Plastic packaging Waste recycling in China’s E-commerce sector: A market outline and opportunities for Dutch companies

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1 Executive Summary

The goal of this report is to provide valuable insights on the current plastic packaging market in Mainland China’s e-commerce industry and to demonstrate how the market may provide opportunities for the Netherlands by analysing the industry. Due to the size of the report, the executive summary provides an overview of the report’s key contents, allowing the reader to quickly grasp the current situation in China, its future trends, challenges and how they link to opportunities.

The report firstly elaborates on the Dutch market. The Netherlands has a long history of recycling. Since the 1970s, the implementation of separate collection channels in the Netherlands made it possible to recycle glass and paper. This initiative came well before the European regulations implemented in 2008. Nowadays, many organizations in the Netherlands have a direct or indirect focus on sustainability, circular economy or recycling. Various initiatives, such as public-private partnerships and research institutions, support this focus.

Indeed, the Netherlands has surpassed its total packaging recycling goals. The rapid implementation of new initiatives indicates that the Netherlands has the capabilities and expertise to become an international leader in mechanical after-sorting of plastic packaging, a strategy not often used abroad. It should be noted that the Netherlands did not reach its goal of 52% plastic recycling in 2017. This is mainly due to China’s decision to refuse to recycle foreign plastic, including plastic originating from the Netherlands.

Afterwards, the report introduces the current plastic packaging situation in China’s e-commerce market. As the appetite of Chinese consumers for online shopping continues to grow, packaging solutions need to quickly evolve. Currently the express delivery market faces three major challenges that are impeding progress:

1. Over packaging;
2. Rapid increase of parcels;

Overpackaging has become a trend of late, as shippers aim to minimize damage to goods during transport. The volume is bound to increase rapidly as express delivery players transported a volume of 51.8 billion packages in 2018, a number expected to grow exponentially, reaching 192 billion packages in 2023. Fusing this fact with the thin low-quality plastic used for plastic packaging, such as PVC, a low recycling rate of an enormous volume is the consequence. Moreover, the payoff is currently too low to recycle low quality plastic packaging materials.

The year 2018 started with a significant change for the Chinese waste and recycling industry: the banning of foreign solid waste imports. The Chinese government announced their intention to ban 24 waste categories, including plastics and unsorted waste paper, by the end of 2017. By January 2018, the policy had taken effect. This not only impacted how countries such as the Netherlands deal with their waste, but also affected China itself.

Next to the ban on foreign solid waste, many laws, rules and regulations regarding sustainable plastic packaging and circular economy in general are now in place to address those numbers. In 2018 alone, the government has
published and approved over five new regulations and/or revisions, including the National Standard for Parcel Packaging Products. The goal of all these implementations is to make sure the three challenges are tackled.

Transitioning to a more circular economy requires action from, and collaboration between, public and private stakeholders to improve the current plastic packaging situation. The volumes place a huge burden on the market, not only for packaging waste but also efficiency in the logistics sector, where automatization and other advanced technologies will prove crucial. The market, dominated by only a handful of players, is investing rapidly. Most investments are being pushed from private companies with a direct business model.

For the plastic recycling industry and e-commerce parcel waste recycling, it is crucial to build a recycling management system and develop the value chain. Specifically, the report elaborates on the following trends:
- Increase of plastic packaging quality, both biodegradable and recyclable;
- Expanding plastic packaging waste qualification models;
- Implementation of the Extended Producer Responsibility Framework;
- Improving regulations and government incentives;
- Reducing plastic packaging through data analysis;
- Boosting market expertise & knowledge;

Though it has made progress, China must not be complacent. It must tackle several challenges to speed up the implementation. The challenges described in the report are as follows:
- Significant increase in express parcel delivery volume;
- Current lack of high quality plastics in the market;
- Disorganized domestic recycling systems;
- Social acknowledgement.

Combining the current situation, future trends, challenges and the Dutch market outline, the following Sino Dutch opportunities will be relevant:
- Assisting to improve plastic packaging quality;
- Implementing plastic packaging waste qualification models;
- Enhance the Extended Producer Responsibility framework;
- Help to improve policy enforcement and corporate certification;
- Make sure that domestic recycling systems will be increasingly centralized;
- Technology and R&D implementation;
- Boost social acknowledgment.

There are various opportunities for the Netherlands as a leading recycling nation in China. These opportunities exist due to the rapidly grown importance of public and private stakeholders dealing with the increasing plastic volumes in China.
Introduction

2.1 E-commerce – Plastic Packaging

The issues of resource scarcity, pollution prevention and environmental protection earned growing attention worldwide. The Chinese government has focused its efforts in recent years on packaging, specifically the materials used for and the waste produced by plastic packaging. Government regulation in the packaging sector has so far disrupted common practices and created new business opportunities.

These disruptions and opportunities also affect Dutch companies active in or with China. Disruptions include a regulation announced by the Chinese government in 2017 that bans waste imports (waste paper and plastics) from Europe via the port of Rotterdam to China. The policy will be fully implemented by 2020. On the other hand, opportunities arise from the Chinese government mandate to make packaging more sustainable and circular. The development of physical infrastructure and standards creates more opportunities that may also benefit the Netherlands. The Netherlands seeks to become fully circular in 2050; the regulatory environment in China will certainly affect the outcome of this plan.

In order to better understand the potential posed by the aforementioned opportunities, the Dutch government (RVO, in alignment with the Economic Network in China) has selected China’s e-commerce sustainable packaging and waste for closer study. This report will look at the Chinese market, specifically e-commerce and plastic packaging, from a macro perspective.

2.2 Research Scope & Content

The scope of this report is to analyse the current situation regarding plastic packaging waste recycling in Mainland China’s ecommerce sector. Specifically, the report takes a dive in the waste resulting from the transportation of products and express parcels and looks at the current activities in China’s ecommerce market and the current & future efforts on plastic packaging waste recycling.

This is done by looking at the Dutch plastic packaging sector in Chapter 3 and subsequently at the plastic packaging situation in China in Chapter 4. Chapter 5 will analyse the relevant laws, rules & regulations as well as associations for the plastic packaging sector. Chapter 6 will take the relevant private sectors into account, namely the Chinese e-commerce market and plastic recycling sector. Chapter 7 looks at trends for the upcoming years that will (re)shape the industry and will also elaborate on challenges that might delay this development. Finally, Chapter 8 looks at Sino Dutch Cooperation Opportunities and their implications after which conclusions and recommendations are given in Chapter 9.

The first appendix show a broad overview of key Dutch organizations in Chapter 10. Chapters 11 and 12 yield deeper analyses regarding Mainland China as a whole and the Chinese ecommerce and express delivery market. Furthermore, Chapter 13 provides three short examples of biodegradable plastics. Finally, the appendix will elaborate on all recent changes in the regulatory framework in Chapter 14 and relevant Chinese associations in Chapter 15.
3 Analysis of the Dutch Plastic Packaging Industry

To fully comprehend the opportunities for Dutch organizations in the Chinese plastic packaging of the e-commerce industry, it is important to first elaborate on the Dutch plastic packaging industry. With a clear overview of what players and expertise there are in the Netherlands, we can look at China’s market and compare both markets. We will first dive into which Dutch organizations and initiatives are key players in this industry. Afterwards, this chapter will elaborate on which commercial companies play or will play a big role in the future. Following commercial players, we will focus on what knowledge and future expertise will most likely make an impact on the Dutch plastic packaging industry. Finally, the report will formulate a conclusion why the Dutch plastic packaging industry is so unique and what components of this industry can be useful when looking at China. The links and opportunities towards China will be elaborated upon in Chapter 8.

3.1 Overview of Dutch Initiatives and Non-Profit Organizations

The Netherlands is a strong player on recycling. One of the reasons for this is a strong governmental and supporting framework which strategically enhances the recycling industry. Many institutions are linked to one another with both separated and shared responsibilities. Figure 1 below outlines a relevant overview of the Dutch market public sector and non-profit organizations. For a broader overview of all Dutch organizations see Chapter 10.1.

Figure 1: Current situation Netherlands (Afvalfonds Verpakkingen)
3.2 Commercial Key Players in the Netherlands

With such a strong supporting network of companies, the recycling industry in the Netherlands is substantial. In this sub-chapter we will share seven key commercial players in plastic recycling, waste management and even production. These companies are cherry picked to show how varied the knowledge in the Netherlands is on plastic packaging and how these can be used for economic profit. For broader description of the commercial key players in the Netherlands, please check chapter 10.2.

<table>
<thead>
<tr>
<th>Commercial key players</th>
<th>Recycling Expertise</th>
<th>Appendix</th>
</tr>
</thead>
<tbody>
<tr>
<td>Van Werven Rigid Plastic Recycling</td>
<td>Plastic recycling company in the field of infrastructure and recycling.</td>
<td>Chapter 10.2.1</td>
</tr>
<tr>
<td>Bollegraaf Recycling Solutions</td>
<td>Plastic recycling and waste processing equipment manufacturer.</td>
<td>Chapter 10.2.2</td>
</tr>
<tr>
<td>Suez</td>
<td>Waste sorting and water treatment company.</td>
<td>Chapter 10.2.3</td>
</tr>
<tr>
<td>Renewi</td>
<td>Waste management solutions.</td>
<td>Chapter 10.2.4</td>
</tr>
<tr>
<td>Royal DSM</td>
<td>Recycled product manufacturer.</td>
<td>Chapter 10.2.5</td>
</tr>
<tr>
<td>Ioniqa</td>
<td>Smart materials and separation processes.</td>
<td>Chapter 10.2.6</td>
</tr>
<tr>
<td>Avantium</td>
<td>Plant based plastic substitute.</td>
<td>Chapter 10.2.7</td>
</tr>
</tbody>
</table>

3.3 Upcoming Expertise in the Netherlands

Commercial companies in the Netherlands often get their innovations thanks to collaboration with research organizations, entrepreneurial initiatives and universities. These creators of innovations are often regarded as international leaders in the areas of sustainability, recycling and the e-commerce circular economy. In this sub-chapter, we will go into a few of the innovations which are being developed in the Netherlands at the moment. For broader description of the upcoming expertise in the Netherlands, please check chapter 10.2.

