



Internet-based recycling: A new circular economy business model in China

Tingting Liu, Yufeng Wu

The institute of Circular Economy, Beijing University of Technology

2024.4.25





Beijing University of Technology

1960

Established in 1960, the school's motto is "Constantly Striving for Improvement, Continuously Pursuing Knowledge"

1996

In 1996, it became a part of the China "211 Project"

2008

In 2008, it successfully hosted two events during the Olympic Games, namely badminton and artistic gymnastics.

2017

In 2017, it entered the ranks of national first-class universities in the construction of disciplines.

32

In 2020, it was ranked 32nd in the QS World University Rankings among universities in mainland China.

6

In 2021, six disciplines, including engineering, materials science, and chemistry, entered the top 1% in the Essential Science Indicators (ESI) rankings.



3

There are 3 national key disciplines.

4

There are 4 "111 Plan" bases.

2

There are 2 national engineering laboratories.

1

There is 1 provincial and ministerial co-constructed national-level key laboratory incubation base.

4

There are 4 "111 Plan" bases.

46

There are 32 majors selected as national-level first-class undergraduate program construction sites, and 14 majors selected as Beijing municipal-level first-class undergraduate program construction sites.

16

16 teaching and research institutions.

3301

There are 3,301 faculty and staff members.

19

There are 19 secondary-level Communist Party of China (CPC) organizations.

10981

There are 10,981 members of the Communist Party of China (CPC).

25829

There are 25,829 students enrolled in the school.

160000

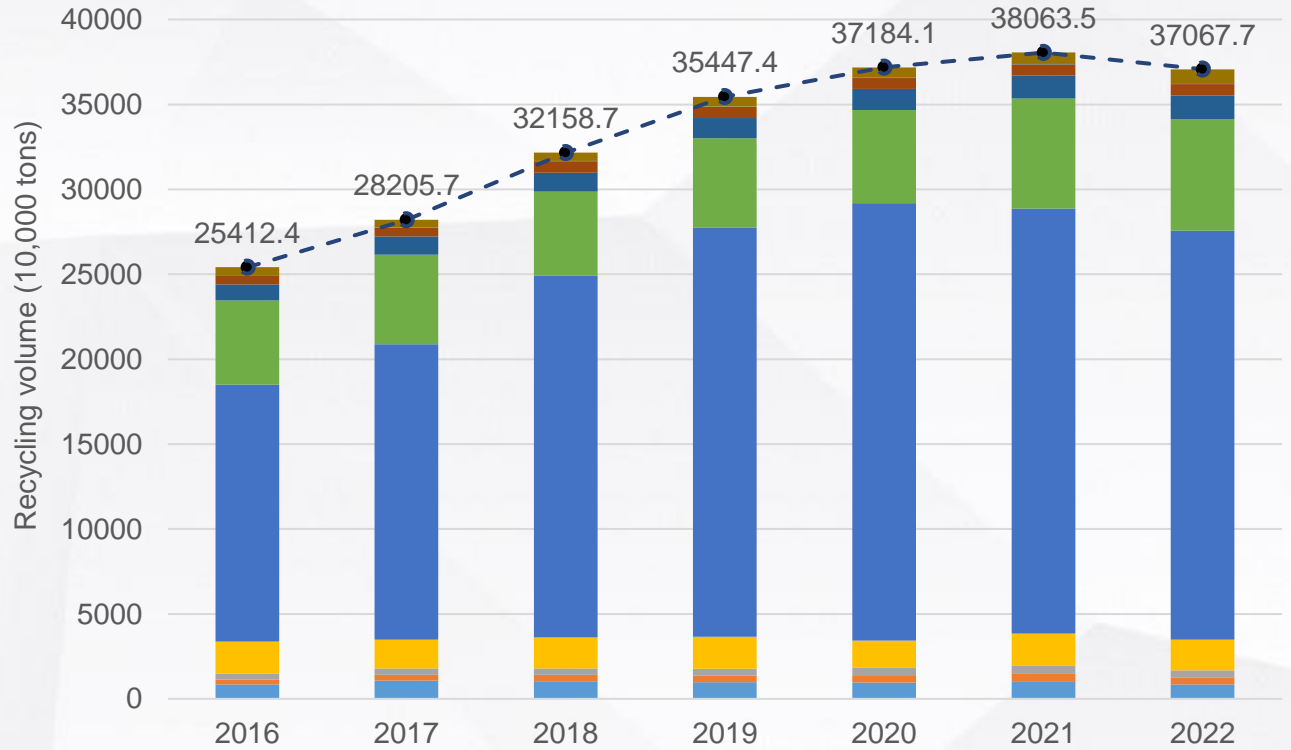
There are over 160,000 graduates.



创新 协调 绿色 开放 共享



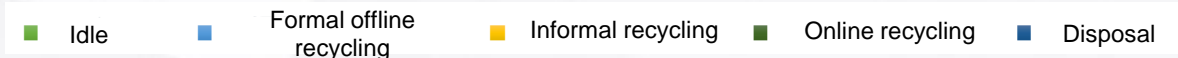
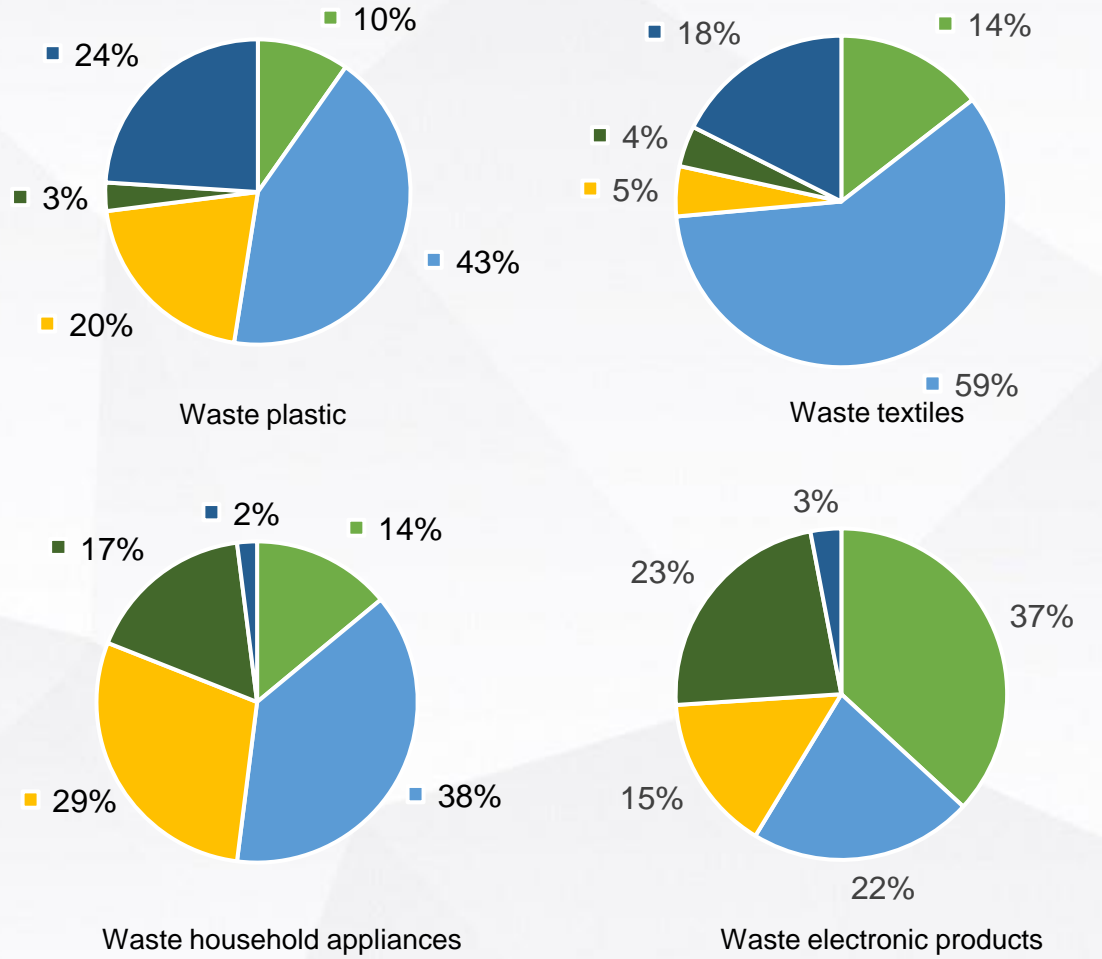
Current recycling situation in China



