postal industry. It is conducive to the income-generating of rural passenger transport, city-entering of agricultural products, and reduction of logistics cost. Suzhou uses the rural passenger transport network to convey mails and packages (Figure 3-6). For example, the urban distribution company under Suqi Group worked with parcel delivery enterprises to ensure the transportation of 110 branch lines, which alleviated the transportation pressure of the parcel delivery enterprises.



Figure 3-6: Parcel Delivery by Bus

(2) Parcel-Parcel cooperation and Parcel-Postal cooperation refer to the joint delivery of different parcel delivery enterprises and postal delivery enterprises. The mails and packages belonging to different delivery enterprises but with the same destination will be integrated and delivered to rural stations. Thus, the problem of low income and high cost in rural parcel delivery can be effectively improved by the Parcel-Parcel cooperation and Parcel-Postal cooperation.

### 3.2.3 Promoting the Development of Technological Innovation

Focusing on packages sorting and transportation monitoring, Suzhou expedites the application of big data, artificial intelligence, the Internet of Things (IoT), 5G and other modern information technology, to improve delivery efficiency and supervision level.

Firstly, the distribution centres are encouraged to introduce automatic sorting equipment to improve processing capacity. Advanced equipment such as automated loading and unloading, intelligent equipment and intelligent parcel lockers are widely used to improve distribution efficiency. Some key technologies such as intelligent label recognition, package tracking and positioning, mobile information services and visual location services are used to enhance the transparency of parcel distribution services, and make the whole process more trackable. At present, all parcel sorting centres with certain scale in Suzhou are equipped with automated sorting devices.

Secondly, Suzhou's government has built a comprehensive supervision platform for the parcel delivery in Suzhou, which can effectively realise data sharing among departments at different levels and perform functions such as daily supervision and inspection management, instant message, vehicle management, etc.

### 3.2.4 Promoting the Green and Low-carbon Development

The Chinese Government attaches great importance to the green and low-carbon development. As resource constraint and environmental protection continue to increase, green development has become the consensus of the parcel delivery industry. Suzhou promotes the green and low-carbon development of the parcel delivery industry through carbon reduction measures in the key links including parcel packaging and delivery.

Firstly, the parcel packaging greenness is promoted. Suzhou has issued the "*Implementation Opinions on Further Enhancing the Green Packaging Management in the Parcel Delivery Industry*", to promote the standardisation, greenness, reduction and recyclability of parcel packaging. It mainly includes laws, regulations and standards for green packaging, supply of green packaging products, "reduce plan" of parcel packaging, cyclic utilisation of parcel packaging resource, and waste recycling system construction of parcel packaging. At present, the use rate of 45 mm adhesive tapes in Suzhou reaches 99.1 %, the rate of "no secondary packaging" of e-commerce package is 97.6 %, the use rate of reusable transit bag is 91.9 %, the setting rate of packaging waste recycling device is 88.38 %, and the use rate of electronic waybill is 100 %.<sup>12</sup>

Secondly, energy saving and emission reduction in the transportation and delivery processes are carried forward. Through the electrification of delivery vehicles, Suzhou has achieved the reduction of emission in the transport sector. In 2019, Suzhou issued the “*The Measures for Reward and Subsidies on Green Freight Vehicle Operation of Suzhou*”, to promote the new energy delivery vehicles. The subsidies are provided for the electric freight vehicles with annual travel distance reaching 10,000 km. At the same time, Suzhou government issued the “*Implementation Opinions of Suzhou on the Standardised Management of Electric Tricycles for Postal Parcel delivery*”, which regulates the management of Suzhou’s special electric tricycles for postal packages. Through a vehicle anti-counterfeiting hard license, tricycle pass record certificate, driver’s traffic safety activity card and a three-level information monitoring platform, Suzhou has established a vehicle management mode of total volume control, source control and road linkage. At present, a total of 13,900 certificates for electric tricycles have been issued.<sup>12</sup> Figure 3-7 shows the standardised electric tricycle and recycling packaging products for parcel delivery.



Figure 3-7: Standardised Electric Tricycle and Recycling Packaging Products for Parcel Delivery

### 3.3 Analysis of Relevant Economic Factors of Suzhou Parcel Delivery Industry

#### 3.3.1 Analysis of Operating Costs of Parcel Delivery Enterprises

In recent years, the unit price of parcel delivery has declined constantly, and its average unit price has dropped rapidly from 20.7 RMB/piece in 2011 to 11.8 RMB/piece in 2019 (Figure 3-8).<sup>14</sup> The ratio of total social logistics cost to GDP of Suzhou has dropped from 14.6 % in 2016 to 13.2 % in 2019 (Figure 3-9).

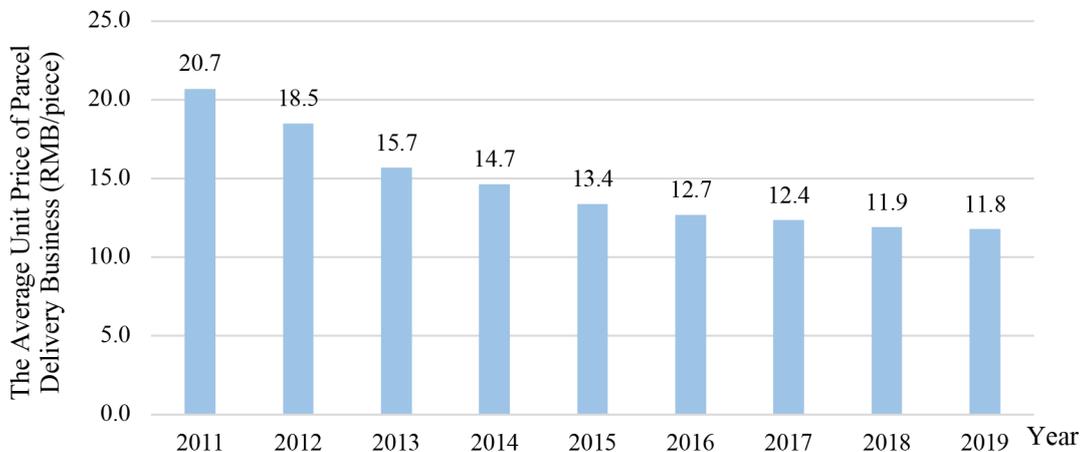


Figure 3-8: Changes in the Average Unit Price of Parcel Delivery from 2011 to 2019 (RMB/piece)<sup>14</sup>