<table>
<thead>
<tr>
<th>Upcoming Expertise</th>
<th>Recycling Expertise</th>
<th>Appendix</th>
</tr>
</thead>
<tbody>
<tr>
<td>Great Bubble Barrier</td>
<td>Specialist in removal of plastics from rivers/channels/canals.</td>
<td>Chapter 10.3.1</td>
</tr>
<tr>
<td>Ocean Cleanup</td>
<td>Specialist in removal of plastics from oceans.</td>
<td>Chapter 10.3.2</td>
</tr>
<tr>
<td>Technical University Delft</td>
<td>Sustainable and circular product design.</td>
<td>Chapter 10.3.3</td>
</tr>
<tr>
<td>TNO</td>
<td>Circular economic advice.</td>
<td>Chapter 10.3.4</td>
</tr>
<tr>
<td>University of Twente</td>
<td>Research into energy and material savings.</td>
<td>Chapter 10.3.5</td>
</tr>
<tr>
<td>Vrije Universiteit Amsterdam</td>
<td>Research into various sustainable and circular economy topics.</td>
<td>Chapter 10.3.6</td>
</tr>
<tr>
<td>Wageningen University</td>
<td>Research into circular, bio-based economy.</td>
<td>Chapter 10.3.7</td>
</tr>
</tbody>
</table>

3.4 General Overview Plastic Packaging Recycling Netherlands

The Netherlands has a long history of recycling. The implementation of separate collection channels in the 1970s paved the way for the recycling of glass and paper in the Netherlands, well before the European regulations were introduced in 2008. Moreover, the number of recycled products has been steadily increasing, due to increased attention from both public and private initiatives. According to the Afvalfonds Verpakkingen’s website, over 78% of the packaging materials in the Netherlands were recycled in 2017. The Netherlands is a plastic packaging recycling leader in Europe. The Netherlands employs a wide collection strategy to gather all plastic packaging. Economically, however, the Dutch system has declined somewhat due to low-cost coverage. This
low-cost coverage stems from relatively high collection and sorting costs plus low recycling value. The recycle rate is low in value also because less valuable plastic is being collected. When a more selective collecting strategy is rolled out, recycling quality will rise, while the total percentage of recycled plastic will decline.

The Netherlands has a high collection response and stable plastic collection strategy thanks to a longstanding and consistent gathering system. This can be improved by providing a financial stimulus for sorting and controlling for quality. According to the KIDV, the Netherlands is capable of becoming an international leader in the mechanical after-sorting of plastic packaging, as this is not a strategy used often abroad.

The Netherlands surpassed its total packaging recycling goals in 2017. The results of recycling for paper and cardboard, wood, and metal are above the European and Dutch goals for packaging. For glass, the Netherlands surpassed the European goals, but not their own goals.

However, the Netherlands did not reach their 2017 goal of 52% recycling for plastic. This is mainly because China refused to recycle foreign plastic. The decreased percentage of plastic recycling due to the import ban of company waste was mitigated by household plastic waste, which is recycled in Europe.

According to NedVang, the big steps for improvement in the Netherlands compared to other packing material recycling is with plastic. The plastic cycle should transform from a demand to a supply-driven chain. This change can happen by offering a long-term certainty to chain partners, moreover better cost control. With regards to interventions, NedVang suggests:

- To raise the quality of recycled plastic so a bigger market will be created for the end product;
- Further stimulate citizens and municipalities to reduce mixed waste when gathering waste;
- Increase quality of waste gathering and sorting, by stimulating innovation;
- Scaling up and innovating at the recycling companies, so the quality of the recycle rate is higher.
4 Current Plastic Packaging Situation in China’s E-commerce Market

This chapter will look at the current packaging situation and elaborate on how it contributes to the volume of packaging waste. During the past years, the ecommerce market has been booming in China. This is on the one hand due to the growing middle class as elaborated upon in the Appendix, but also due to the rapid evolution of the online sector. Figure 2 below indicates that the market has grown significantly in terms of volume during the recent years. The market boomed from 5.69 billion packages in 2012 to a staggering volume of 40.1 billion packages in 2017 (China Statistic Bureau). In comparison, the Netherlands had 420 million packages in 2017 which was a 10% increase compared to the Dutch volume in 2016 (Afvalfonds Verpakkingen). This is significantly less growth than in China and roughly 1% of the volume.

![Figure 2: Courier traffic in China in 2012 – 2018 (in Billion Pieces)](image)

As can be seen in figure 3, this is only the start. With the current market development, an estimated 192.3 billion packages will be sent by 2023. Looking at how these parcels are packaged and taking into account the over packaging explained in the next paragraph, significant steps need to be taken in order to ensure that plastic packaging waste doesn’t quadruple.

![Figure 3: Projected Demand for the Express Delivery Market: 2018 – 2023 (in billions of packages) (Source: ChinaIRN.com)](image)
The current situation in China’s ecommerce landscape is far from ideal. Whilst transporting express goods, retailers and delivery companies may use up to seven types of packaging material for each parcel to minimize damage caused during transportation. These materials include paper waybills, envelopes, cartons, plastic bags, woven bags, tape and buffer materials like bubble wrap. Over packaging protects goods and reduces the risk of damage during transport and also potentially boosts customer satisfaction. In 2017, courier volume made another increase; 40.06 billion pieces of parcels were delivered. This means that more than 40 billion sets of parcel waste, which equals 8 million tons of waste generated. In the first half of 2018, the courier traffic volume already reached 22.08 billion pieces.

In China’s megacities, the increase in express packaging waste accounted for 93% of the increase in solid waste, and in some large cities that share is as high as 85% or 90%. Parcel packaging waste contributes 40% of municipal solid waste. Municipal solid waste is the solid waste generated in the daily life of the city or services provided from the daily life of the city, as well as solid wastes that are considered as municipal solid waste by laws and regulations. It includes household waste, commercial waste, market garbage, garbage from public places (excluding hazardous solid waste such as industrial waste and special waste). The volume of China’s municipal solid waste between 2010 and 2016 can be seen in the graph below:

![2010-2016 China's Municipal Solid Waste](image)

Currently, the express market uses thin and low-quality plastics which are, according to Tsinghua Research Centre, rarely recycled. This is due to the fact that the quality of the plastic is too poor for reuse. Consequently, the payoff is too low to recycle such plastic packaging materials which means that, in effect, the incentive to recycle remains low. Therefore, PVC and other low-quality plastics produce large quantities of parcel packaging waste and pollution. At the same time, the over-packaging costs lead to an increase on the overall packaging expense for the e-commerce sector. Cost-wise, the proportion of various types of packaging materials in the courier enterprise’s revenue costs is around 12% to 15%. Based on this calculation, the downstream packaging industry, driven by express delivery has reached an overall scale of CNY 50 billion in 2016 and has been rising...
steadily. In terms of geographical distribution, the distribution of express packaging production suppliers is still concentrated in areas with more developed economies and express services such as East China and South China, with Guangdong, Zhejiang and Jiangsu having the highest density. This is in line with the bigger e-commerce regions, as indicated in the Appendix in Figure 31.

Due to the rapid increase in express parcel garbage, the proportion of plastic and paper waste in domestic garbage has increased greatly. The proportion of plastic waste increased from 12% to 20%, and the proportion of paper waste increased from 9% to 14%. As can be seen from the figure 5 below, the cities with the highest ranking of domestic waste production are also cities with the highest developed economy and highest express volumes. They are all tier 1 cities, including new tier 1 cities. Among them, the proportion of tier 1 cities is as high as 64.1%.

![Figure 5: Top 8 Cities on Waste Production in 2016 (in million tons)](image)

Nowadays, around half of all e-commerce parcels use plastic bags. A detailed composition index can be found in Figure 6. The estimated use of plastic bags in the country in 2018 is about 25.9 billion. Plastic bags in e-commerce logistics are often used only once. Due to the over-packaging problem, a single parcel sometimes uses several plastic bags. Unlike plastic woven bags, normal parcel plastic bags are single-use bags. Therefore, it increases the difficulty of recycling. A potential opportunity lies in the implementation of not only recyclable plastic bags but also the implementation on a national scale.
Currently, some enterprises pioneering in the green packaging sector are investing heavily to develop degradable plastic bag technology and promote the technical application of degradable plastic bags. Cainiao and other enterprises have made great progress in the technology of degradable plastic bag packaging. However, degradable plastic bags are still not recyclable. On one hand, the technology indeed saves non-renewable resources, but on the other hand, it will emit more CO₂ to the atmosphere during degrading process.

The use of e-commerce logistics woven bags in express delivery companies accounts for 45% of the business volume, and around 20 billion woven bags were consumed regardless of recycling factors in 2017. However, in order to promote the development of green packaging and to reduce packaging waste, many courier companies have begun to promote the recycling of woven bags. Some e-commerce logistics companies have used circulatory boxes to replace woven bags or use canvas bags instead of woven bags. In 2017, the industry consumed 800 million plastic woven bags used for transferring and transporting parcels.
Except focusing on plastic packaging, the express market has implemented digital waybills, in the form of a small squared-sticker and it contains sender’s and receiver’s information. This digital waybill has now completely replaced the normal handwriting waybills. In 2017, the express market used about 40.06 billion express delivery waybills, of which 32 billion were electronic waybills, accounting for 80%. This is a significant improvement and a simple but progressive example in green packaging for e-commerce logistics.

By implementing this, the industry saved 21 billion traditional paper waybills, 6.4 billion meter of tape and 400 million transfer woven bags by the end of 2017. The leading express delivery enterprises could save 5.5 billion pieces of packaging materials through solving the over-packaging problem and reusing the paper boxes. In recent years, it can be seen that the usage of packaging in CEP industry has been decreased dramatically, especially if the growth of the parcel volume is taken into account.

As a step between the current levels of recycling and a complete circular economy, some companies started to invest heavily to develop degradable plastic bag technology and promote the technical application of degradable plastic bags. Organizations, such as Cainiao, have made great progress in the technology of degradable plastic bag packaging. By replacing the traditional PE or PVC plastic bags, these initiatives have saved 2,000 tons of polyethylene by using bio-degradable plastic materials. However, degradable plastic bags are still not recyclable. On the one hand, the technology indeed saves non-renewable resources, but on the other hand, it will emit more CO₂ to the atmosphere during degrading process. Three initiatives can be found in Appendix IV.