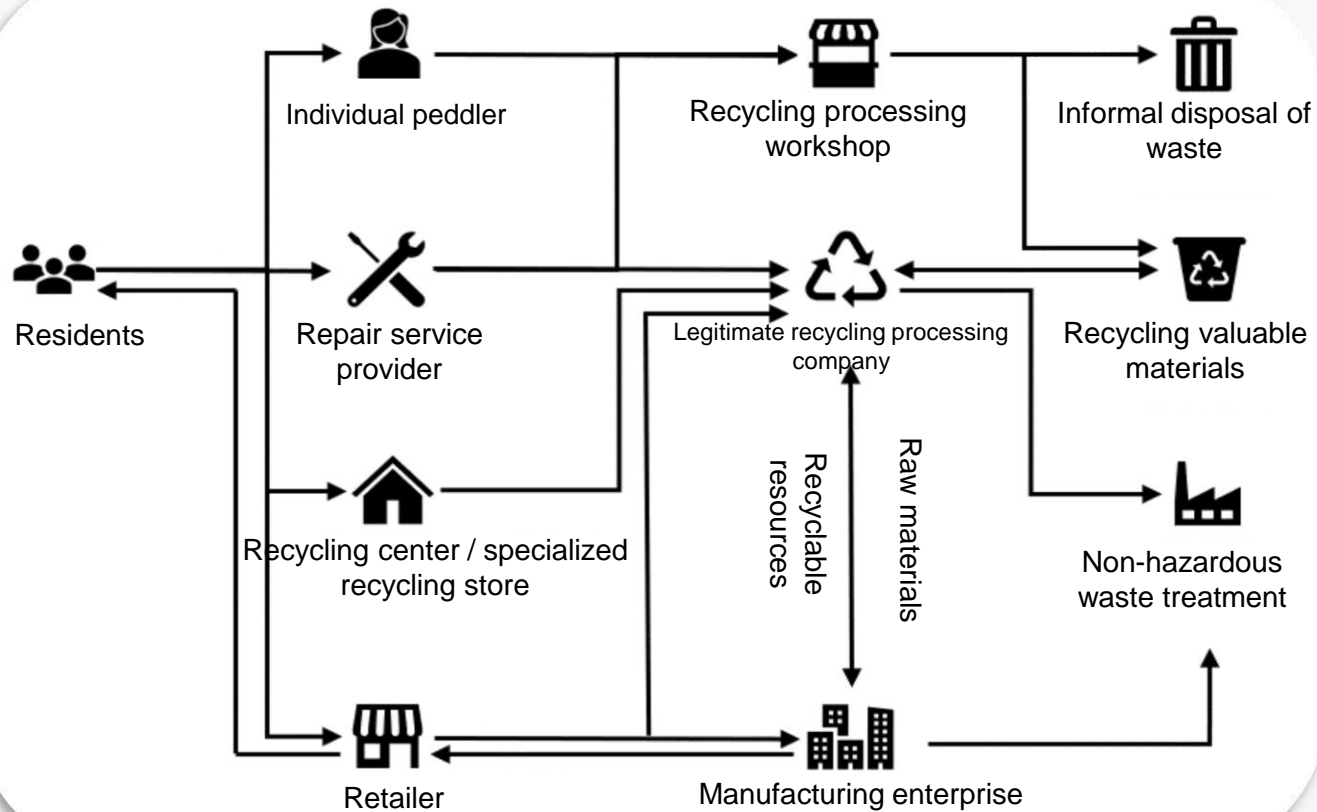
The total amount and proportion of recyclable resources in China from 2016 to 2022

Data Source: 《China recyclable Resource Recycling Industry Development Report 》

The disposal methods of recyclable waste by residents



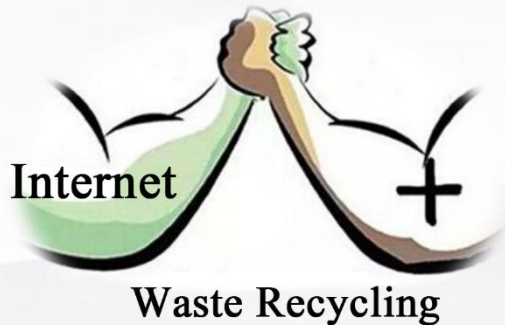
Data Source: Questionnaires



- **High operational costs:** There exists information asymmetry between consumers and recycling enterprises, significantly increasing search, logistics, and transaction costs for both consumers and businesses throughout the transaction process.
- **Low recycling efficiency:** The process from consumers to recycling enterprises to processing enterprises to manufacturers requires transportation time at each node, resulting in low recycling efficiency.
- **Lack of competitiveness:** It lacks core competitiveness in terms of recycling price, portability, information security, and environmental impact.



- The Internet-based recycling system is based on information technologies such as the **Internet, the Internet of Things, and big data**, and organically combines **modern information technologies such as the Internet with traditional recyclable resources recycling** to build an efficient, convenient and sustainable recyclable resources recycling platform, aiming to **optimize the resource recycling mode, improve the utilization rate of resource recycling, and reduce recycling transaction costs**.
- This new “internet +” recycling program is a revolution of the traditional recycling method, which implements the internet idea, technology, and mode into the way of recyclable resource recycling.
- It helps to solve the problems that are faced by tradition recycling such as asymmetric information and the high percentage of informal recyclers.

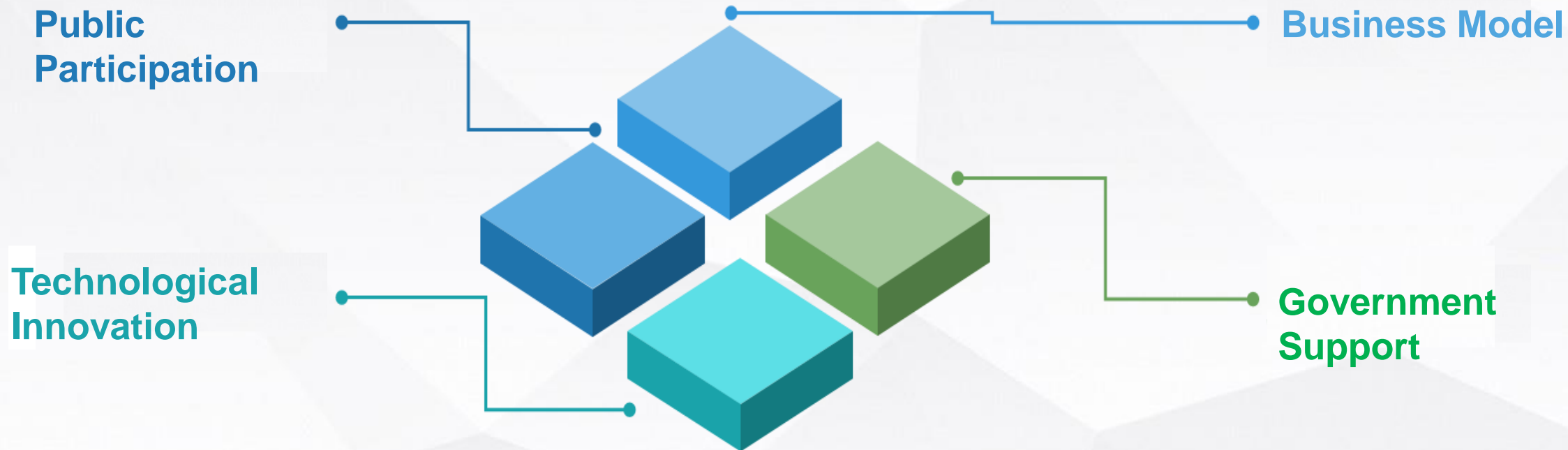


The recycling industry of recyclable resources

Reference:

Li, et al. Research on the construction of Internet-based recyclable resource recycling system[J]. recyclable resources and circular economy,2023,16(12):40-43.

Xi, et al. . Construction of recyclable resources "Internet-based recycling" model[J]. Science and technology management research,2018,38(23):260-267.



Concept Education



Interactive Recycling Education



Waste Sorting VR Game



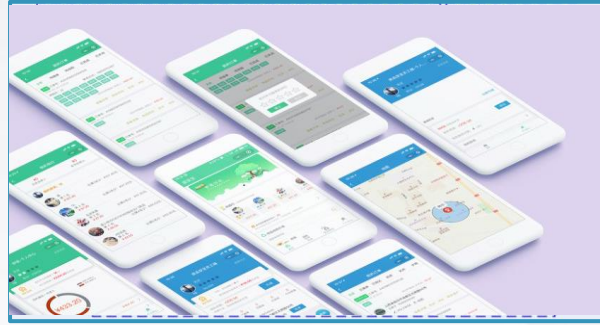
Active Participation in Recycling



- As of December 2023, the number of Internet users in China has reached 1.092 billion, and the Internet penetration rate has reached 77.5%.
- The number of mobile phone users in China is 1.683 billion, and the population penetration rate has risen to 119.2 mobile phones per 100 people.