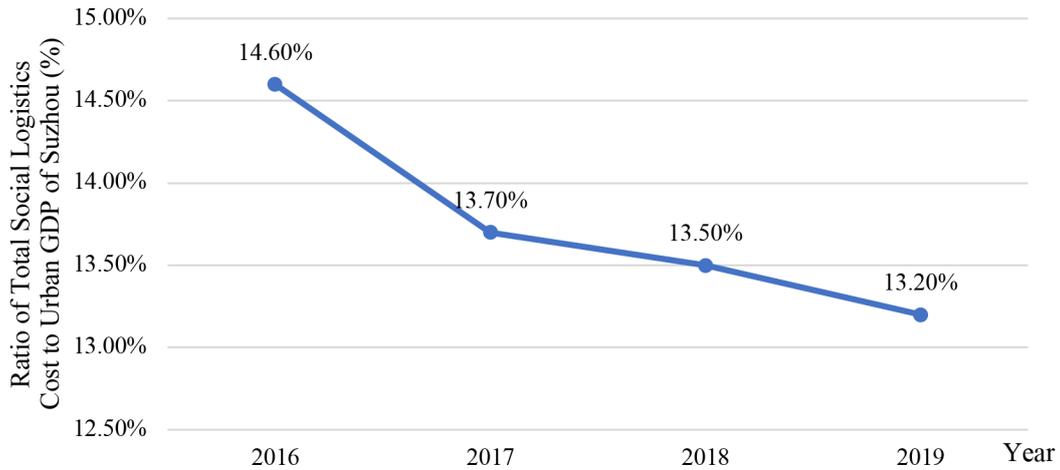


Figure 3-9: Changes in the Ratio of Total Social Logistics Cost to GDP of Suzhou from 2016 to 2019<sup>13</sup>

The main reasons are:

On the one hand, due to the wide application of electronic data interchange technology, information scanning and radio frequency identification technology, Internet of Things technology and other modern information technologies in the industry, the level of informatisation in the parcel delivery industry has constantly improved. In parallel, the goods damage rate, operation time, labour costs, and container costs have gradually decreased. Meanwhile, the warehousing, sorting and delivery efficiency continuously improves, so that the comprehensive logistics costs are driven to be reduced remarkably.

On the other hand, the e-commerce parcel industry (with a large proportion in the parcel business volume) grows quickly. While the e-commerce parcel competition undergoes serious homogenisation, new market entities continue to enter the parcel delivery market. Due to continuous growth of business scale, enterprise benefits and network benefits are continuously improved. Under the influence of multiple factors, the parcel delivery price remains low.

According to an interview survey with typical parcel delivery enterprises in Suzhou, the costs of parcel delivery enterprises are affected by employee salaries, outsourcing costs, transportation costs, office lease costs, material costs, depreciation and amortisation expenses and others. Among them, the cost of outsourcing has increased, mainly including the salaries of parcel delivery personnel, and its proportion is also increasing. Because of the large amount of labour employed in the last mile delivery business and the high mobility of personnel, many parcel delivery enterprises outsource the employment of the last mile delivery business to reduce management costs such as personnel recruitment. Figure 3-10 shows the proportion of main operating costs of typical parcel delivery enterprises in Suzhou.

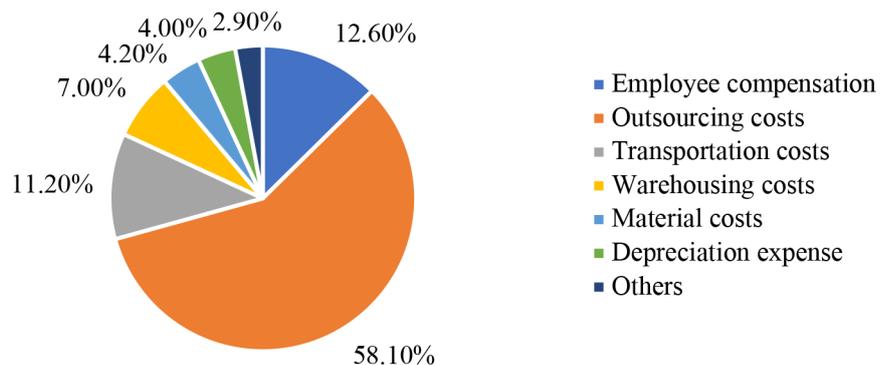


Figure 3-10: Proportion of Main Operating Costs of Typical Parcel Delivery Enterprises<sup>15</sup>

### 3.3.2 Cost Analysis of Single Piece Parcel Product

In 2019, the cost of a single piece parcel delivery was 2.24 RMB/piece, a year-on-year decrease of 13.85 % (as shown in Table 3-2).<sup>12</sup> According to a research survey with representative parcel delivery enterprises in Suzhou, the cost of a single parcel product includes delivery costs, transportation costs and warehousing costs. These three are all reduced with the growth of parcel delivery business volume and the increase in the utilisation rate of automated sorting facilities.

In terms of delivery costs, as the volume of a parcel delivery business increases, the volume of parcel delivery vehicles increases accordingly. With the increasing coverage rate of parcel stations and intelligent parcel lockers, couriers can finish the act of parcel delivery and leave immediately, which increases delivery efficiency. A person in charge of the parcel delivery company said that through the parcel station and intelligent parcel locker, the labour costs of about two couriers can be saved for parcel distribution in one community.

In terms of transportation costs, on the one hand, fuel costs can be saved due to the use of electric parcel delivery vehicles. On the other hand, the increase in parcel delivery business volume will be beneficial to optimise the running route and to reduce the empty load rate.

In terms of warehousing costs, the parcel sorting centres of major parcel delivery enterprises in Suzhou have fully put into use automated sorting facilities and equipment, which has greatly improved the parcel delivery capacity.

Table 3-2: The Cost of a Single Piece of Parcel Product and Its Changes in Typical Parcel Delivery Enterprises<sup>14</sup>

Item	Amount in 2019	Amount in 2018	Change ratio
Delivery cost	RMB 1.31	RMB 1.37	-4.4%
Transportation cost	RMB 0.69	RMB 0.8	-13.7%
Warehousing costs	RMB 0.21	RMB 0.4	-47.5%
Parcel sheet cost	RMB 0.03	RMB 0.03	0

### 3.4 Overview of Suzhou's Parcel Service Network System

The parcel service network of Suzhou consists of parcel sorting centres and parcel stations. Major parcel delivery brand enterprises all have parcel sorting centres in Suzhou, which can be divided into regional-level, prefecture-level, and city-level (Table 3-3).