It is vital that the market takes rapid steps to improve the current situation. Looking at the volumes in the upcoming years, the percentages of recycled plastic needs to be boosted. That can on the one had be started with making sure the plastic quality is good but the current waste management flow also needs to have a critical upgrade. The next section will elaborate on this.

4.1.1 Plastic Packaging Waste Management Flow

China has improved waste management and recycling systems to tackle environmental issues caused by a build-up of garbage. According to Worldscrap, and shown in Figure 7, the standardized plastic waste management flow is as follows:

1. Garbage pick-up vehicles will pick up the trash from household or residential areas;
2. Garbage is transferred from residential areas to regional trash-gathering centres for the initial sorting;
3. Trucks will pick-up large amount of sorted waste plastic either to recycling companies;
4. Recycling companies will sort the plastics which could be recycled and send the rest to landfill or burning station;
5. Recycled plastic will be reproduced to recycled plastic pellets, and they will be sent to plastic products manufactures;
6. New products are produced and back to the market.

![Waste management Flow](http://www.worldscrap.cn)

Figure 7: Waste management Flow (Worldscrap.cn, 2018)

However, from the first step to the second step, there are only many minor operators and individual recyclers. Currently, there are over 15,450 of small recyclers in China. Based on the current situation in China, the waste from step 1 goes to step 2, it will go through 3 to 5 sub steps through small operators, which also increase the cost of waste and decreases the efficiency on waste recycling. Currently in China, it is important to start building a standardized e-commerce recycling flow.

In order to unite the small operators who are involved in Step 3 to 5, it is crucial to regulate the supply chain of the waste. Most waste have been polluted for the second time during the recycling process. The individual recyclors and minor organizations, which are either undocumented operators or scattered operators, often try to raise profit for themselves. For example, adding some water to the garbage to with the only goal to make it weigh heavier. Such behaviour makes the recycling industry not only inefficient but also could lead to a loss in reputation of recyclers.

Each centre has wasted courier-packaging material. If that package waste can be recycled for secondary treatment, it could recycle 3-5 tons of waste plastic on an annual basis. The total estimated consumption and value output per material can be seen in the figure below:
<table>
<thead>
<tr>
<th>Order</th>
<th>Packaging Type</th>
<th>Estimated Quantity (Billion Pieces)</th>
<th>Estimated Amount (CNY Billion)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Express waybill</td>
<td>100.25</td>
<td>6</td>
</tr>
<tr>
<td>2</td>
<td>Woven Bags</td>
<td>14.66</td>
<td>14.66</td>
</tr>
<tr>
<td>3</td>
<td>Plastic Bags</td>
<td>40</td>
<td>16</td>
</tr>
<tr>
<td>4</td>
<td>Envelopes</td>
<td>15</td>
<td>6</td>
</tr>
<tr>
<td>5</td>
<td>Boxes</td>
<td>48</td>
<td>96</td>
</tr>
<tr>
<td>6</td>
<td>Tape</td>
<td>82</td>
<td>19.24</td>
</tr>
<tr>
<td>7</td>
<td>Fillings</td>
<td>14.4</td>
<td>0.72</td>
</tr>
<tr>
<td>8</td>
<td>Others</td>
<td>10</td>
<td>6</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>324.31</td>
<td>164.62</td>
</tr>
</tbody>
</table>

Figure 8: Estimated consumption and total output value China’s express packaging 2020.

As over 90% of the parcel plastic packaging waste are not recycled, they will be thrown away directly as household garbage. Therefore, in current stage, the plastic packaging waste management flow is actually household waste management flow in China. The Ministry of Housing and Urban-Rural Development of the PRC (MOHURD) has published a new management scheme regarding household waste management. 46 cities are selected as pilot cities for this management scheme. Figure 9 shows that the new household waste management flow in the 46 pilot cities. The e-commerce plastic packaging waste will also follow this flow. Due to the fact that the plastic packaging materials using for parcel transport don’t have high recycling value, in another word, the quality of the plastic is not good. Therefore, most of parcel plastic packaging will be transported to unrecyclable waste treatment centers to be burned for energy recycling.

Figure 9: Waste management Flow (MOHURD, 2018)
5 Chinese Market: Laws, Regulations & Associations related to Plastic Packaging

The goal of this chapter is to elaborate on the focus of the Chinese local & central government on plastic packaging in China. There have been many changes and/or introductions of new regulations in China and this chapter picks out the most important changes and implications thereof. Changes are often coming from input of local and national governments as well as associations which have often been incorporated through government initiatives. A short overview of relevant associations and their goals is provided. The complete list of rules and regulations as well as relevant associations can be found in the appendix. Lastly, the chapter elaborates on regional initiatives and current activities and ends with a case study elaborating on Guangdong Province.

5.1 National Level

In order to promote the development of sustainability, Chinese central government has promoted circular economy constantly since it unveiled the 11th five-year plan in 2006. The country is currently in the transition from being the world’s factory to a major hub of innovation and advanced technology. China’s aim to promote the circular economy is to “harmonize” economic development and environmental conservation through maximizing economic and social benefits, while minimizing resource consumption and adverse environmental consequences. The circular economy in China is currently focused on waste reduction and optimisation on the long run. This is different from Netherlands and the European Union in which the focus lies on creating a total circular economy which reuses all materials. Even though China has entered the phase of “economic new normal” with a relatively slowed-down GDP growth, the country is still focussing strongly on improving sustainability.

5.1.1 National Goals

A potential big impact for the plastic packaging industry was developed in 2016. Specifically, the 13th five-year plan outlines the Extended Producer Responsibility (EPR) Framework. As part of its supply-side structural reforms and upgrading of manufacturing processes, the State Council now requires manufacturers to be responsible for the entire lifecycle of a product. The framework will take product design, circulation consumption, recycling and waste disposal into account for the first time. The plan should begin to take shape by 2020, and all relevant laws and the complete framework should be finalized by 2025. The Extended Producer Responsibility is a large, new responsibility for producers and manufacturers and will have an impact in plastics development and plastic recycling. From the side of the government, the following goals are set:

- 50% of all waste should be recycled by 2025;
- New products must contain 20% recycled materials by 2025;
- Usage proportion of degradable green packaging materials will reach 50% by 2020;
- A socialized express delivery packaging recycling system will be basically established by 2020.

\(^1\) China's Economic New Normal: China’s GDP growth rate has started to fall since 2012. From 2012 to the 3rd quarter of 2018, the growth rate drops from 7.86% to 6.5%. It is a fundamental shift in the stage of economic growth. China moved away from the rapid growth of about 10% on average over the past 30 years. China’s economy has shown a new normal with three characteristics, which are changes from high-speed growth to medium-high-speed growth, economic structure optimization and upgrading, and changes from factor-driven and investment-driven to innovation-driven.
The government promotes cost efficiency and green logistic to logistic and express delivery industries, as they are highly related with plastic packaging waste control. In the “Special Action Plan for Reducing the Cost and Increasing Efficiency of the Logistics Industry (2016-2018),” the National Development and Reform Commission will give full play to the important role of logistics information platforms in optimizing and integrating logistics resources, promoting information interconnection and interoperability, and improving the degree of organizational organization of logistics. Being sustainable on packaging materials is cost efficient and resource efficient. The Post Bureau in China has encouraged post office and express delivery companies to take actions according to the goals set in “Proposal of Promoting the Green Packaging of the Express Industry”. The promotion started in 2016, with aim of developing a “low pollution, low consumption, low emission, high efficiency, high efficiency and high efficiency” express delivery industry.

The 11th Five Year Plan (2006–10) was the first plan to place strategic importance on the development of the circular economy. This plan suggested the practical implementation of the circular economy at three levels (enterprises – micro; industrial parks – meso; and cities and regions – macro). It resulted in the publication of the Circular Economy Promotion Law in 2008, one of the first pieces of circular economy legislation in the world, with a focus on the ‘Reduce, Reuse, Recycle (3R)’ principle.

During the 12th Five Year Plan (2011–15), China’s National Development and Reform Commission (NDRC) synthesised 60 best practices from the pilot projects at enterprise, industrial park, and regional levels. It also upgraded the circular economy to a national development strategy by scaling up the demonstration of the circular economy within the Development Strategy and by launching the Immediate Action Plan of Circular Economy in 2013. This action plan outlined how the demonstration pilot programme would target ten projects, 100 cities and 1,000 enterprises.

The current 13th Five Year Plan (2016–2020) keeps the circular economy and low-carbon economy as key focus areas for policy. It introduces binding targets relevant for the circular economy, emphasises the importance of an Extended Producer Responsibility (EPR) framework, and proposes to further strengthen municipal waste management and the remanufacturing industry.

5.1.2 Rules & Regulations

Following the guidelines of national goals, government has published several laws and regulations for implementation. Often, new trends in China started through rules & regulations as well as incentives provided by the government. A centralized approach is normal in China implying that the rules are provided on a national level whereas implementation can vary across regions. This section analyses on the most important national rules & regulations and the impact thereof.

The report “The Circular Economy Opportunity for Urban Industrial Innovation in China” from the Ellen MacArthur Foundation during September 2018, suggests “China’s government has been showing its commitment to the implementation of a circular economy by actively developing the legislative framework and guidelines while setting binding targets at a national level.” Linking plastic packaging waste to the e-commerce
sector, the goal of Chinese government is to promote a prosperous but sustainable market by the promotion of green logistics and efficient utilization of resources. Policymakers at both national, provincial and city levels are playing a leading role in establishing the policy and frameworks to enable businesses to achieve the circular economy and sustainable vision.

“In August of 2008, Circular Economy Promotion Law of PRC was published and was put into effect on January 1st, 2009. The law emphasizes on packaging recycling and the encouragement to packaging material manufacturers to use recyclable materials. In Article 19, it states that “in the design of processes, equipment, products and packaging materials, materials and design schemes that are easy to recycle, easy to disassemble, easily degradable…” and “design product packaging should implement product packaging standards to prevent waste of resources and environmental pollution caused by excessive packaging.”