Dual Information Clearing Technology



Precision Recognition Technology

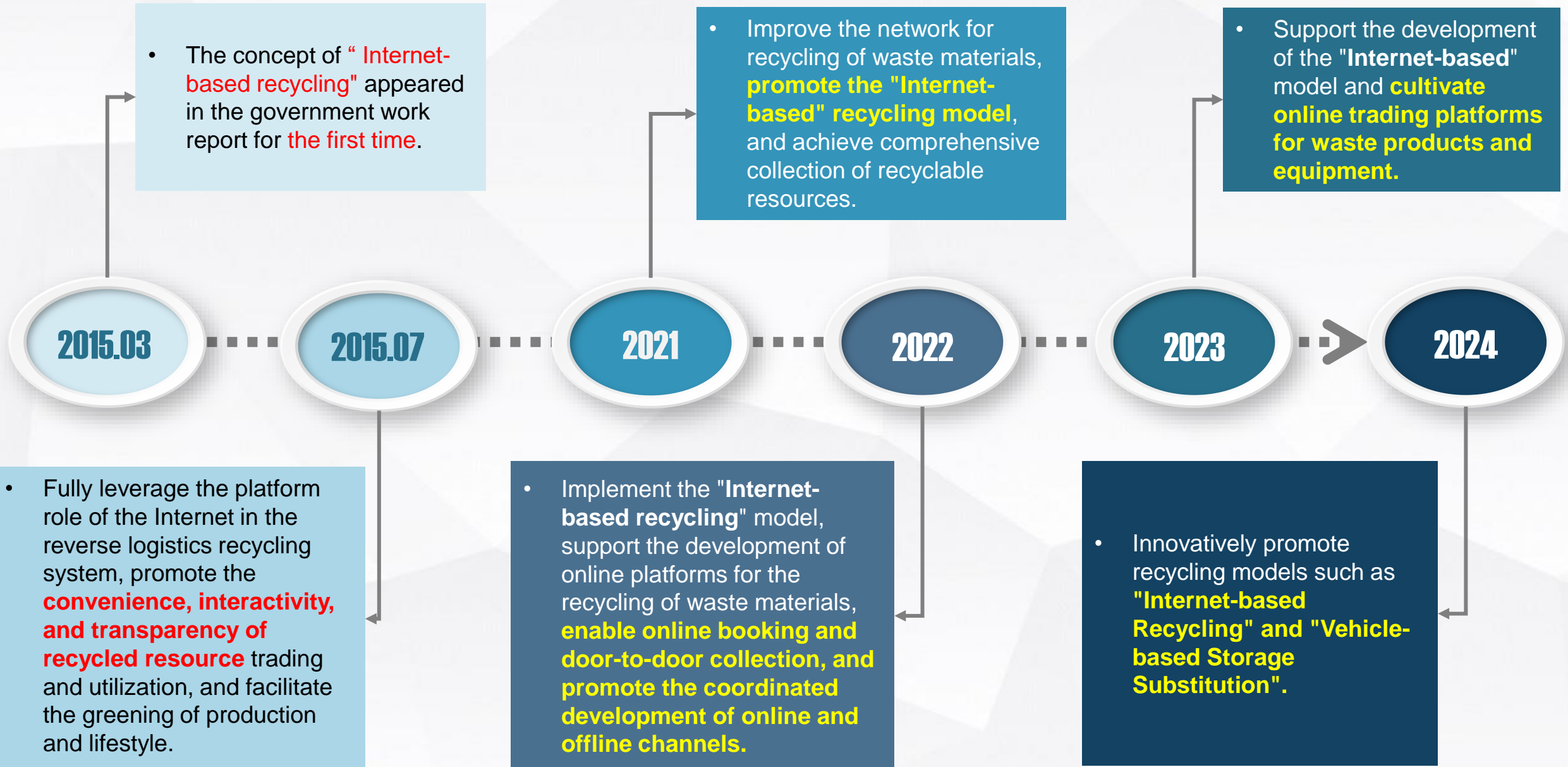


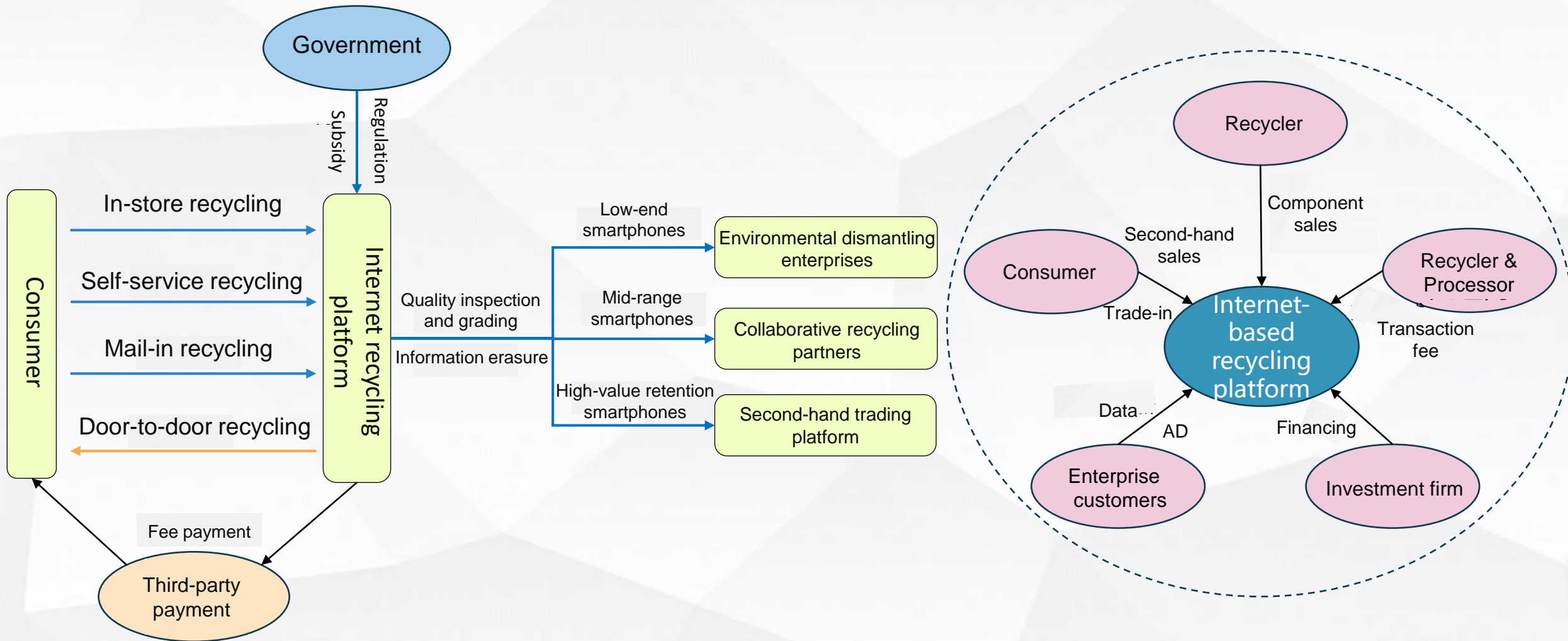
Value Assessment Technology

Multi-source Information Collection
Coupling Technology

Intelligent Scheduling Technology

- In the Internet era, the emergence of new technologies such as big data, cloud computing, the Internet of Things (IoT), geographic information systems (GIS), and artificial intelligence (AI) can significantly enhance the overall technological capabilities related to the entire process of recycling and utilization of recyclable resources.





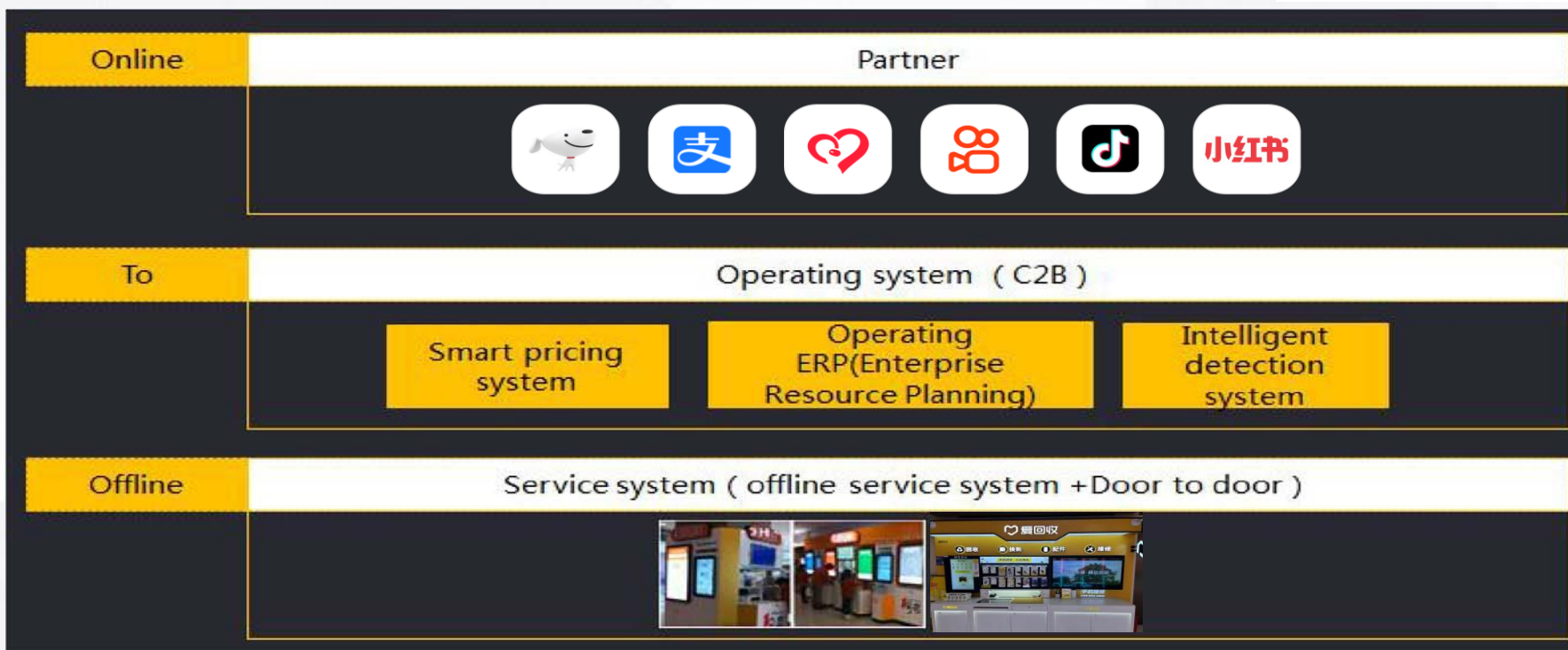
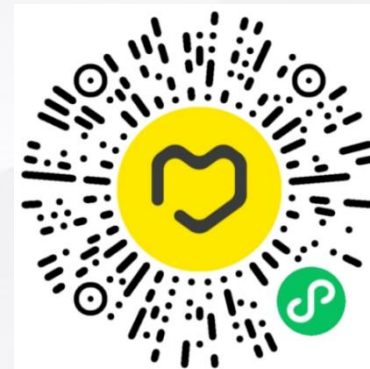
Typical Internet Recycling Platform Business Model (Left) and Revenue Model (Right) (Using Old Mobile Phone Recycling as an Example)

Case 1: WEEE internet-based recycling (Aihuishou)



URL: <https://www.aihuishou.com/>

- In 2022, the trading volume was **32 million units**
- **270,000** waste electronic devices were recycled
- **21,038** intelligent recycling machines, the user scale exceeded **15 million**
- the annual recycling volume reached **406,357 tons**



O2O mode and app interface of Aihuishou

Case 1: WEEE internet-based recycling (Aihuishou)

"Aihuishou" builds RE Planet with the 3R environmental protection concept as the core. So far, 94,831,539 people have joined RE Planet, participating in environmental protection recycling for a total of 439.62 million times, reducing about 3.39 million tons of carbon emissions for the Earth.