Table 3-3: Classified Service Scope of Parcel Sorting centres

Classification	Service Scope	Quantity
Region-level sorting centre	Serving regional collection, distribution, dispatching and transshipment; core node of trunk transportation, with the ability to transfer to other region-level sorting centres in China.	4
Prefecture-level sorting centre	Serving the collection and distribution in urban area, with the ability to transport and distribute to other region-level and city-level sorting centres in China.	6
City-level sorting centre	Serving distribution and sorting in urban district or county; parcels need to be transferred through region-level or prefecture-level sorting centres.	12

The general route of the parcel delivery network: sender-franchisees / self-operated parcel stations / city-level sorting centre — prefecture-level sorting centre / region-level sorting centre where parcels are collected — city-level sorting centre/ prefecture-level sorting centre where parcels are delivered — franchisees/self-operated parcel stations city-level sorting centre that deliver parcels — addressee (Figure 3-11).

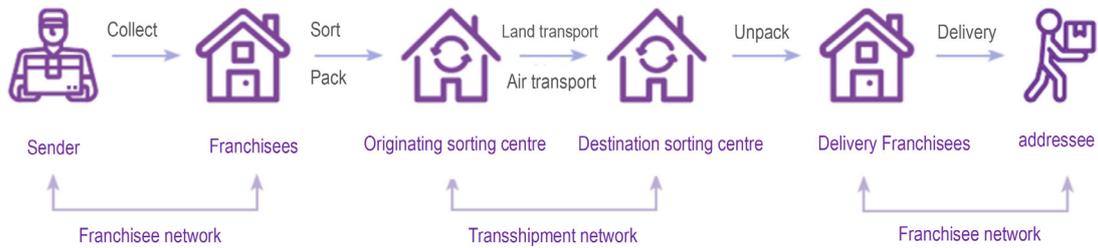


Figure 3-11: The Delivery Process Diagram of a Typical Parcel Delivery Enterprise

There are 13 region-level sorting centres that serve Suzhou's parcel delivery, four of which are located in Suzhou, with the remaining ones located in neighbouring cities. In particular, the Sunan Parcel Delivery Industrial Park gathers most parcel service brands, including ZTO, STO, Yunda, SF, Deppon, EMS, JD.com, YTO and BSHT. Among them, YTO and BSHT need to use the region-level sorting centre of Wuxi Sunan Parcel Delivery Industrial Park to collect and distribute packages from the inner-city of Suzhou. In addition, different districts and counties in Suzhou use the parcel sorting centre nearby according to their spatial distance. Major parcel service brand enterprises in Wujiang District use the region-level sorting centre in Jiaxing City. The city-level distribution sorting centre in Changshu connects to the region-level sorting centre in the Sunan Parcel Delivery Industrial Park, and the city-level sorting centre in Kunshan connects to the regional sorting centre in Shanghai. The major parcel delivery brand enterprises in Taicang use the Shanghai region-level sorting centre, and the major parcel delivery brand enterprises in Zhangjiagang use the parcel sorting centre in Wuxi.



Figure 3-12: Spatial Distribution of Parcel Sorting Centres in Suzhou

Figure 3-12 shows the spatial distribution of parcel sorting centres in Suzhou. The parcel sorting centres in Suzhou can meet the daily throughput (packages delivery and storage) of 20 million pieces. On average, each sorting machine can process packages of 25,000 to 30,000 pieces per hour, with processing time up to 12 hours/day. Figure 3-13 shows an example of a parcel sorting centre.



Figure 3-13: Parcel Sorting Centre of ZTO in Suzhou

Parcel stations include parcel delivery company stations, joint distribution stations, and intelligent parcel lockers, covering residential areas, enterprises, office buildings and other parcels flow clusters. At present, there are 2,955 parcel stations in Suzhou, 1,024 rural stations, and 9,331 sets of intelligent parcel lockers with 1.045 million boxes. The 1 km-coverage rate of parcel stations is about 35.3 % (excluding the area of Tai Lake). The average daily delivery of packages is 4.56 million pieces.<sup>12</sup> Figure 3-14 and Figure 3-15 show the spatial distribution of parcel stations in Suzhou and the last mile coverage of parcel stations in Suzhou. Figure 3-16 shows several examples of parcel stations.

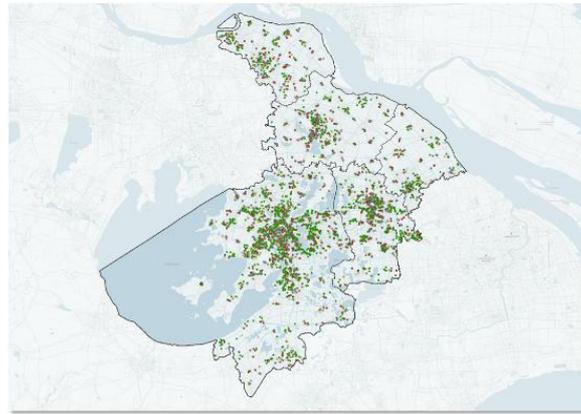


Figure 3-14: Spatial Distribution of Parcel Stations in Suzhou

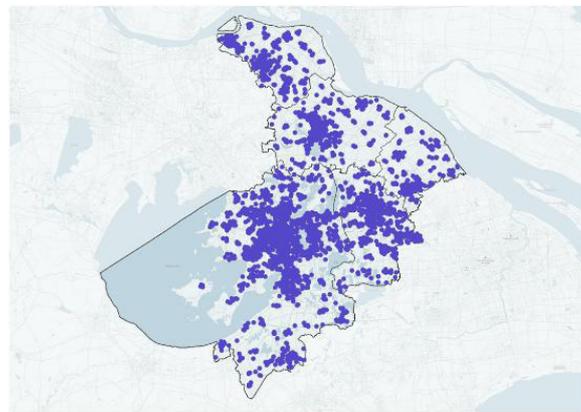


Figure 3-15: Last Mile Coverage of Parcel Stations in Suzhou



Figure 3-16: Parcel Stations

### 3.5 Overview of Suzhou's Parcel Delivery Vehicle

Due to the long transportation distance, fuel-powered trucks are generally used to transport between region-level sorting centres and between prefecture-level sorting centres. Among them, 7 tons and 14 tons fuel trucks are selected to transport between the region-level sorting centres according to loading capacity, and 3 tons fuel trucks are used to transport between the prefecture-level sorting centres. To take SF as an example, as of October 2020, SF has a total of 821.14 tons fuel trucks, 531.7 tons fuel trucks and 790.3 tons fuel trucks, up 114 %, 82 %, and 99 % year-on-year respectively.