Based on the Circular Economy Promotion Law, Chinese government has successively issued the “Implementation Plan for Promoting Green Packaging Work in Express Delivery Industry,” “Guiding Opinions on Collaborative Promotion of Green Packaging Work in Express Delivery Industry” and “Provisional Regulations for Express Delivery” beginning in 2016. The promulgation of new regulations has promoted the green development of the express delivery industry. Since 2016, with a premium focus from the federal level, new laws and regulations have been published and implemented to the express delivery industry to regulate and control the packaging waste, not only on plastic packaging materials, but also on paper boxes, tapes, plastic woven bags, envelopes, plastic fillings and waybills.

In order to encourage companies and senders to use environmental-friendly packaging materials that are degradable and recyclable, “Provisional Regulations for Express Delivery” was revised and implemented on May 1st, 2018. It is the first highest-profile legal document in China’s Express Delivery industry upon its implementation. Under the guidance of the national green development concept, the standardized governance and supervision of express packaging is also expected to move toward legalization.

Furthermore, “National Standard for Parcel Packaging Products” was also revised and published on September 1st in 2018. For the first time, the policy clearly stated that “plastic packaging bags should be biodegradable plastics,” and strengthened requirements for packaging reduction. It increases the relevant requirements for second use of express envelope. Under the premise of meeting the standard, the express packages can be reused. For different express packaging products, recyclable signs, reusable signs or plastic product marks should be printed for easy recycling.

One of the latest regulations, “Guidance of Express Delivery Green Packaging” was issued in December 17th in 2018. It is a trail which aims to regulate the goals of packaging standardization, material usage minimization and recycling, to enhance the cooperation within the supply chain, and to gradually achieve the minimization and reuse of the packaging materials. According to this guidance, express delivery companies are supposed to actively provide green packaging option for their customers. Therefore, it could increase the use of green packaging and increase the society’s consciousness regarding the use of green packaging materials.
Besides on the promotion on the recycling of plastic packaging waste, the year 2018 began with a significant change for the waste and recycling industry: the ban of foreign solid waste imports. The government announced their intention to ban 24 categories, such as plastics and unsorted waste paper, by the end of 2017, and the policy has come into force in January 2018. This not only had an impact in how countries such as the Netherlands deal with their waste, it also had a big impact in China itself. The implementation of the ban on “foreign garbage” resulted in the decrease of total amount of plastic waste resource for Chinese recyclers. The recyclers had to search for new resources inside China in order to sustain production levels. Therefore, the recycling rate of domestic waste plastic resources will be greatly improved. The demand in China’s domestic market is bound to accelerate, which will provide a huge opportunity for the renewable resources recycling industry in 2018. On the one hand, the relevant industries need to search for new local raw materials searches.

As it can be seen, in 2018, Chinese government has implemented three regulations to express delivery industry regards to packaging waste and green packaging materials. It shows that China focusing on dealing with parcel packaging waste and sustainable development on green packaging materials. According to those regulations, companies and organizations in the related industries are pushed to move to the track of recycling plastic and paper packaging materials as well as green materials development.

A detailed overview of all relevant laws associations can be found in the Appendix, Chapter 14.

5.1.3 Associations

The Chinese central government, in line with the regulations described in the previous section, has established a variety of relevant associations for plastic packaging and sustainability. The chairmen of most of the associations are elected from official government departments or from the leading companies in their respective industries. The goal of these associations is often twofold: act as an umbrella association and build on the current expertise and advice regarding new policies and future directions. These associations play a crucial role in the implementation of the regulations.

Relating to this project for plastic packaging recycling, the following associations would be relevant for the sector; China Plastic Recycling Association (CPRA) and China Synthetic Resin Association Plastic Recycling Branch. With the experience in the industry, these two associations could provide companies with market insights and business connections. The Plastic Recycling Branch under China Synthetic Resin Association is newly founded in the end of 2017. In the interview with its Chef Secretary, Ms. Jiang Nanqing shared that the association aims to help and assist companies to understand Chinese market, and to get the first-hand information from the enterprises and government organizations. Moreover, on a more general level, China Association of Circular Economy (CACE) involves with building the resources recycling system in China, and plastic packaging recycling is one of the key elements. CACE has a number of provincial and municipal branches over China. For example, CACE Guangzhou Branch involved with the building of plastic packaging materials recycling system in Guangzhou City.

A full overview of all relevant associations can be found in the Appendix, Chapter 15.
5.2 Regional Level

Many rules and regulations are introduced in a center-out fashion. Under the guideline of Chinese central government, some provincial and municipal governments have taken the lead and make detailed regulations based on their regions’ realistic situation. This section will take some cities and provinces as examples in the development of managing plastic packaging waste and green plastic packaging materials, their regulations, incentives, and activities will be introduced in this part of the report. The city Guangzhou will be listed as a case study as Guangzhou City is one of the leading cities on building recycling systems regarding e-commerce plastic packaging waste.

5.2.1 Local Regulations and Incentives

Integrating packaging logistics and implementing integrated packaging solutions have become a realistic demand. In the Eastern and Southern regions, as their express delivery industry is playing a dominating role, some regional governments took action towards the plastic packaging waste problem in major cities. Therefore, this section introduces cities and provinces which are located in the Eastern and Southern regions.

Shanghai:

- Newly issued “Implementation Scheme on Building and Improving Shanghai Household Waste Classification System” indicates that Shanghai will basically complete the waste classification system by 2020. On the other hand, to integrate the recycling and classification nets to increase the recycling rate of household waste to 35%. It also specifically stated that waste plastic must be recycled.
- In a general level, Shanghai has issued a “Three-year Action Plan on Environment Protection and Construction 2018 – 2020”. It highlights recycling of solid waste and prevention of solid waste pollution.

Zhejiang:

- As the birthplace of the express delivery industry in China, the courier traffic in Zhejiang Province exceeded 10 billion pieces in 2018, and 95% of those are from e-commerce. The plastic packaging waste is therefore a major problem in this region. Zhejiang Provincial Post Bureau has issued “Management Plan of Express Delivery Green Packaging” together with seven other governmental departments. In accordance with the national goal, Zhejiang government plans to increase the usage of degradable packaging materials to 50% by 2020. The plan supports the local express delivery companies to participate into the building of packaging waste recycling system. It also encourages the pilot cooperation projects between recycling companies and express delivery companies.

Shenzhen:

- At the beginning of 2017, the CPPCC’s "Proposal on Comprehensively Promoting the Waste Classification System and Further Improving the Quality of Shenzhen's Urban Development" was listed as the supervision proposal of the CPPCC Chairman’s Meeting and was handed over to the Municipal Urban Management Bureau and other units.
- “Regulation of Household Waste Classification in Shenzhen (Draft)" has mentioned that the regulation requests e-commerce and express delivery companies to use recycled packaging materials and the decrease the amount of packaging materials used for the parcels.
Shandong:
In January 2018, nine departments of Shandong Province jointly issued the "Opinions on Supporting Key Enterprises to Try and Build Waste Plastics Recycling System," focusing on guiding and supporting leading enterprises in the province to effectively construct waste plastics and waste paper recycling systems.

5.2.2 Pilot Cities’ Activities
In the cities and regions mentioned above, they have taken actions and carried out activities regarding plastic packaging recycling or development of green packaging materials. This section elaborates some activities that took place in those places.

Shanghai:
With support from various stakeholders such as the Ministry of Environmental Protection, the Development and Reform Commission and the Municipality Financial Department, the city charges fees to electrical appliance producers, puts the proceeds in a fund, and uses it to give subsidies to e-waste processing companies. The development situation of waste plastics recycling and analysis industry in Shanghai has changed the phenomenon of scattered, disordered and single channel in waste plastics recycling market in China. Now the Internet and other channels should be actively used to develop waste material recycling, while also realizing industrialization, recycling into specialized industrial parks. To achieve the goal of environmental protection, energy saving and high production, especially the recycling of waste paper, waste equipment, waste plastics and other waste products, it is necessary to establish a long-term effective material recycling network, as long as a long-term industrial chain is further formed, the recycling and reuse can be better implemented as soon as possible. The recycling development of waste plastics in Shanghai will surely be on a new level.

Shenzhen:
The city began to directly recycle the express packaging in 2018. This means that in the future, the courier will be responsible for recycling the express package and its waste. Current, the daily delivery and receipt of express delivery in Shenzhen are 6 million pieces and 3 million pieces, and the daily fast food take-away is as much as 1.5 million pieces, resulting in a large number of express packaging. Therefore, Shenzhen City will actively explore the direct recycling of express packaging. At present, Shenzhen Urban Management Bureau has carried out a feasibility study on the classification and recycling of express packaging materials. In 2018, the joint communication department and the express delivery industry will jointly carry out direct recycling pilot work.

Shandong:
A key province in the production and processing of recycled plastics, has always relied on imported waste plastic materials. The tremendous changes in the market have also brought strong pressure on many companies. Longfu Recycling Energy Scientech is a company mainly engaged in the recycling of polyester resources. Its raw materials have been mainly imported from abroad. However, the implementation of the ban on solid waste importing shifted the focus of Longfu from foreign market to domestic waste plastic recycling. With the support of the government, the plastic recycling system in Shandong Province was rebuilt with new standards. From the perspective of domestic policies, the future waste plastics recycling industry will develop towards sustainable and higher add-value development.
5.2.3 Case Study: Guangdong Province

Guangdong Province is always the leading region on environmental issues and initiatives. In the aspect of express delivery packaging waste, a number of regulations, incentives and activities have been carried out by the provincial government and the municipal governments in Guangdong Province.

**Household Waste Classification:**

As over 90% of the parcel packaging waste goes into household waste, the promote of household waste classification will meanwhile increase the recycling rate of express delivery packaging waste. In the beginning of 2018, Ministry of Housing and Urban-Rural Development of the PRC (MOHURD) issued a notice to 46 cities in China to request them to promote classification work on household waste. Among the 46 cities, Guangzhou and Shenzhen are both in Guangdong Province. By July in 2018, both Guangzhou and Shenzhen have made major progress on the household waste classification. After Guangzhou Municipal government issued the “Management Regulations of Household Waste Classification” in July in 2018, the classification of household waste has made huge progress. The government enforces the implementation of the regulation, and there is penalty when companies, organizations or residential communities didn’t follow the regulations.