In 2011

The first used 3C recycling mode

In 2019

Merge with Paipai to open up the whole industrial chain of C2B2C and realize the closed loop of circular economy

In 2021

Make efforts to recycle luxury goods and expand overseas business

With 3R environmental protection concept as the core, the ecology is continuously built by RE people

In 2015

Create the old for new cooperation model

In 2020

Build the world's first set of non-standard used electronic products automatic circulation system, including transportation, quality inspection, sorting and storage, automation rate up to more than 90%

In 2022

Expand multi-category recycling services. From "recycling phones" to "recycling Everything"

94,831,539 人
Join RE Planet

↑↓ Total Environmental Recycling
43,962 Ten thousand times

CO₂ Reduce carbon emissions
339 Ten thousand tons

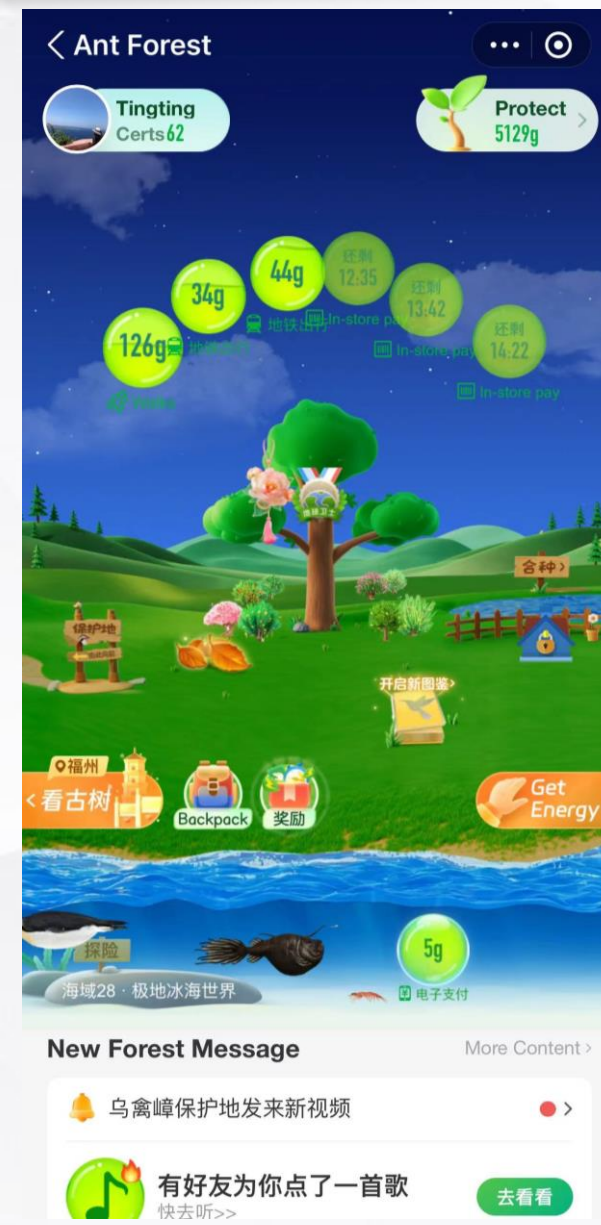
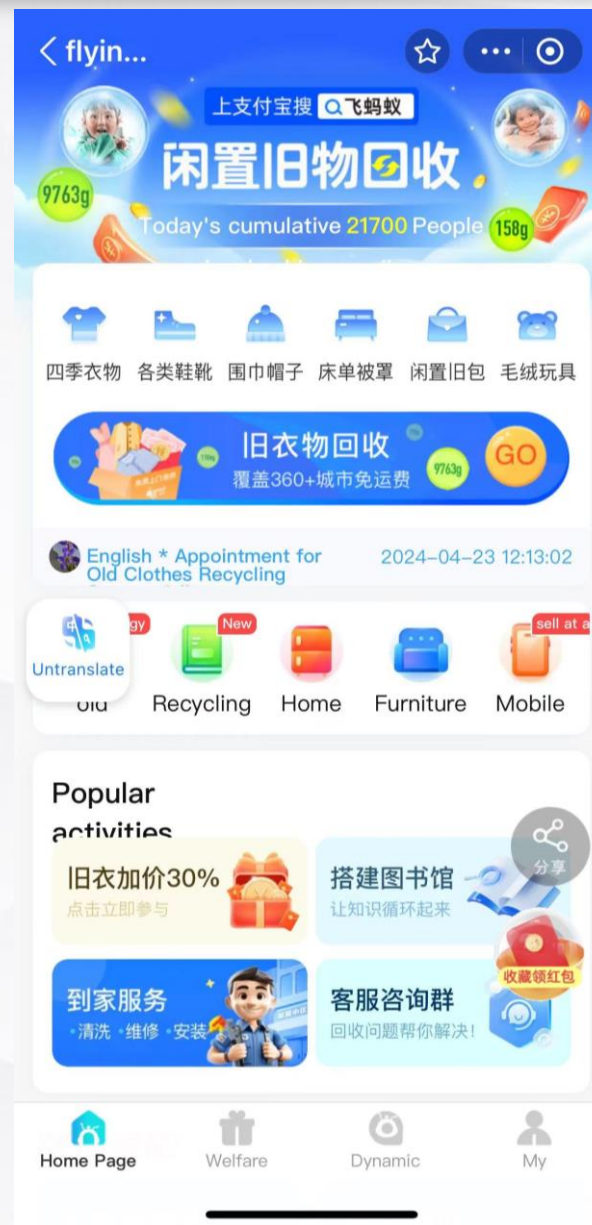
"Aihuishou" development milestones and contributions

China's first online comprehensive platform for **clothing recycling and processing**

URL: <http://www.fmy90.com/>



- **Online appointment for free home pickup recycling is available.**
- Customers are rewarded with corresponding environmental beans, coupons, and environmental certificates.
- Offline environmental clothing stations are also established, where users can locate the nearest "environmental clothing station" on the Feimayi platform and deliver their clothes to the nearest one.

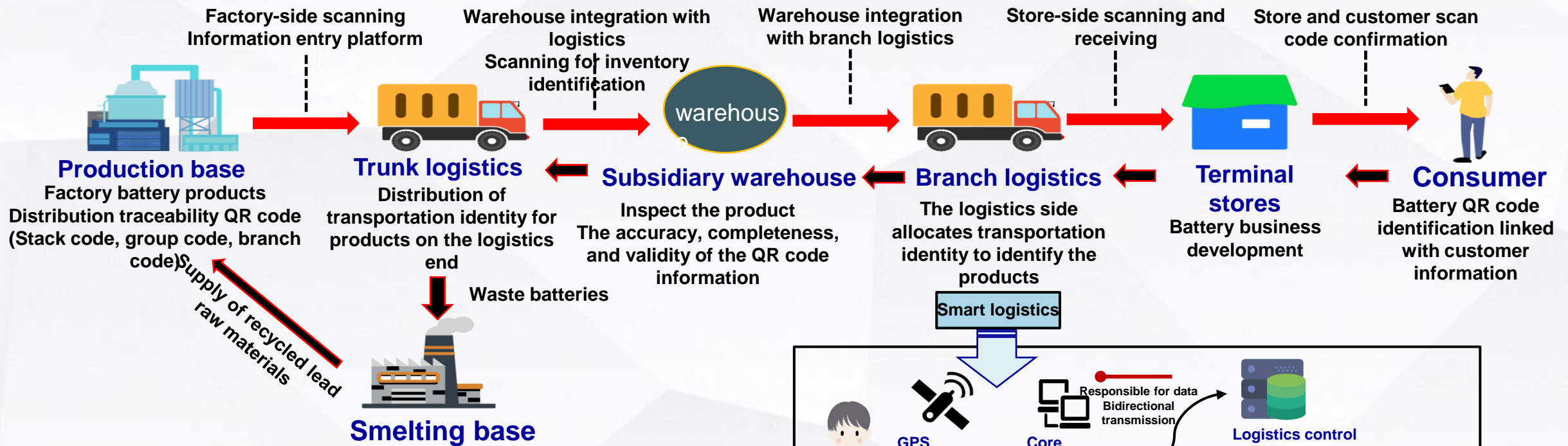


Case 2: Textiles internet-based recycling platform (Feimayi)

- In 2022, the Feimayi has provided recycling services for more than **10 million users**
- door-to-door recycling used clothing business covers **300+** cities across the country, **65** cooperative sorting factories across the country, and more than **4,000** recycling boxes can only be laid offline across the country.
- About **3.1 million** pre-ordered recycling orders for used clothing were collected annually, and the total amount of recycled used clothing exceeded **66,093 tons**, equivalent to a reduction of **353,598 million** tons of carbon dioxide emissions.