Standard minivans, vans, and light trucks (as shown in figure 3-17) are used for transportation from prefecture-level sorting centre (level 2) to parcel stations (level 3). As of June 2020, there are 52,915 parcel delivery vehicles in the urban area of Suzhou, including 4,033 new electric urban delivery vehicles.<sup>12</sup>

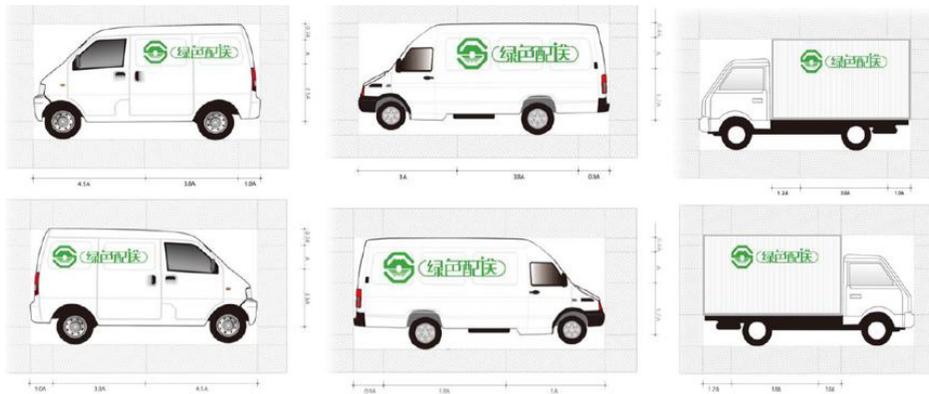


Figure 3-17: Diagram of standardised New Energy Freight Vehicles

The last mile delivery at parcel stations is fully performed via standard postal parcel special electric tricycles (as shown in Figure 3-18). More than 13,900 electric tricycles dedicated to postal parcel have been put into use. All electric tricycles are equipped with GPS to achieve real-time docking with supervision platforms and playback of driving tracks (Figure 3-19). In the last mile delivery, “zero emission” has been realised.



Figure 3-18: Standardised Electric Tricycle for Parcel Delivery

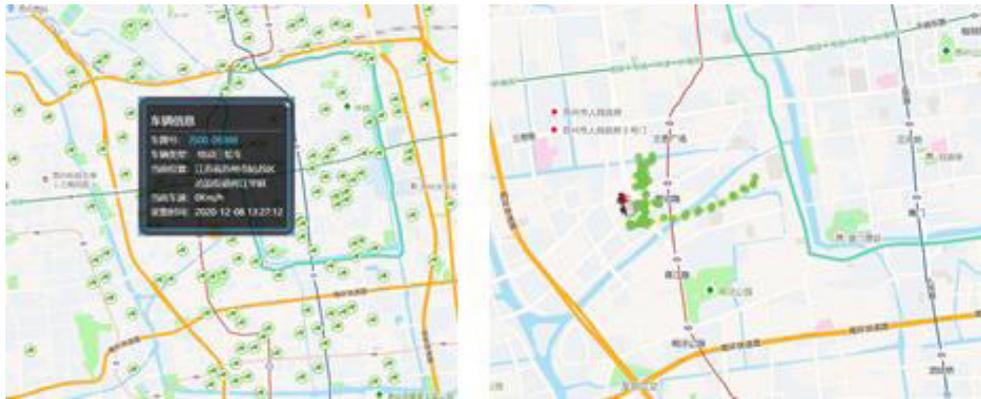


Figure 3-19: Screenshot of the User Interface of the Electric Tricycle Supervision Platform Dedicated to Parcel Delivery

### 3.6 Analysis of Last Mile Delivery Service in Suzhou

#### 3.6.1 Last Mile Delivery Service Mode

In Suzhou, the last mile delivery includes diversified service patterns like self-run parcel station, joint distribution station, intelligent parcel locker, community property management agency, doorkeeper, convenience store agent, and main delivery scenarios are residential areas, office buildings, schools, etc.

##### (1) Delivery Scenario of Residential Areas

The last mile delivery in residential areas is mainly handled by ways of intelligent parcel locker, Cainiao parcel stations and manual delivery, supplemented by self-pickup at the property office.

- **Intelligent parcel locker**

The intelligent parcel locker is a smart device that ensures the delivery of packages by the courier and the self-service pickup and delivery by the addressee. It is triggered when the courier puts the package in an intelligent parcel locker, and its system sends a unique pick-up code to the customer in a particular way, then the addressee can pick up the parcel from the intelligent parcel locker within a certain period (normally 48 hours).

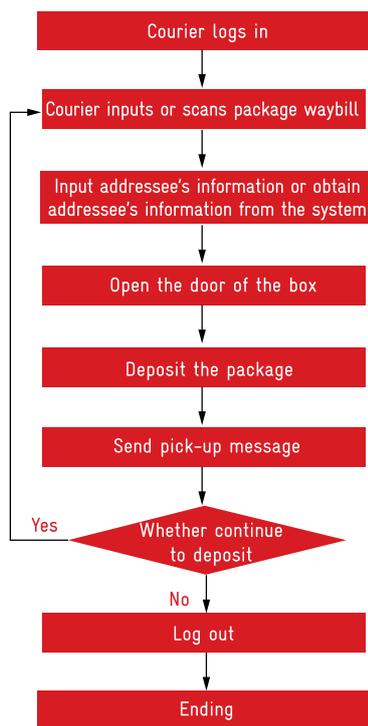


Figure 3-20: Courier's Delivery Process

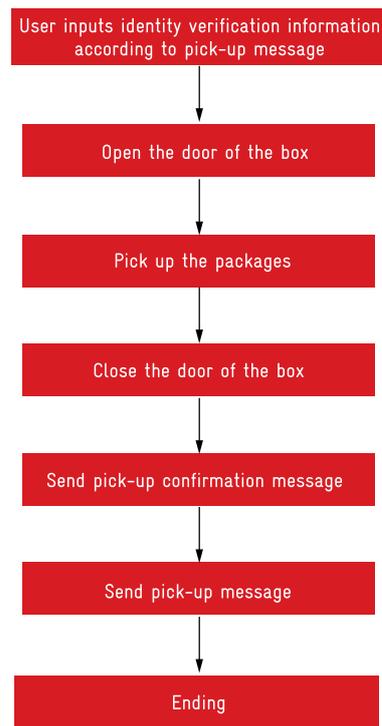


Figure 3-21: Customer's Pick-Up Process

**Courier's delivery process** (Figure 3-20): the courier arrives at a designated intelligent parcel locker and confirms the identity information (in front of a camera) → inputting package information including tracking number and addressee's mobile number → selecting a box with proper specification for the package → confirming the size selected, the system will pop up the door of corresponding idle box → the courier deposits the package into the box and closes the door → the system automatically sends information containing location of service station and pick-up verification code to addressee's mobile → the courier repeats above steps until all packages have been deposited.