**Promoting Green Packaging**

A list of regulations was implemented in Guangdong Province on January 1\textsuperscript{st}, 2018. As such, shippers that use unqualified packaging materials for express delivery will be punished. The Guangdong Provincial Postal Administration recently said in response to the proposal of the CPPCC\textsuperscript{2} members that it will promote the green packaging work of the express delivery industry and will strictly investigate the express delivery enterprises that use unqualified express delivery industry packaging materials. The Post Administration will organize product inspections and quality inspections of packaging materials in the express delivery. It will seriously investigate and deal with the founding of illegal production of unqualified express delivery industry packaging materials and express delivery enterprises that use unqualified express delivery industry packaging materials. All express delivery companies must purchase and utilize the packaging materials products, which produced by enterprises that have obtained the supervision certificate; otherwise, the express delivery companies will be punished together.

Shenzhen began to directly recycle the express packaging in 2018. This means that in the future, the courier will be responsible for recycling the express package and its waste. Current, the daily delivery and receipt of express delivery in Shenzhen are 6 million pieces and 3 million pieces, and the daily fast food take-away is as much as 1.5 million pieces, resulting in a large number of express packaging. Therefore, Shenzhen City will actively explore the direct recycling of express packaging. At present, Shenzhen Urban Management Bureau has carried out a feasibility study on the classification and recycling of express packaging materials. In 2018, the joint communication department and the express delivery industry will jointly carry out direct recycling pilot work.

\textsuperscript{2} CPPCC: The National Committee of the Chinese People’s Political Consultative Conference. One of the responsibilities of CPPCC is to negotiate national and local policies and important issues in political, economic, cultural and social life before making decisions and to discuss important issues in the implementation of decision-making.
5.3 Implications

Many of the current steps in the industry are taken after the government has taken action. It is therefore important to keep following the regulatory framework and publications of relevant government institutions and/or associations. Due to the fact that there is a lot of initiative from the government, there is a likely support from the side of the government towards (international) collaboration initiatives. This could pave the way for Dutch companies to pursue collaborations with local companies and/or governments.
6 Chinese Market: Private Sector Overview in China’s E-commerce Plastic Packaging Waste

This chapter provides general introduction of e-commerce, express delivery, plastic and plastic recycling industries, as well as the leading companies in each industry, and their achievements on plastic packaging recycling and green packaging materials development.

6.1 Related Industries Overview

Based on the research scope of this report, the industries related with plastic packaging waste resulted by express delivery are e-commerce industry, express delivery industry, plastic industry and plastic recycling industry. General overview of these four industries can be found in this section.

6.1.1 E-commerce & Express Delivery Industries

The e-commerce and Express Delivery industries in China are growing at a rapid pace. With the e-commerce boom in China, the total value of social logistics goods sold in China was over CNY 252.8 trillion in 2017. A growth rate of 6.7% in comparison to 2016. For 2018 there is an estimated increase of 6.5%. Because e-commerce has grown dramatically in the recent year, it boosts the express delivery industry at the same time. Moreover, the growth on the two industries expected to satisfy the wishes of both the Chinese government and an increasing amount of the Chinese population to increase sustainability, bolster the circular economy and fast-track recycling.

China leads the global e-commerce boom, with online retail sales reaching CNY 7.18 trillion in 2017, a year-on-year increase of 39.1%. China’s online economy is growing at an astounding rate, powered by the growing number of Internet users and the increasing popularity of online shopping, with 466 million Chinese people buying goods and services online. Since 2013, the average worldwide sales in e-commerce grew around 5%. By comparison, between 2007 and 2014 e-commerce sales in China grew 80% per year, on average. This growth slowed down but still stands between 25% and 35% annually. As seen in Figure 10, the Gross Merchandise Volume (GMV) is expected to reach CNY 9 trillion by the end of 2018.

![GMV Graph](image)

Figure 10: GMV (Gross Merchandise Volume) of China’s Online Shopping Market 2011-2018
Increasing household expenditures partially resulted in the e-commerce boom in China. China has risen to its present status as the largest manufacturer and exporter in the world, since the country first opened to foreign investment in 1978. The ensuing flood of wealth into China has delivered 700 million people out of poverty and into the middle class. In 1995, the average annual urban household expenditures were CNY 3,538. This number has risen to CNY 24,400 in 2017. It is estimated that 76% of urban households will be in the middle class by 2022.

China’s e-commerce market currently accounts for the majority of global sales. By contrast, only 308.5 million US citizens purchased products online in 2016. However, the US population is just 322.7 million people. While almost 96% of the US population bought products online, the online population in China still greatly outnumbers the number of online shoppers in the US. This shows how much untapped potential there still is in China’s e-commerce market.

Figure 11: Retail e-commerce Sales Share Worldwide, China vs. US, 2015-2020

China’s online economy and e-commerce are growing hand-in-hand, and both at an astounding rate. The growth is powered by the growing number of internet users and the increasing popularity of online shopping, with 466 million Chinese people buying goods and services. Approximately 731 million Chinese are active Internet users. This is around 60% of the country’s population. Of China’s 731 million Internet users, 466 million (about 65%) are shopping online. This growth is mainly driven by young people.

Figure 12: Number of Online shoppers as a percentage of the Internet population (2012 – 2017)
Express Delivery industry has achieved huge business growth due to the growing of e-commerce industry. According to Xinhua.com, the express delivery sector handled 50.5 billion parcels in 2018 in China. That’s about three parcels a month per Chinese. The frequency of delivery is 1,600 parcels per second, which means literally about 150 parcels are delivered in China while a person blinks his eye. Since costs and environmental efficiency are driving the entire logistics industry, the industry is especially expected to receive a boost of technology revolution and implementation of sustainable strategies.

China’s Express delivery business and business income have increased year-on-year since 2011. According to a report published by the State Post Bureau, compare to 2017, 26% growth on the total volume of parcels delivered, and 22% growth on the revenue in 2018.

Overall, China’s express delivery industry can be divided into two business models:

- Direct business model (such as SF Express and JD). Headquarters have the authority to directly control all branches on all fronts, including (but not limited to) implementation and management. Thus, these businesses can ensure a high standard for service quality and obtain a brand premium. All costs are the company’s costs and are not divided among franchisees. Likewise, all corresponding income is the company’s revenue.

- Franchisee – Headquarter model (such as by STO, ZTO, YTO and Yunda). Headquarters controls the franchisees mainly through the franchise agreement. Aside the corporate brand name franchisees need to manage their own transport equipment, recruit employees, build branches and so on. Headquarters generates revenue from courier receipt charges, transit fees and delivery fees; their costs include the operation of the transit center costs, transportation costs and delivery costs. The light asset management model makes sure that the operation and sales net expand in a short period of time.
The difference is important as the direct business model seems to push much faster for innovations, for example in the packaging and recycling industry. The franchisee model, where local franchisees look to each other and to headquarters for new implementations are innovating at a slower rate. China’s express delivery industry has always achieved higher growth in business volume than in revenue. In 2015, industry-wide business volumes grew by 13% more than revenue, but the disparity in growth rates has gradually narrowed in the last two years. As can be seen in Figure 14, the difference between business volume and revenue was less than 4% in 2017, the two numbers are approaching each other over time. Costs are being controlled and business is more sustainable.

6.1.2 Plastic Packaging and Plastic Recycling Industry

With the rapid spread of e-commerce online shopping, the express packaging industry has achieved an annual growth rate of more than 50% in recent years. E-commerce drove the rise of express packaging industry, and the downstream packaging materials industry driven by express delivery reached CNY 50 billion last year. As the upstream packaging manufacturers, plastic packaging industry, and the end-stream plastic waste re-producers, plastic recycling industry, both are highly related with e-commerce plastic packaging waste treatment.

According to the “2017 China Express Industry Green Packaging Development Status and Trend Report,” more than 70% of the packaging materials come from e-commerce sellers or e-commerce platforms. Consequently, it is vital that awareness is spread, both throughout the e-commerce players and consumers buying the products. The average product sold online is covered in at least three layers. These are product inner package, product outer package, and parcel delivery package. The amount of packaging materials increases market demand to packaging industry.

In accordance with the customer demands and newly published sustainable and green regulations, environmentally friendly packaging is one of the new characteristics for packaging materials. The materials must be recyclable, reusable, degradable, and the total amount of materials used for one product must be minimized. This initiative is increasingly present in rules & regulations and companies are implementing this. Nonetheless, a trend can be seen where consumers would rather have overpackaged products which make them feel secure as opposed to using less packaging. This is also partially due to the fact that the regulations are still at an early phase and did not reach maturity yet.

With the large-scale application of plastics and the current level of oil prices, the market of China’s plastics recycling industry has gradually prospered since the start of the 21st century. The business model has started to transform from a family workshop culture to the huge market-demand-driven incorporations it knows today. This development has been rapid, and many companies grew enormously over a short amount of time. Naturally, these companies are in the vicinity of the manufacturing regions. Currently, there are a large number of plastic recycling enterprises in China, mainly located in the developed areas on plastic processing, such as Guangdong, Zhejiang, Jiangsu, Fujian, Shandong, Hebei, Henan, Anhui and Liaoning. In 2017, China’s domestic waste plastic recycling capacity reached 16.93 million tons. The market size of China’s recycled plastics industry was CNY 129.7 billion.
In the first half of 2017, the import volume of waste plastics reached 7.05 million tons, and in 2018, the import volume was 76,000 tons, accounting for only 1.1% of the 2017 imports of waste plastics. This is majorly due to the new law of the ban of foreign solid waste imports. The import of recycled polyethylene (PE) from January to September 2018 was 10,300 tons, a decrease of 1.6 million tons compared with the same period of last year, a drop of 99.39%. The domestic recycling market of PE recycling granule is also unsatisfactory. From January to October 2018, the amount of recycled PE in China was 2.3 million tons, a decrease of 17.84% compared with 2017.