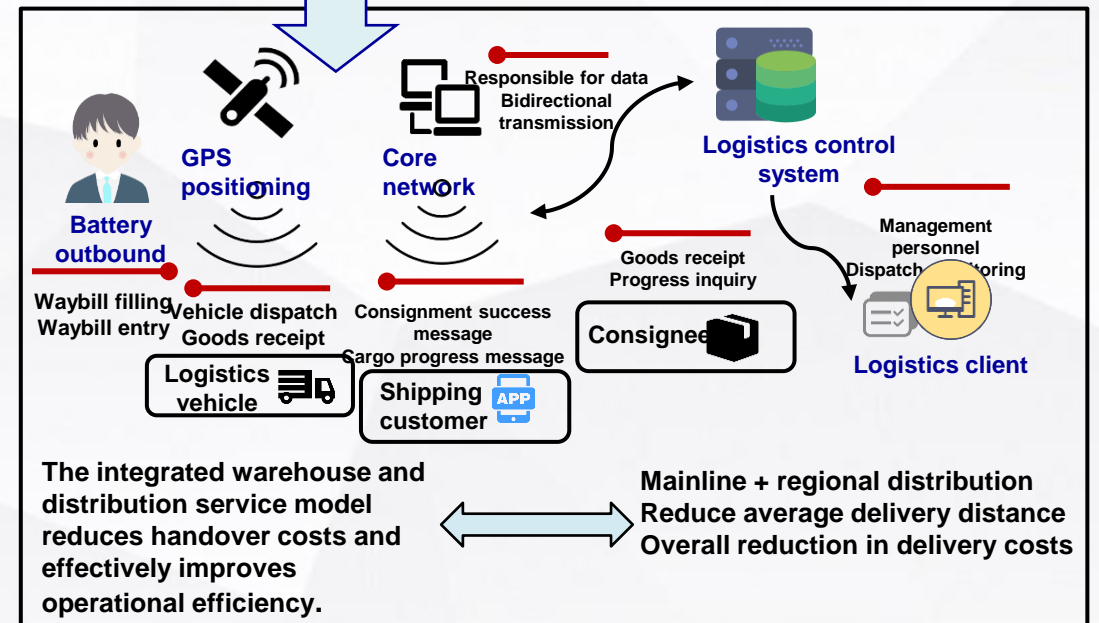


Product traceability system



URL: <https://www.koodpower.com/>

- QR code identification for battery products across their production, logistics scheduling, sales (trade-in, sharing, leasing, usage), recycling, and smelting processes via an APP platform.
- Real-time monitoring of battery lifecycle data, ensuring precise management of each stage of battery life and providing effective decision-making data support.





Battery smelting
and production site

2



Old battery annual
processing capacity

100万



Battery
production line

27



Annual production
capacity of new
batteries

30M



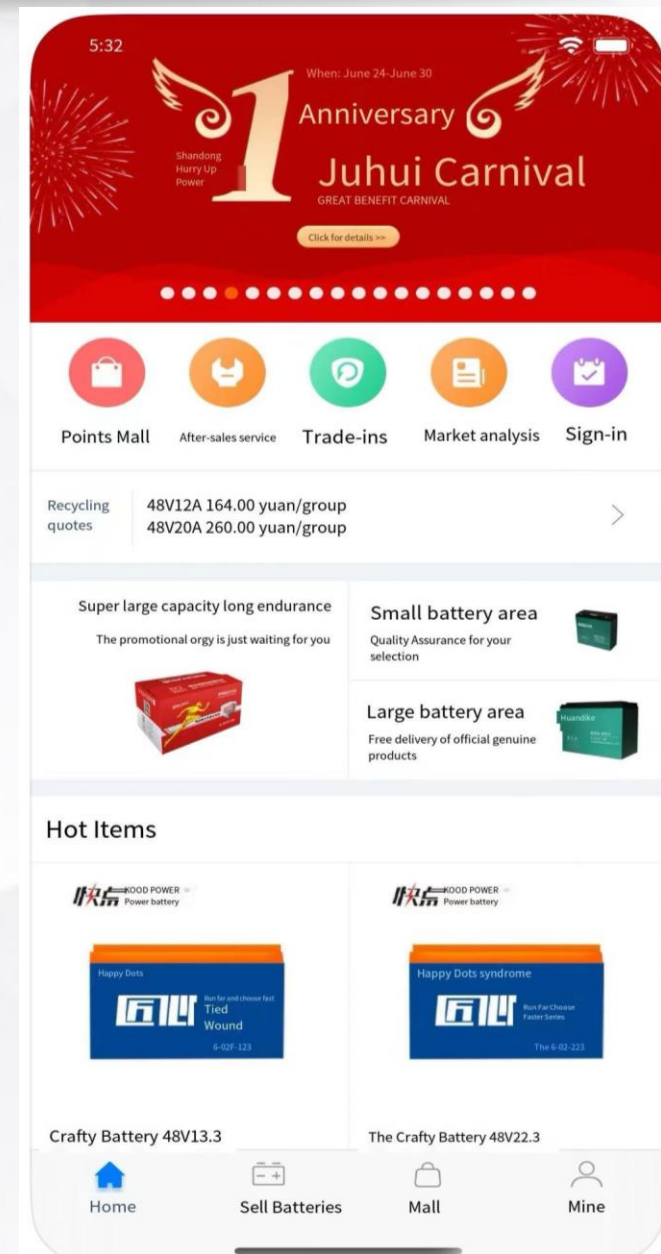
Cumulative service
users

4000万

Two kinds of service:

1. Sales model

- Download the APP through a mobile device, register as a user, one click to submit a battery reservation, and professional service staff to collect; the price is transparent and reasonable, and payment is time. Users can also submit battery orders online, and service personnel can quickly deliver them to the door.



Two kinds of service:

2. Rental model

■ Step1: One-click positioning, map to find points

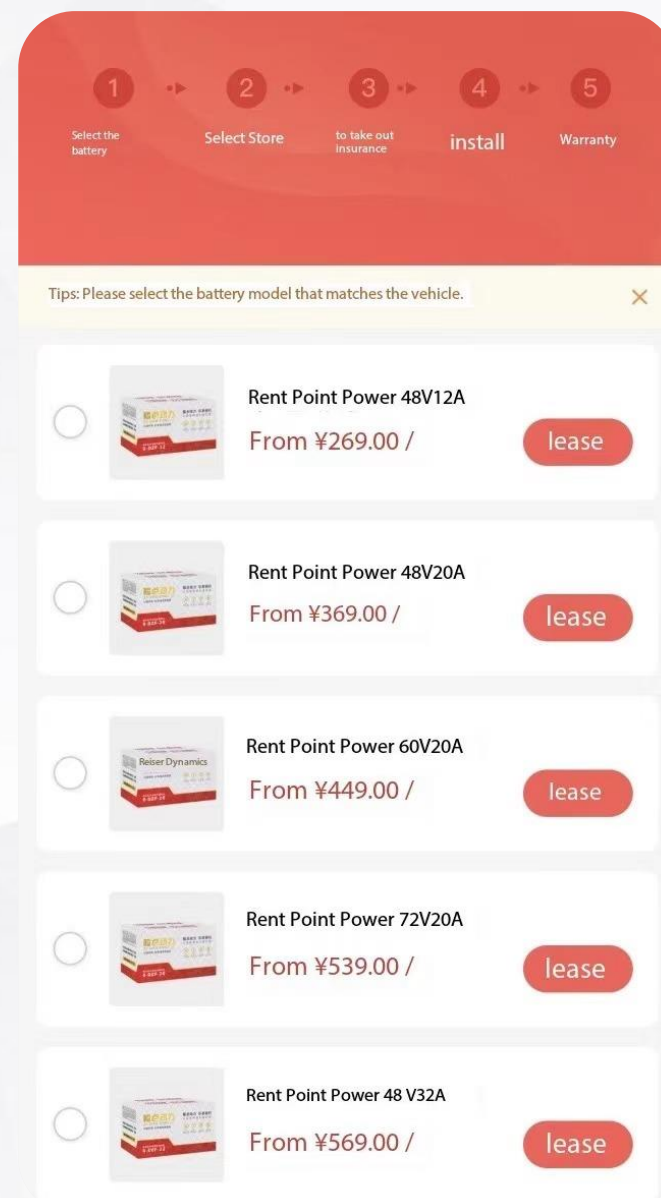
Autonavi maps accurate positioning, nearby outlets full display, more network search function, network phone advance booking, and rental battery more efficiently.