**Addressee's pick-up process** (Figure 3-21): addressee may pick up the package at a convenient time after receiving the prompt message → after arriving at the intelligent parcel locker, the addressee inputs mobile number and received verification code on LCD touch screen → the door of corresponding box will be opened when the relevant information is detected and confirmed to be correct → the addressee picks up and checks the package, and closes the door.

The intelligent parcel lockers (Figure 3-22) are mainly distributed by e-commerce giants, mainstream parcel delivery enterprises and third-party intelligent parcel locker companies. For instance, the standard Hive Box smart cabinet (Figure 3-23) consists of 1 main locker and 4 accessory lockers, the size is 2.1 m × 4.5 m × 0.5 m (height × width × depth), including 84 boxes which are classified into three sizes<sup>16</sup>: large, medium and small. The Hive Box smart cabinet is expandable, the accessory lockers at two sides can be expanded and increased as needed. More than 9,331 intelligent parcel lockers with 1.045 million boxes have been distributed in Suzhou at present.



Figure 3-22: Intelligent Parcel Locker

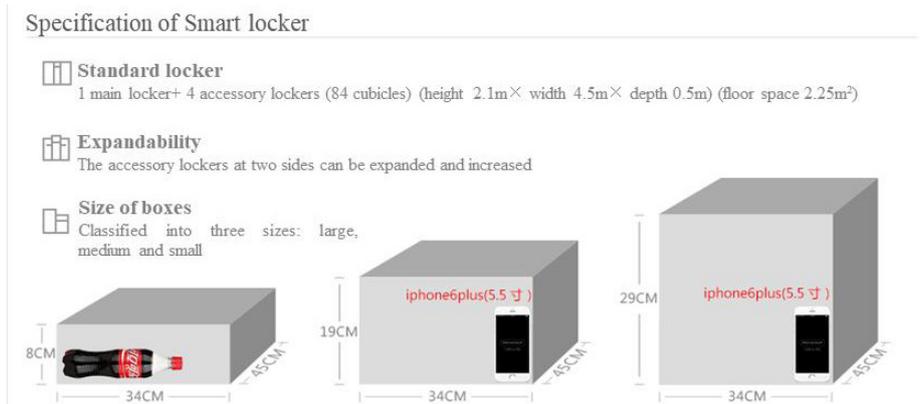


Figure 3-23: Specifications of Hive Box Smart Cabinet

#### • Cainiao Parcel Station

Cainiao Parcel Station (Figure 3-24) is a community and campus-oriented logistics service platform sponsored by Cainiao Network Company. Founded by an Alibaba-led consortium in 2013, it is a 47 % owned logistics affiliate of Alibaba Group, which provides network users with last mile parcel collection services. Cainiao Parcel Station mainly adopts the way of franchised stations. Business entities which join in Cainiao Parcel Station mainly include two types: one type is franchise stores, such as parcel delivery agencies or individual franchisees; another type is store-in-store, such as retail, service and other community stores. Basic income of the parcel station comes from picking up and delivering parcels. Delivery fees vary between RMB 0.5-1 per parcel, fees for parcel collection vary between RMB 3-8 per order. Furthermore, the visitor flow rate from parcel business of the parcel station may also increase income from other businesses.



Figure 3-24: Cainiao Parcel Station

Cainiao Parcel Station is one of the most typical examples of joint distribution. By cooperating with different parcel delivery enterprises, the packages of parcel delivery enterprises only need to be delivered to the Cainiao parcel station. The Cainiao parcel station transfers it to the addressee, which can save delivery and waiting time of parcel enterprises. At the same time, it can integrate the resources of different parcel delivery enterprises and reduces the total costs of last mile delivery. The customer can also pick up the packages on his own schedule, so as to improve the efficiency of parcel delivery in the last mile.

The delivery process is organised as follows: First, when the package arrives, the staff enters the order information with an OCR scanner or related similar devices, then the system will generate a corresponding pick-up code. Second, the system will send the pick-up code to the customer's mobile phone via SMS according to the recorded order information. The customer can then pick up his packages at the corresponding Cainiao Parcel Station according to the pick-up code. Third, after the parcel is delivered to the customer, the Cainiao Parcel Station system will scan the signing information and re-enter the order completion information into the system and send feedback to the corresponding parcel delivery enterprise, it is the last step to show the completion of the order.

In addition to Cainiao Parcel Stations, there are some other stations built by national parcel delivery enterprises, such as Village Postal Service Station, SF Parcel Station, Best Neighbour, YTO Mama and Yunda Parcel Station, etc. Suzhou has also developed a batch of local parcel stations, including “Yukuai Joint Distribution” in Changshu, “Kun City Parcel Station” in Kunshan, “Port City Parcel Station” in Zhangjiagang, “Jiangzhou Parcel Station” in Wujiang etc.

- **Pick-Up at the Property Office**

At present, there are many kinds of goods for online shopping. When the volume of the product exceeds the maximum volume of an intelligent parcel locker, or when some communities are not equipped with intelligent parcel lockers, the courier is often required to deliver it manually. In most cases, the parcel delivery company cooperates with the community's property, and the courier directly puts the package items into the designated place of the property and the customer picks it up. The property company working staff will assist consumer to pick up and register related parcel information, then make a signature confirmation.

### (2) Delivery Scenario of Office Buildings

Packages for office buildings are usually delivered manually. The courier will provide door-to-door delivery service according to the customer's needs. Manual delivery can ensure in-person inspection, reducing the likelihood that the customers will bear goods damages. If the customer is unavailable to receive the packages due to special circumstances (such as on weekends), a second time delivery of the goods will be required.