On the domestic side, the plastics market has been sluggish in 2015-2016. The sluggishness of the market is due to the fact that the downstream manufacturers were affected by environmental supervision and plastic prohibition orders. The operating rate and product output both fell. The supply pressure of the plastics market will gradually become more prominent. The gap of nearly seven million tons mentioned above promises to be opportune for market entrants. This suggests the following question: How can the recycling industry increase the circularity of waste plastics?

As with many initiatives and improvements in China, progress can be made swift as long as the government is supporting it. Since the 13th Five-year Plan, the adjustments that China has made to products and the industrial structure of technological innovation have made China's recycled plastics industry a success. According to Professor Wen Zongguo, leader of Circular Economy Industries Research Center in Tsinghua University and one of the leading Research Centers in China, the recycling rate for high quality plastics such as PET bottles is already over 90%. Recycled plastics have become the new trend of industrial development. Recycling will become the inevitable development trend of the plastic industry. The goal of the central government in the Industrial Green Development Plan (2016-2020) has stated that domestic recycling of waste plastics should reach 23 million tons by 2020. Meanwhile, the “Circular Development Leading Action,” issued by the National Development and Reform Commission (NDRC) in May 2017, proposing that by 2020, the main waste-recycling rate will reach

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1 National Development and Reform Commission: It is a macro-control department that comprehensively studies and formulates economic and social development policies, balances the total amount, and guides the reform of the overall economic system. For detailed functions of NDRC please refer to this link.
54.6%. There is still a long way to go compared to 2018 and pushes from both private and public sector are required in order to reach this goal. Foreign expertise is necessary to achieve this.

6.2 Business Actions

The industries introduced above are highly involved in the recycling of plastic packaging waste and in the development of green packaging materials. In this section of the report, enterprises in those industries will be introduced as well as their achievement towards plastic packaging waste management. They are the leading companies in their respective industries in terms of market share, technology research and development, and amount of the investment to be sustainable. The companies listed below have already invested and are planning to invest more on packaging recycling and green packaging materials developing. They could be potential partners for the Dutch companies which would like to enter Chinese market in the future.

6.2.1 Leading E-commerce and Express Delivery Companies

Due to the growing for circular economy and plastic waste problem, China’s biggest e-commerce and express delivery companies take a part in the development and give initiatives for the development. As most e-commerce platforms and express delivery companies cooperate closely with each other, or they have their own online retail platform and delivery service (i.e. JD), the companies from both industries will be introduced in this part together.

JD, an omnichannel established in 1998, started to expand its B2C e-commerce business in 2004. According to its official website, transactions in 2016 amounted to CNY 939.2 billion, earning the company a net income of CNY 26 billion. JD accounted for a 24.8% share of the B2C market in 2016. JD was also the first Chinese Internet company to be recognized as a Fortune 500 company. JD became a listed company in the United States in May 2015.

Besides the platform of online retail, JD has the largest logistics infrastructure in China's e-commerce sector, and it has integrated logistics facilities for small and medium-sized, large-sized, refrigerated and frozen warehouses. JD Express is established in 2017, as one of the services of JD Logistics, and officially entered into express delivery market.

As one of the biggest online retail platforms, JD has invested a large amount of effort to optimize its customers shopping experience. It established JD Smart as its subsidiary company, which focuses on developing technologies and provide smart solutions to logistic and online-retail sectors. It explores in smart logistics and the related technologies.

In June 2017, together with 9 brands, JD launched “Qingliu Project”. Through the project, JD has estimated that by 2020 JD will reduce 10 billion of one-time paper boxes from brands to suppliers, JD plans to achieve the recycle of 80% of product packaging materials and reduce 25% of the weight of the package for each product. Moreover, JD expects that on the client side, 50% of the packaging materials should be degradable material, 100% of the delivery packaging is renewable and recyclable material, and all the printing on packaging is 100% green.
In terms of the practice and effectiveness of green environmental reduction packaging, JD initiates:

- 100% promotion of the use of electronic invoices, reducing paper use by 60,000 tons per year;
- Promote the use of slim tape, reduce the width by 15%, reduce the use of 1 billion meters per year;
- Reduce the weight of cartons, 3-layer cartons instead of 5-layer cartons, reducing paper by more than 1 million tons per year;
- By introducing new material technology, the cushioning packaging thickness will be reduced, and the use of plastic will be reduced by more than 500 tons per year.

Currently, JD biodegradable packaging bags are mainly used in business, and so far, nearly 50 million bags have been used, accounting for about 5% of the amount of plastic packaging materials usage. About 500 million secondary cartons are recycled, accounting for more than 40% of the amount of carton usage. Through the front-end packaging optional system, consumers can choose to use when placing orders. It is estimated that nearly 20 million biodegradable packaging can be used every year. In addition, developing the system for recycling or degrading packaging. Consumers can choose green packaging on their own when placing orders.

Cainiao Internet Technology was established in 2013 by Alibaba, Yintai Investment, Fosun Group, SF Group (SF Express), YTO, ZTO, STO, Yunda, ZJS Express, Best Express and China Smart Logistic Network. Cainiao has successfully integrated the data and network of the top CEP players. It provides storage and sorting solutions. Cainiao plans to invest CNY 100 billion to build the infrastructure for the logistic industry in China.

Cainiao launched a green logistic imitative in 2013 alongside 32 Chinese and international partners, focusing on green solutions such as promoting the use of greener packaging and recycling, adopting electric delivery vehicles in nearly 20 cities, and applying big data to improve efficiency in logistic in 2015.

Cainiao, Alibaba Foundation, China Environmental Protection Foundation, and six largest logistics companies in China, formed a foundation in 2016. An investment of CNY 300 million has been planned for research to promote green logistics, consumption and supply chain management.

SF Express is one of express delivery companies in China under direct business model. It provides integrated logistic solutions. In 2017, SF Express ranked No.5 among the express delivery companies in China in terms of market share. It owns 7.69% market share domestically. The other top four express delivery companies are under Franchisee-Headquarter business model. By the end of June in 2018, SF Express owns 138 warehouses across the country. The company delivered 1.858 billion parcels during the first half year of 2018, increases 35.29% compare to 2017. With 32.16% increase, the revenue in first half of 2018 is CNY42.504 billion. It has 899 major service centers domestically. In the first half of 2018, SF Express invested more than CNY 766 million to research and development.
SF uses reusable canvas bags instead of ordinary woven bags, and uses Degradable Polypropylene plastic foaming materials as recycling insulation box material to improve the resource utilization rate in the field of express packaging. Through the packaging design optimization of stretchable pearl cotton instead of traditional Pearl cotton, 50% of raw materials are saved.

6.2.2 Plastic Packing and Plastic Recycling Companies

Under the direction of the legislative frameworks and regulations, a number of enterprises from plastic packaging industry and plastic recycling industry have been very active in exploring the technologies and methods on parcel packaging recycling and plastic recycling. As it mentioned earlier, these two industries are the upstream and end-stream sectors regarding a life circle of plastic packaging material. Several of these organizations take responsibilities in both sectors. Also, leading companies which specialized in plastic recycling and reproducing will be introduced as well.

Guangdong Tengen is a technology company that specializes in the research and development, production, and sale of packaging and printing products for the express delivery e-commerce industries. Tengen has strategic partnership with a number of e-commerce and logistic industry stakeholders such as SF Express, JD, EMS, YTO and Yunda. In order to promote sustainable development and green packaging, Guangdong Tengen took effort and invested in new materials innovation and e-commerce waste recycling building. Established in 2010, Tengen is growing rapidly. It has five manufacturing bases in China, which are located in the southern, eastern, northern and mid-China.

The Dutch circular economy delegation and the Guangdong Provincial Circular Economy Association conducted a joint visit to Guangdong Tengen on April 10, 2018. As one of the leading companies in the green packaging development in logistic and e-commerce sectors, Tengen has long-term cooperation with universities and research centres in China. It has achieved a list of innovations regarding green packaging solutions. Tengen uses 100% recycled paper material for its paper boxes and 93% of recycled paper material for its envelops. It raised a concept of green packaging before the country started to publish rules and regulations regarding sustainable packaging materials. The company invests 4% - 5% of its annual revenue to research and development, which has led to this successful green packaging development.

With the cooperation with government, Tengen has been invited to contribute to the drafting of revision of "National Standard for Parcel Packaging Products." The specialists and research teams has contributed to the input of the new standards. Taking the thickness of the bag as an example, the 2009 version of the standard is 0.06-0.08mm. The first draft of the revision is unchanged, and the second is changed to 0.05mm, but Tengen proposed to modify it to 0.03mm and provided samples. In the end, this modification was accepted. Besides producing packaging materials, Tengen is also one of leaders to build the recycling system for e-commerce and express delivery packaging waste.

For green plastic packaging solutions, Tengen has developed:

- Full Biodegradable Courier Bag: Fully biodegradable to water and carbon dioxide after 180 days of burial.
Repeated use of courier bags and secondary use of courier bags: Recycling health and environmental protection, saving packaging costs.

Full biodegradable sealing glue: The membrane is a whole bio-based, the glue is a biodegradable adhesive, which will completely degrade after being buried for 180 days.

Secondary use of bubble bags: Compressive, moisture-proof, abrasion-resistant, and can be reused twice.

In terms of recycling, Tengen also develops technology to re-produce packaging products by using recycled plastic packaging waste. Tengen has proposed a recycling system, which actively involved recyclers and express delivery companies to the recycling system of e-commerce plastic packaging waste. The packaging waste could be recycled through delivery person and be gathered in sorting centers or warehouses. Recyclers collected the wastes and recycle them for secondary treatment.

Innovation in business model, the company directly cooperates with the waste original source that produces waste products, such as supermarkets, office buildings and communities, and directly recycles these wastes. The company has built a recycling system, in which there is recycling personnel and also their own logistics fleet, which ensures that these waste products can flow to Ben Gege’s own standardized sorting center. Then its chain and standardized sorting center will carry out classification, which can improve the efficiency of the entire recycling chain. In the end, they will sell the waste to the downstream waste reproducing enterprises.