■ Step2: Scan code to use, quickly rent batteries

You can access the battery by scanning the QR code, selecting the lease term, and completing the online transaction.

■ Step3: Lease renewal and return, all the rental points are completed

Log in to rent power, enjoy the power battery sharing rental integrated service and rent power. Battery rental, replacement, renewal, and refund are all done.





The Green Mountains Initiative



Blue Planet Initiative

Cutlery Choice

Green Incentives



Old Interface: Default cutlery choice on the checkout page is preset to 'Provide cutlery'



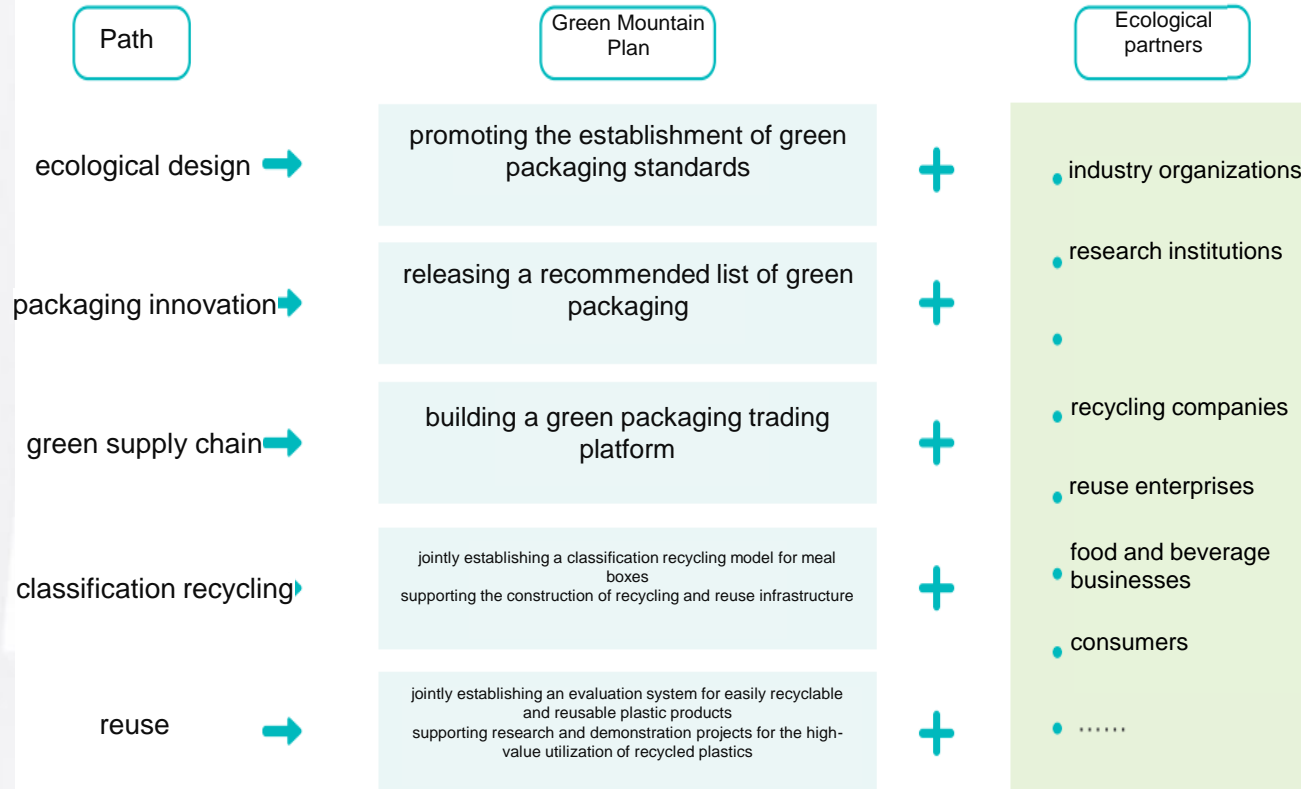
Updated Interface: A window regarding cutlery will automatically pop up during checkout. The default tableware option is set to No Cutlery'

Green Low Carbon



美团外卖
美团外卖 送啥都快

The Green Mountains Initiative



- Accumulatively, 30 types of 1.91 million green packaging products have been incubated and launched. Large-scale waste sorting and meal box recycling projects have been implemented in over 1500 communities and units. The large-scale recycling projects have collected over 5400 tons of plastic meal boxes, resulting in a carbon reduction of over 7000 tons.
- Large-scale meal box recycling projects have been completed or are under construction in seven provinces and two municipalities directly under the central government. The annual scale of recycling and reusing plastic meal boxes totals approximately 15,000 tons.
- The platform has gathered more than 1.09 million Green Mountains public welfare businesses to jointly support environmental welfare, and more than 360 million users have used the Meituan takeaway "no cutlery" function.

Challenge 1: Information security concerns still exist, and overall acceptance is not high



- **Consumers' concerns about information security have not been completely eliminated.** There is a lack of a unified national certification system, resulting in an overall low recycling rate, with a large number of obsolete mobile terminals still idle as the norm.

- The recycling price of most waste materials is low, and the enthusiasm of most families to use the Internet is not high. And because "Internet based" is a concept put forward in recent years, "Internet based recycling" is still in its infancy, and the types and recycling scope of recycled materials are relatively limited.



Challenge 2: Sustainable profitable way needs further exploration

- The recycling value of most recyclable resources is relatively low, and the profit of resources obtained by Internet enterprises through recycling is relatively limited.
- The online recycling channels for waste products are rapidly increasing, **whereas offline services are developing slowly**, leading to a **mismatch between online and offline services**. "O2O" door-to-door recycling often faces issues such as delayed arrival, low quality of recycling personnel, and lagging information feedback.
- Mainly focusing on high-value obsolete products, the large-scale and low-value recycling has not yet been extensively expanded. Overall operating costs are high, and government subsidies may even be required.