### (3) Delivery Scenario of Schools

Packages for schools are usually delivered manually or through parcel stations set by school. Taking the Changshu Institute of Technology in Suzhou as an example, most of the parcels are picked up at the Ziyue Parcel Centre (Figure 3-25). Ziyue Parcel Centre has a total area of about 500 square metres, special management personnel is employed there and provides parcel collection service for students, etc. With storage capacity of more than 6,000 pieces, the Centre covers most parcel delivery brands such as SF, Post, YTO, ZTO, Yunda and other parcel delivery enterprises. The average daily delivery volume of the Centre is about 3,500 to 4,000 pieces. During the “Double Eleven”<sup>③</sup> period, the daily average reached 12,000.<sup>17</sup>



Figure 3-25: Ziyue Parcel Service Centre

<sup>③</sup> “Double Eleven” is a shopping festival held by leading e-commerce platforms in China, such as Taobao and JD.com. The hyped-up shopping festival falls on November 11, and is the largest and most popular annual global shopping festival in the world. Link: <https://www.china-briefing.com/news/chinas-double-11-shopping-festival-tests-consumption-strength-after-covid-19/>

Ziyue Parcel Service Centre adopts an electronic system to realise customer self-service sign for parcels, and also provides parcel collection, packaging recycling and delivery services. The service time is from 9:00 to 19:00, which meets the schedule of most students. By entering the information of package which arrived on the day into the system, and sending a text message to the students, the students will find the package marked with the same number as the last four digits of the pick-up code on the corresponding shelf and floor. In order to prevent mistaken pick-ups, it is required to show the student ID or ID card when picking up the package. It is best to pick up the package on the same day, and the maximum retention time is 5 days. Parcel sending service can also be provided.

### 3.6.2 Comparative Analysis of Last Mile Delivery Mode

At present, Suzhou has established a diversified last mile delivery form, including door-to-door delivery, intelligent parcel locker and parcel station delivery, which significantly improves consumers' service experiences of packages sending and receiving. The advantages and disadvantages of different delivery patterns are compared and analysed from the perspective of cost, safety and efficiency, as shown in Table 3-4.

Table 3-4: Contrastive Analysis of Last Mile Delivery

	Manual delivery	Intelligent Parcel locker	Cainiao Station	Pick up at the property office
Cargo loss rate	Lower	Low, video surveillance is available	Low, query in the system is available	Lower
Delivery cost	Higher	Large investment in the early stage but long-term low	Lower	Lower/free of charge
Package form	Unrestricted	Not applicable for large and parcels with fresh products	The size and weight are not limited, and the parcels with fresh products are limited.	The size and weight are not limited, and the parcels with fresh products are limited.
Receipt inspection	Available	Not available	Available	Not available
Cash on delivery	Available	Partly available	Available	Not available
Pickup time	Restricted	Unrestricted	Restricted	Unrestricted
Pickup difficulty	Suitable for everyone	Not familiar with the product, difficult to operate	Relatively simple	Suitable for everyone
Privacy protection	Not available	Better privacy protection	Privacy protection to a certain extent	Not available

The intelligent parcel locker is a new delivery form, which has only emerged in recent years. It can effectively save time for couriers and consumers, and protect consumer privacy. Due to its convenience, intelligent parcel lockers have been welcomed by the market and have developed rapidly. By using Cainiao Station, the courier's time can be saved, ensuring "delivery and go". According to the statistics of Hivebox Technology, in the traditional mode, it takes an average of 7 minutes for the courier to deliver a package. However, with the help of an intelligent parcel locker and the Cainiao Parcel Station, it takes only an average of 3 minutes; the per capita efficiency of couriers can hence be doubled. It reduces the contacts with customers and distribution costs, and satisfies consumers' demand for time flexibility.

Considering the factors such as time cost, service experience, and safety guarantee, intelligent parcel delivery and the Cainiao Parcel Station are encouraged to be applied in places with large and concentrated populations. Firstly, it is more flexible for consumers to pick up

the packages, so that time costs are reduced with the reduction of parcel delivery time. Secondly, it ensures the safety for areas with large populations and constrains the access of strangers. Thirdly, to a great extent, it can avoid interruption during work, study, and rest time. Students can pick up the packages after school, office workers can pick them up after work. At the same time, bulk and fresh goods are suggested to be delivered manually, so as to ensure delivery service completeness and package intactness. The courier is required to get in touch with customers in time before delivery to determine the delivery time to avoid unnecessary disputes.

It should be pointed out that the early construction investment costs of intelligent parcel lockers and Cainiao Parcel Stations are large. Taking the intelligent parcel locker as an example, at present, the cost of an intelligent parcel locker is about RMB 18,000 to 60,000, excluding installation costs and later electricity, operating costs and land occupation costs. So it cannot be profitable in the short term, which makes it impossible to quickly promote the self-pickup form.

### 3.7 Analysis of Energy Saving and Emission Reduction for Suzhou Parcel Delivery Industry

#### 3.7.1 Calculation of Emissions

In accordance with “*Measurement Methods of Greenhouse Gas Emissions for Parcel Delivery Industry* (YZ/T 0135-2014)”, the total greenhouse gas emissions for the parcel delivery industry can be calculated and obtained by direct greenhouse gas emissions, indirect greenhouse gas emissions, and other indirect greenhouse gas emissions.<sup>18, 19</sup>

Among them, **direct greenhouse gas emissions** refer to greenhouse gas emissions of aviation kerosene, gasoline, diesel, natural gas and other fuels which are used in collection and distribution, transportation, logistics support and other activities of the parcel delivery enterprises, and obtained by multiplying fuel consumption by emission factor. **Indirect greenhouse gas emissions** refer to the sum of emissions generated by electric locomotives, non-automatic vehicles, and outsourcing electric power and heating power consumed in comprehensive management processes when the parcel delivery enterprises collect, distribute and transport the parcels. They are mainly emissions from electric vehicles, electro-tricycles and comprise the comprehensive power consumption of distribution centres. **Other indirect greenhouse gas emissions** refer to the sum of other indirect greenhouse gas emissions from outsourcing packaging supplies for parcel service, outsourced collection, distribution and transportation of parcel delivery enterprises, including parcel delivery waybill, envelope, packaging box, packaging bag, transparent tape, etc.

The formula is as follows:

$$AE = AE_{\text{Transportation}} + AE_{\text{Packaging}} = AD_{\text{Fuel Oil}} \times EF_{\text{Fuel oil}} + AD_{\text{Power Consumption}} \times EF_{\text{Power Consumption}} + \sum_{n=1}^n M_{\text{Packaging}} \times EF_{\text{Packaging}}$$

According to above calculation formula, combined with the proportion of the amount of packages of the same city, different regions, international, and the proportion of vehicle types in the transportation process, the calculation results are obtained.