**Ben Gege** is an internet technology company dedicated to the recycling sector in China. The company, founded in July 2016, is headquartered in Beijing. As Ben Gege connects mechanic technologies, bio-technologies and recycling industry, Ben Gege uses a “+ Internet” model to increase the efficiency of traditional recycling methods.
the waste paper as an example, the company recycled 73,000 tons of waste paper and eliminated about 705,508 tons of carbon dioxide emissions in 2017. This is equivalent to indirectly protecting 1,241,000 trees.

Shandong Intco Recycling Resources Co., Ltd. is a supplier of renewable packaging solutions, located in Zibo Shandong Province. Over the past 16 years, the company has been committed to recycling renewable PS plastics effectively, and green application in PS environmental protection frame.

Intco purchases large number of renewable PS plastics worldwide and manufactures them into recycled plastic particles through its own recycling granulation equipment. Some of the recycled plastic particles can be sold to downstream plastic products enterprises. The company even processes some recycled particles into high-quality home products. By using waste from PS packaging filling materials, Intco reproduced them into photo frames and frame materials for interior decorations.

After having analyzed the plastic packaging sector, and elaborating on both public and private initiatives, the current chapter will look into the future trends in the plastic packaging sector in China’s e-commerce industry and what has to be done to achieve them. The chapter will outline which developments will shape the industry in the upcoming years. Afterwards, this chapter elaborates on the challenges which can prevent the developments and have to be tackled.

7.1 Industry Development & Future Outline

The Chinese national renewable resource market is enormous and has a strong upside. The economic value of waste plastics in China is estimated to reach CNY 124.5 billion in 2024. The current challenge is that recycling efficiency is low, probably less than 60%. Compared with other more developed regions, such as Europe, which have up to 80% to 90% recycling efficiency. Taking the Chinese volumes into account, the gap is tremendous in absolute numbers and would need both local and international expertise in order to improve. Next to the volume, the geographic spread and increasing shift to Central and West China increases the difficulties to keep boosting the number. On a positive observation, this means China contains great opportunities for recycling businesses to enter the market.

Innovations in recycling have to be implemented on both national and regional levels in order to achieve the goals set for 2025. This implies that there is still a lot of work to be done. The transition to a more circular economy requires the individual and collaborative efforts of public and private stakeholders. It is vital that current and future designers, engineers, strategists, and marketers are able to pioneer circular economy solutions and to think in terms of ecosystems. It is crucial to building a recycling management system for the plastic recycling industry and e-commerce parcel waste recycling, and to develop the value chain. Compared to previous years, such as 2016, express packaging has already undergone significant changes in terms of going-green, reduction and recyclability. This section will outline future trends and the development of the industry.

7.1.1 Plastic packaging material quality requirements

The market is beginning to outline requirements for plastic packaging. Currently, due to the low quality of plastic packaging using in express delivery, the recycling value is very low, which also results that the parcel packaging waste is not efficiently recycled and over 90% of them went into household garbage. In order to increase the parcel packaging recycling rate, the quality of the plastic materials must be increased. Instead of using lowest quality plastic, the packaging producers seeing trend to use better quality plastic but in smaller amount. Moreover, the industry is developing bio-degradable materials to replace the current plastic packaging. New material development is always top trend in this industry.

7.1.2 Extended Producer Responsibility

The State Council has issued a plan regarding the extended producer responsibility (EPR) in order to increase protection of resources and the environment. The new plan, published in 2017, requires producers to be responsible in resource consumption and adhere to environmental standards. The goal of the plan is to protect
the environment throughout the lifetime of a product. Although the plan is still in its early stages, the producer responsibilities will extend to product design, consumption, recycling and waste disposal. Specifically, packaging products are mentioned. By 2020, an EPR policy framework should begin to take shape, while relevant laws and regulations shall be formed by 2025 according to the State Counsil.

This trend will place a big responsibility on producers and will reshape the way companies produce and design their products and package them.

7.1.3 Regulations & government incentives
Policies and regulations have been introduced and implemented intensively between 2016 to 2018. The implementations surpassed the goals of the five-year plan and started to trickle down to various other regulations and local policies. Although a lot of changes start from a regulatory change, not all of them have been enforced for the players in the market. As mentioned before, the current climate still bolsters many small players. Although the climate is expected to change over the years, the enforcement will still be challenging until that change. Foreign countries have a longer history in recycling higher volumes and can therefore advice China on a policy level to increase its enforcement. Still, one has to make sure that an adapted approach is taken into account towards the Chinese market, taking both the geographical distance and fragmented market into account.

There is expected to be a trend towards the legalization of express packaging supervision: After the official implementation of the "Provisional Regulations for Express Delivery," The implementation will be the first highest-profile special legal document in China's express delivery industry. With the implementation of this legal document, under the guidance of the national green development concept, the standardized governance and supervision of express packaging is also expected to embark on the track of legalization after which the quality of packaging should improve, and waste should decrease.

Another future trend is in the form of government incentives. The Chinese government is currently looking into government incentives but is still researching how to start its implementation and to whom it should offer incentives. According to both Tsinghua Research Center and the China Synthetic Resin Association, the current European framework is an interesting one and something the Chinese government is willing to look at and perhaps even model itself after. This model should also raise recycling prices, given that the quality of plastic is increasing. An estimation of this can be seen in the figure below:
7.1.4 Plastic Packaging Waste Classification

According to the latest regulation on household waste classification issued by MOHURD, 46 cities in China have started to take actions on waste classification. It is still on an early regulation and incentive building stage, however, five cities are actively moving forward on waste classification and acting as leading cities under this new regulation. Plastic waste is one of the major parts in household wastes components. To build efficient plastic waste classification system is crucial to the country to effectively promote the new regulation. When Chinese government starts to implement new policy, most of the time the new policy will start from a number of pilot cities. Then it will push the policy to the whole country. Therefore, it is a hot trend that in next few years, Chinese government is going to push waste classification policy all over the country.

Because of the rapid growth in e-commerce and express delivery market, plastic packaging waste has contributed a large amount to the household waste. After implementing of classification system, plastic packaging waste resulted from e-commerce and express delivery could be efficiently recycled.

7.1.5 Reducing Plastic Packaging Through Data Analysis

A big boost will come from the integration of express packaging applications: Since express companies operate the packaging procedure in the warehouse integration system, the company can package the parcel reasonably, to avoid over-packaging. With the further development of the integration of logistics warehouses, express packaging can also gradually transform into the integration of packaging and warehouse allocation. Warehousing and distribution as the service sector of end of e-commerce supply chain, mainly to solve the seller’s cargo allocation and delivery to customers. Since the courier company operates the packaging procedure in the warehouse, the courier company can reasonably package parcels according to each parcel’s transportation requirements, therefore eliminating excessive packaging.

Using this obtained data, the express packaging research can rapidly modernize in the following three aspects:

- Design reduction;
- Material greening;
- Production personalization.
According to the relevant data of the State Post Bureau, the current proportion of express delivery business, the proportion of e-commerce parcels reached about 74%. With online shopping gradually becoming one of the main lifestyles of people, express packaging should take on more functions, such as sales, transporting, express delivery and recyclable. This will become one of the important development trends of product packaging. This packaging solution has many advantages for suppliers and e-commerce: goods can be delivered directly to customers, avoiding secondary packaging; reducing the cost of color printing and coating of packaging, which is lower than the cost of traditional retail packaging.

7.1.6 Boosting Expertise and Knowledge

In 2019 and beyond, mergers and acquisitions in the renewable resource recycling industry are expected to continue to increase, and industrial concentration is expected to increase as well. The exploration on going-green is active. So far, the exploration of green packaging for parcel delivery focuses on biodegradable raw materials and the recycling of packaging materials (i.e. plastics and paper). As China attaches great importance to the concept of green development, especially the huge gap faced by the green packaging industry in the express market, many companies are aiming at this business opportunity to intervene in advance.

Recycling gets more attention from the public and private sectors. Reusable and recyclable packages are now becoming standardized. The construction of the end recycling system has achieved its initial goals and continues to expand. With the combination of modern information technology such as the Internet of Things, big data, cloud computing and recycling industry, the pace of innovation and development of renewable resource recycling enterprises will be further accelerated. Environmental protection policies and regulations have been continuously introduced, especially the implementation of the circular development leading plan, the recycling price of renewable resources will also rise, and the renewable resource utilization industry will steadily move forward under the leadership of the government and social capital cooperation model. Also, enterprises will usher in many development opportunities. Domestic demand for renewable resources is strong, and renewable resource recycling companies with complete recycling networks and channels have bargaining power.

7.2 Current Challenges

The management of express green packaging is a systematic project involving multiple entities such as express delivery enterprises, e-commerce, packaging enterprises and recycling enterprises. It is necessary to formulate green packaging industry support policies, and adopt targeted financial subsidies, tax incentives, credit rewards and punishments, etc. For instance, it is essential to have policy and financial support for enterprises that develop and use green packaging. Moreover, it is important to promote the popularization of green packaging, to give incentives to merchants and express delivery enterprises that recycle packaging products, and to establish recycling incentive mechanism for waste packaging classification and processing.

According to Professor Wen Zongguo from the Tsinghua Research Centre, regulations and categorization of the waste are advanced and delicate in European countries. It is an aspect that Chinese policymakers could learn from. Moreover, it is planning to make new regulations on charging fees on such waste from e-commerce and express delivery industry, hoping to raise more attention to more stakeholders and in the society. When people have to pay a fee when they consume materials that will eventually become un-recyclable waste, they will put
more effort to use sustainable and green plastic packaging. Looking at the plastic packaging recycling industry in general, several challenges are still very relevant. They will be elaborated upon in the following paragraphs.

7.2.1 Significant increase in Express Delivery
Although many initiatives have started to reduce plastic packaging waste, the increase of express delivery from 52 billion parcels in 2018 to an estimated 192 billion parcels in 2023. Even if the industry manages to deal with the current plastic packaging waste and improves recycling rates, much higher efficiency and levels of implementation have to be realized to deal with the future volume.