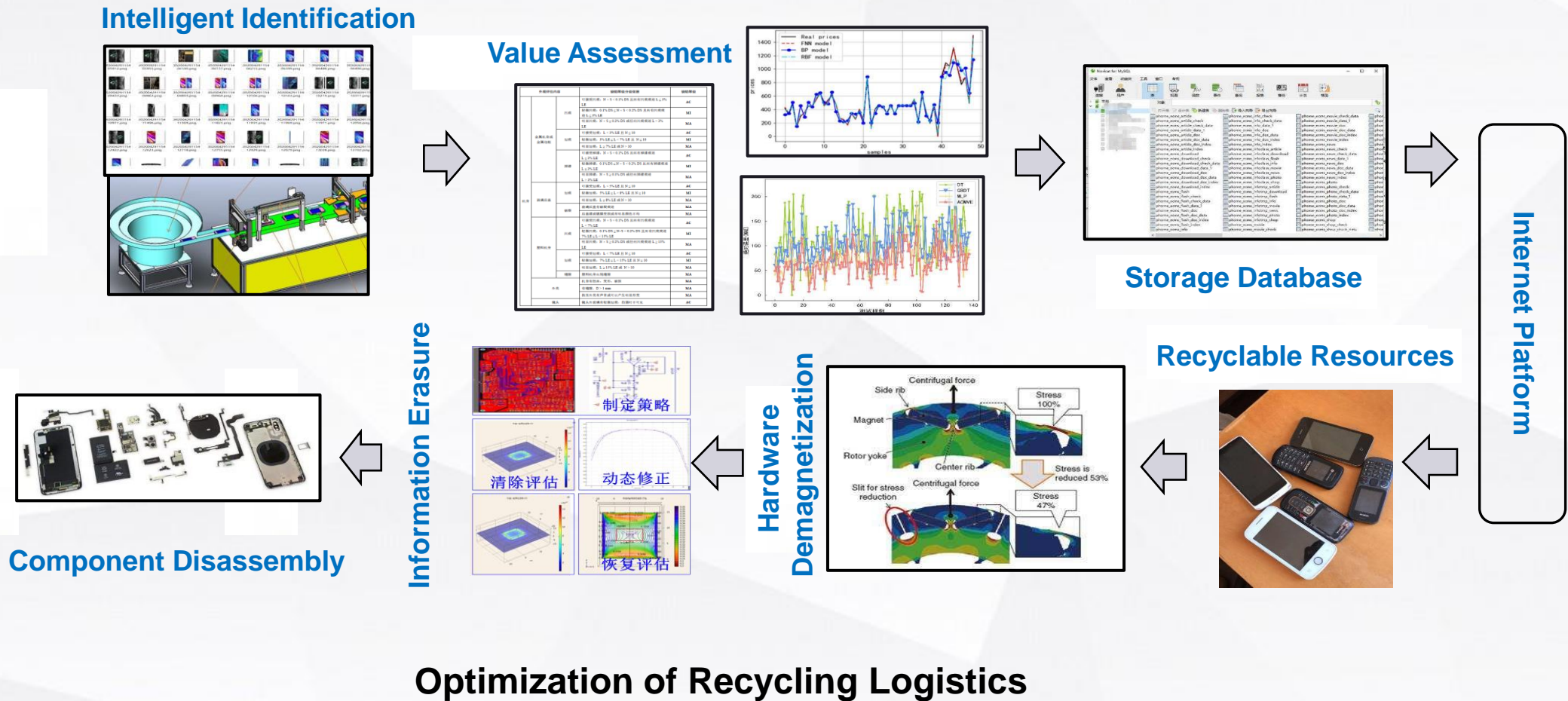


Challenge 3: The industry management system is not perfect

- Due to the lack of standards and regulations, internal competition within the waste recycling industry is relatively chaotic. Internet based recycling enterprises show a significant homogenization effect and have not formed unique core competitiveness.
- The opaque transaction prices and the inability to realize value-added tax deductions make it difficult to expand the market through normal financing, resulting in challenges for enterprises to grow and strengthen their competitiveness.
- At present, the publicity of Internet recycling enterprises is low, the business scope is limited, there are few well-known enterprises, and the recognition degree of citizens for Internet recycling is relatively low.

1. Further promote the combination of advanced Internet technology and recycling models

Ensure information security, improve efficiency, reduce costs, environmental standards



2. Establish an improved recycling system that combines online and offline

- Construction and Integration of Recycling Technology Paths for Obsolete Mobile Terminals
 - Building a large database of obsolete mobile terminals to support source classification.
 - Intelligent identification of 'waste' and 'obsolete', facilitating automatic sorting, and regulating the second-hand market.
 - Smart Disassembly
 - Component Reutilization

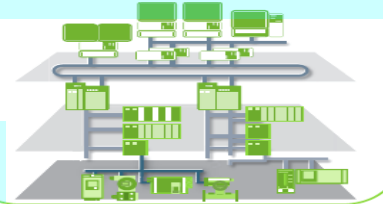
Intelligent Disassembly



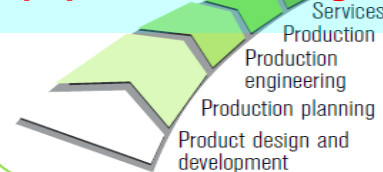
Green + Recycling



Reuse



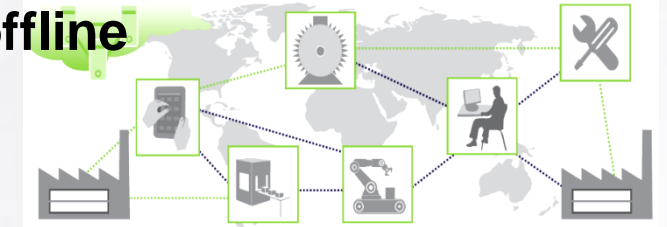
Equipment Matching



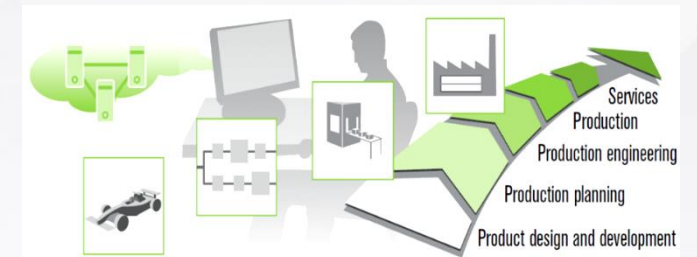
Technology Integration

software

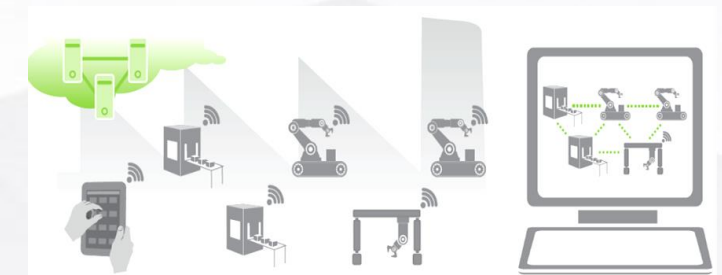
- Production management software
- Control and regulation software



Horizontal integration between industries is realized through value chain and network



Digital integration of end-to-end processes across the entire value chain



Vertical integration of flexible networked supervision system in each link

3. Establish an Internet-based recycling demonstration base



- Deepen the system docking with major traffic platforms and sales channels such as home appliance manufacturers and offline stores; Expand more offline recycling channels such as large supermarkets and intelligent recycling machines, integrate offline individual decentralized recycling networks in the form of joining, integrate various industrial chains, fully docking the combination of chains and the Internet, and form more competitive recycling models.

- Beijing, Shanghai and Guangzhou were selected as pilot cities to implement demonstration platforms and application technologies for recyclable resource recycling models. Use the advantages of the Internet combined with the support of existing standards to optimize the transportation path, control and supervise the whole chain of the recycling industry.





北京工业大学
BEIJING UNIVERSITY OF TECHNOLOGY



Thank You!

Email: tingting.liu@bjut.edu.cn