#### Carbon dioxide emissions:

$$\begin{aligned} AE_{\text{Transportation}} &= AD_{\text{Fuel oil}} \times EF_{\text{Fuel oil}} + AD_{\text{Power Consumption}} \times EF_{\text{Power Consumption}} \\ &= AD_{\text{Diesel oil}} \times EF_{\text{Diesel oil}} + AD_{\text{Aviation oil}} \times EF_{\text{Aviation oil}} + AD_{\text{Power Consumption}} \times EF_{\text{Power Consumption}} \\ &= 101944.92\text{t} \times 3.21\text{tCO}_2\text{e/t} + 100.74\text{t} \times 3.01\text{tCO}_2\text{e/t} + 41.30\text{MWh} \times 0.96\text{tCO}_2\text{e/MWh} \\ &= 327243.19\text{ tCO}_2\text{e} + 303.23\text{ tCO}_2\text{e} + 39.65\text{ tCO}_2\text{e} \\ &= 327586.07\text{ tCO}_2\text{e} \end{aligned}$$

### Carbon dioxide emissions of parcel packaging:

$$\begin{aligned}
 AE_{\text{Packaging}} &= \sum_{n=1}^n M_{\text{Packaging}} \times EF_{\text{Packaging}} \\
 &= AD_{\text{Express Waybill}} \times EF_{\text{Express Waybill}} + AD_{\text{Express Sealing}} \times EF_{\text{Express Sealing}} + AD_{\text{Express Packaging}} \times EF_{\text{Express Packaging}} \\
 &\quad + AD_{\text{Plastic Film Packing Bag}} \times EF_{\text{Plastic Film Packing Bag}} + AD_{\text{Plastic Woven Cloth Packing Bag}} \times EF_{\text{Plastic Woven Cloth Packing Bag}} \\
 &\quad + AD_{\text{Transparent Tape}} \times EF_{\text{Transparent Tape}} \\
 &= 1310.85 \text{tCO}_2\text{e} + 14161.62 \text{tCO}_2\text{e} + 31846.83 \text{tCO}_2\text{e} + 4537.54 \text{tCO}_2\text{e} + 210.66 \text{tCO}_2\text{e} + 552.83 \text{tCO}_2\text{e} \\
 &= 52620.33 \text{tCO}_2\text{e}
 \end{aligned}$$

### Nitrogen oxide emissions:

$$\begin{aligned}
 AE_{\text{Transportation}} &= AD_{\text{Fuel Oil}} \times EF_{\text{Fuel Oil}} \\
 &= AD_{\text{Diesel oil}} \times EF_{\text{Diesel oil}} + AD_{\text{Aviation oil}} \times EF_{\text{Aviation oil}} \\
 &= 101944.92 \text{t} \times 1.663 \times 10^{-4} \text{tNO}_x/\text{t} + 100.74 \text{t} \times 0.861 \times 10^{-4} \text{tNO}_x/\text{t} \\
 &= 16.96 \text{tNO}_x
 \end{aligned}$$

According to comprehensive measurement and calculation, total greenhouse gas emissions from parcel delivery industry in Suzhou is 380206.40 tCO<sub>2</sub>e, including 327586.06 tCO<sub>2</sub>e (carbon dioxide) emissions generated in transportation process, and total nitrogen oxide emissions is 16.96 tNO<sub>x</sub> (nitrogen oxide).

Suzhou has a total business volume of 1.73 billion parcels in 2019, the average greenhouse gas emissions is 0.22 CO<sub>2</sub>e per piece. During the transport process, the average carbon dioxide emissions for each parcel is 0.19 CO<sub>2</sub>e and average nitrogen oxide emissions for each is  $8.08 \times 10^{-5}$  NO<sub>x</sub>.

### 3.7.2 Typical Case of Energy Saving and Emission Reduction in Parcel Packaging

Parcel packaging is the key link for promoting green and low-carbon development of the parcel delivery industry. Suzhou has introduced special actions on green management of parcel packaging. Through measures such as plastic bag drawing reduction, reduction in carton corrugated layers, straight sending packaging, recycling packaging, and slimming tape, the growth of packaging consumption has efficiently declined, and the reduction of parcel packaging has achieved significant results.

(1) Full coverage of electronic waybill has been fully achieved. Currently, the utilisation rate of electronic waybills has reached 100 % in Suzhou. It is equivalent to the saving of 1.73 billion pieces of A4 paper consumption, which is about 8,650 tons of raw paper. It means that 52,900 trees, equivalent to 75.54 cubic metres of water, are saved, and equivalently, about 12,369 tons of carbon emissions are reduced.

(2) “Slim tape” has been widely used. At present, the utilisation rate of 45mm and below tape in Suzhou has reached 99.1 %. On average, the tape used for each package has been reduced by nearly 20 % on a year-on-year basis, and the annual decrease in tape usage was 16.178 million metres.

(3) Circular packaging in transit links has been widely used. At present, the utilisation rate of reusable transit bags in Suzhou is 91.9 %, and the use of container bags has decreased by 96.4 % year-on-year. In 2019, about 2.403 million transit bags were consumed in the parcel transit link, of which 1.682 million were reusable woven bags. Calculated on the average of a 40 times reuse for each bag, in that way, 67.28 million disposable plastic woven bags will be saved annually.

(4) Industry solutions for parcel packaging recycling were developed. At present, there are more than 1,000 parcel packaging recycling devices in Suzhou; the set rate of waste recycling devices thus reaches 88.38 %. All these are mainly installed in parcel stations and some governments and enterprises. In 2019, more than 5 million packaging boxes were recycled and reused. Table 3-5 shows the recycling packaging products of typical parcel delivery enterprises.

(5) The use of package fillers has significantly been reduced. The Suzhou government encourages parcel delivery enterprises to use ready-to-use fillers. At present, the utilisation rate of this kind of filler in major parcel delivery enterprises has reached 98 %.

Table 3-5: Recycling Packaging Products of Typical Parcel Delivery Enterprises<sup>6</sup>

Parcel Delivery Enterprise	Product name	Product highlights
SF	SF BOX	Up to hundreds times of service life: 10 million „SF BOX“ can replace 500 million cartons, 1.4 billion metres of tape and 2.25 million cubic metres of inner filler.
Suning	Drift box plan-small yellow box	Each drifting box can be recycled more than 2,000 times, which can save about a 10-year-old tree; the length of the parcel box saved in one year can encircle the earth.
ZTO	Recyclable bag	The new environmental protection bag can be reused 20 to 100 times.
YTO	RFID new environmental protection bag	Oil resistance, high/low temperature resistance, recyclable.
STO	Degradable parcel bag	Regular recycling and reuse, reducing the use of packaging consumables by 10 %

### 3.7.3 Typical Case of Energy Saving and Emission Reduction in Parcel Transportation and Delivery

Suzhou has carried out the construction of a green delivery network, and sped up the application of big data, artificial intelligence and other innovative technologies in the industry, so as to improve its operational efficiency and reduce resource consumption. It mainly includes promoting front warehouses, intelligent sub-warehousing, and scientific stowage, dynamic demand forecasting and reasonable route planning, decreasing the vehicle's empty load rate and transit time, and reducing energy consumption during parcel transportation.

(1) Various industry stakeholders apply their own transportation vehicle management systems to realise a reasonable selection of more optimised transportation mode based on transportation mileage and timeliness requirements. Yunda developed the “Freelander” vehicle operation monitoring system to effectively reduce vehicle fuel consumption. Deppon launched its smart fleet system management platform and improved their vehicle actual load rate. Suning formulated and strictly implemented the “100-mile low fuel consumption” indicator for logistics vehicles, and achieved “last mile” low-carbon operation through GPS monitoring, and personnel energy-saving training. SF Express develops a network planning system, promotes the application of handheld terminals, optimises dispatch and delivery routes, effectively improves delivery efficiency and reduces carbon emissions.

(2) Suzhou promotes the application of drop-and-pull transportation and optimises the operation and organisation of intelligent routes. The function of enhancing efficiency and reducing consumption can hence be significantly improved. China Post's new postal routes will be mainly round-trip drop-and-pull routes, and the new and updated vehicles will be large-tonnage drop-trailers. At present, the proportion of the first-level trunk regular drop-and-pull postal routes is up to 73.9 %. YTO has stepped up its efforts to promote trailer transport vehicles and mid-axle vehicles, reduce the number of vehicles put into use, and fully use the National V emission standard vehicles.

(3) Parcel delivery enterprises are encouraged to promote the use of new-energy distribution vehicles and special electro-tricycle for parcel delivery, in order to reduce the consumption of fossil energy resources and enhance green and environmental protection. Suzhou has unveiled award and subsidy measures for promoting the operation of new-energy distribution vehicles. The measures will grant award and subsidy for four types of new-energy vehicle whose annual mileage is greater than 10,000 kilometres for the duration of three years. The four types of vehicle include minivan, van, light truck and refrigerated truck. The subsidies are separately calculated by actual traveling mileage on the basis of 0.4 RMB/km, 0.6 RMB/km, 1 RMB/km and 1.4 RMB/km respectively. The maximum amount of subsidies can separately reach RMB 8,000, RMB 12,000, RMB 20,000 and RMB 28,000.<sup>20</sup> So far, Suzhou has put into use 4,033 new energy urban delivery vehicles and 13,900 electric tricycles for postal parcel delivery.

## 4. Suggestions on Further Development of Last Mile Delivery

### 4.1 Systematically Plan the Construction of Urban Logistics Infrastructure and Improve the Layout of the Last Mile Delivery Network

It is necessary to strengthen the planning guidance for Suzhou's parcel delivery industry, and to improve the parcel delivery terminal service network (mainly including public parcel stations and intelligent parcel lockers). It is recommended to study and formulate last mile delivery network construction planning, and incorporate it into the land and space layout plan and the overall urban planning. The various patterns of delivery service cooperation between parcel delivery enterprises and commercial companies, community service centres, governments, and schools should be encouraged and promoted, to provide residents with better, more convenient services. Through the support of the construction of drone take-off and landing sites in suitable locations, UAV (unmanned aerial vehicles) delivery service can be further researched and experimented.

### 4.2 Encourage the Development of Joint Distribution and Standardise the Development of Parcel Stations

Joint distribution is an efficient pattern for last mile delivery, which can reduce repeat route delivery and save transportation costs and time. In order to promote joint distribution in the last mile delivery, there are several recommended implementations: 1) Push forward facility sharing of parcel stations, encourage different parcel delivery enterprises to share last mile delivery facilities, and build comprehensive service site of parcel delivery to carry out joint collection and delivery; 2) Develop the standardised construction of parcel stations, and comprehensively improve service capability and service quality of industry.

### 4.3 Encourage the Development of "Intelligent+" and Promote Digital Transformation

Promoting the intelligent development of the parcel delivery industry can not only effectively improve the efficiency of the entire delivery process, but also achieve the purpose of energy saving and emission reduction, such as using electronic waybills. There are several recommended implementations: 1) Enhance popularisation and application of intelligent collection and distribution, sorting, and delivery equipment, take full advantage of IoT, big data and 5G technology to realise efficient interconnection of infrastructure; 2) Introduce RFID (radio frequency identification) technology and informatisation of parcel packaging, enrich and improve service functions including self-service ordering, whole process tracing and query and electronic payment; 3) Push forward the application of smart customer service in the scenarios like business consulting, customer diversion, self-service ordering, query and complaint, and promote service facilitation.

### 4.4 Implement the "Peaking Carbon Dioxide Emissions before 2030<sup>④</sup>" Action Plan and Promote Green Development

Due to China's "Peaking Carbon Dioxide Emissions before 2030" Action Plan, it is necessary to further promote the green development of the parcel delivery industry. There are several recommended implementations: 1) Expedite the popularisation and application of new product, new mode, new process and new technology; 2) Promote the construction of recycle application systems for parcel packaging, encourage postal and parcel delivery enterprises to carry out multilateral cooperation with environmental sanitation department, recycling enterprises and third-party institutions; 3) Set up parcel packaging recycle facilities in parcel concentrated areas (like large communities, business districts, colleges and universities), set up parcel packaging and recyclable parcel bag (box) recycle facilities at household waste sorting recycle bins and parcel stations; 4) Develop green transportation and distribution, promote energy conservation and emission reduction of transportation and delivery, and continue to promote new energy freight vehicles.

④ Link: [http://www.xinhuanet.com/english/2020-12/18/c\\_139601263.htm](http://www.xinhuanet.com/english/2020-12/18/c_139601263.htm)

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