7.2.2 Lack of high-quality plastics
The packaging plastic used for products and to make parcel plastic packaging bags is unattractive to the e-commerce and express delivery industries. Even if several companies start with using recyclable plastics, it could happen that the percentage is so low that they are treated the same way as single-use plastics. Fusing this with the current low value of recycled materials, the industry has realized that a change needs to happen. However, currently there is a trend towards the development of biodegradable plastics. On the one hand, this is a good development, but on the other hand, this would delay the usage of recyclable plastics and still generates a lot of wasted materials.

7.2.3 Disorganized Domestic Recycling Systems
With the current level of automatizations still being rather low compared to Europe, there is a lot of manual labor to deal with the recycling and sorting. Fusing this with the fact that there are over 15,350 registered plastic recycling manufactures in China, it can be stated that there is a lack of standardized process and procedures. Furthermore, most of the non-licensed, small scale factories. This leads to recycling solutions are locally organized which leads to low efficiency, higher errors and a difficult control on quality.

The connection from the 3rd party professional recycling companies is missing in the recycling and circular loop of waste plastic packaging materials. The e-commerce platforms and express stakeholders do not have the ability to deal with the waste plastic packaging materials except reusing them. It is essential to green packaging development and the circulation of plastic packaging materials to bring the 3rd-party professional recyclers on board.
Figure 17: Implementing 3rd party Recyclers

The industry needs to take significant steps in terms of the standardization, automatization and quality control of recycling. This implies heavy investments. Not only in expertise, but also in advanced equipment and standardizing workflows. These investments cannot be done by just the local players, a collaboration needs to form between government and the private sector. From a government perspective, a boost in standard industrial technology is asked for. This would force local players to adapt and adhere to higher standards which in turn lead to better recycling. Due to the disorganized domestic recycling systems, it is difficult to gather relevant industry statistics which is required to analyze the vast amount of data and deal with the waste recycling in an efficient manner.

7.2.4 Social Acknowledgement
Social acknowledgement is one of the key drivers of sustainability. According to Jiang Nanqing, Chief Secretary of China Synthetic Resin Association Plastic Recycling Branch, social acknowledgment affects the demand for sustainable products and packaging. Unless the Chinese population gets more aware on a macro perspective, some of the efforts will be in vain. An increasing amount of people is raising awareness resulting in change. Still, the levels should increase at a faster rate to make sure that awareness is spread significantly. Especially, in Tier 1 cities, the awareness is going up and many local initiatives can be found further snowballing the effect.

7.3 Implications
Both trends and challenges will define the success of the plastic packaging industry and need to be closely followed. Successful regional trends can be spread out fast and national challenges can be solved by looking at best-practices. Dutch players should study them in depth and tailor their business propositions accordingly.
8 Sino Dutch Cooperation Opportunities

Fusing the expertise in the Netherlands and the challenges and future trends in China in the previous chapters, this chapter will elaborate on the opportunities in China on a macro perspective.

The opportunities in China are twofold: on the one hand, policies and incentives need to be improved in China and the enforcement thereof. On the other hand, individual opportunities lay in China for foreign organizations specialized in recycling and circular economy.

8.1.1 Plastic Packaging Quality
The constant innovation of global recyclable plastic materials is never ending. Constant innovation is important in order to sustain a relevant market share. The continues improvement is especially true for materials in the plastic packaging sector. Dutch players can assist Chinese companies with improving their packaging materials and making sure that recycling gets improved. This is also true for degradable plastic, a current trend in China and could be a relevant point of entry.

8.1.2 Plastic Packaging Waste Classification
Over the past years, China is on its beginning stage on building waste classification systems and models. Plastic packaging waste is one of the major contributors on plastic waste in household wastes. Many pilot cities in China, which is selected to implement the new waste classification regulation from MOHURD, have met challenges in terms of building the classification system, educating citizen to classify wastes, and enforcing the policy to enterprises.

In the Netherlands, the classification system is advanced. Dutch people are well-awared that they need to do in-house classification of their household wastes. The policies regarding plastic waste classification and waste classification are well enforced. The knowledge and information exchange opportunity is precious for Chinese government and its local official departments.

8.1.3 Extended Producer Responsibility Framework
Chinese policy makers are studying European EPR system and frameworks. According to the responsible person from related association, to get an opportunity to know how Dutch EPR framework works is valuable for Chinese policy makers. In a city like Guangzhou, plastic packaging producers for express delivery market must use green or recycled materials to make plastic packaging products or paper packaging products. In order to fulfil the goal of forming EPR related laws and regulations by 2025, Chinese government is eger to obtain knowledge and expertise from international cooperations.

8.1.4 Policy Enforcement and Corporate Certification
Relevant expertise towards the government on boosting the levels of policy enforcement in the plastic packaging sector will become an opportunity. These policies are various and nation-wide as well as regional. As many
policies have only been implemented recently, the enforcement levels need to be improved. Moreover, advice on how to implement KPI’s during the route towards enforcement could be very beneficial for China.

Next to the enforcement, incentives for companies that respect the rules will be crucial for success. Specifically, with regards to sustainability and a more circular economy, companies need to invest before they can reap the rewards. Providing incentives on initiatives has proven to be successful in Europe and the gained expertise could be used in China. Looking at other industries in China such as electric vehicles; incentives can truly kickstart the market.

Lastly, certification of companies regarding sustainable plastic packaging is something which is relatively new in China. Building a clear and trustworthy certification system could put awareness on both individual and corporate levels on the FastTrack. Still, in a country with the size of China, both local and central initiatives need to be taken into account. A good start would be having a specific e-commerce recycling label that is visible on the most popular omnichannel such as JD, Taobao etc.

8.1.5 Centralized Domestic Recycling Systems
Organized domestic recycling systems are needed for China. Taking the geographic diversity and specifically the difference between East and Central China into account, a tailored but structured recycling system needs to be implemented. Although there are currently some initiatives, most of them are being implemented by a local consortium of companies or even just one market player. Regional organization of such systems is needed in order to deal with the volume and would make the market less segmented and increasingly efficient. Such efficiency would boost the overall number of recycled plastics and consequently lead to a more sustainable China with less plastic packaging waste. The opportunity for Western players is in the form of collaborating with Chinese players in order to find a local solution that works. Such local, successful initiatives can be used as an example to implement projects on a bigger scale;

8.1.6 Technology and Research & Development
China has been advancing rapidly in the technology sector during the last two decades. Still, there is valued expertise from European technology players that China could benefit from. Providing the technology is not enough though, the implementation of such technology with a local perspective in mind is crucial for its success. There are a handful of players that are technologically advanced in China while the rest is trying to catch up. During this process, there is a rapid need for knowledge and expertise that could yield a direct benefit for Dutch players.

8.1.7 Social Acknowledgment
Assisting the Chinese government with social acknowledgement is an opportunity for Dutch players, especially on a regional level. As indicated before, the Chinese government is currently heavily focussing on implementation of policies, regulations and is supporting (local) initiatives. On the social aspect of plastic packaging and recycling, a boost towards the individual Chinese responsibility should be given. Europe and specifically the Netherlands has a long and successful history with building social awareness. Nonetheless, one
should realize that the ‘Dutch-model’ cannot be copied. Rather, local Chinese culture needs to be studied and the business model should be adapted in order to be successful in China.
The goal of this report was to provide an overview of both the Dutch and Chinese market with regards to the plastic packaging industry and the recycling thereof. In the process, the e-commerce industry has been covered, and the related public and private sectors have been analysed. Afterwards, Sino Dutch opportunities have been elaborated upon. The beforementioned opportunities in Chapter 8 are only a fraction of the available opportunities. The report tries to look at an industry level and by taking the e-commerce and plastic packaging sector into account, derived the opportunities.

As indicated before, the Chinese national renewable resource market is enormous and has a strong upside. The current challenge is that recycling efficiency is low and estimated to be less than 60%. Compared with other more developed regions, such as Europe and Japan, which have up to 80% to 90% recycling efficiency. Taking the Chinese volumes into account, the gap is enormous and would need both local and international expertise in order to close it. Next to the volume, the geographic spread and increasing shift to Central and West China increases the difficulties to keep improving the number. This means China contains many great opportunities for Dutch recycling businesses to enter the market and influence the goals of the government.

The opportunities mentioned in Chapter 8 are relevant and valid points of entry into the Chinese market. Still, as a European enterprise, building a sound and localized strategy can be challenging and a thorough understanding of the Chinese market and culture is required in order to be successful. Small medium enterprises, especially Dutch ones are often focusing on a specific segment. This implies that opportunities are a bit more hidden, but available nonetheless. It is important to keep looking at the market development due to the rapid changes and implementations.

Further expertise can be found in the form of organizing a special trip to China, organized on Dutch national governmental level. The focus of this trip is to gather more information and visit several local initiatives to share experiences. The framework of the trip could revolve around the cooperation opportunities mentioned in Chapter 8 and the trends & challenges in Chapter 7. After the trip, follow up communication should be organized in order to keep connecting the Chinese and Dutch players.

The follow up communication as well as regular visits to China will prove to be an important source of information for Dutch players and will boost their understanding of opportunities in China as well as relevant cooperation models. Only by regularly visiting, one can deepen the understanding of the fast moving plastic packaging waste recycling in China’s e-commerce industry.

Future research is needed, focussing on regional examples and outlining the latest developments, both on a policy level as well as on an organizational level. Fusing the variety of initiatives as well as the segmented market, this could prove to be a challenging task. The Dutch government should also keep liaising with the Chinese government for policies and in its process promote the Dutch expertise. Moreover, special attention should be given to exhibitions in the industry and could be used to showcase Dutch initiatives and expertise.
Finally, a powerful connection between universities, institutions, government and organizations can be made in order to boost expertise from The Netherlands to China on a national level. This would fit the Chinese way of doing business and would most likely yield positive results.

The Chinese market is continuously evolving and reinventing itself, and constantly boosted by governmental initiatives. Just like a circular economy, mixing the right quantity of different materials together reduce waste and allow to make China increasingly sustainable. New materials need to be added at the right time and in the right mixture in order to create a successful, lasting circular model. One can state the same regarding Chinese and Western collaborations; only by fusing the right quantity and at the right time success can be derived.
10 Appendix I: Dutch key players

10.1 Key Dutch institutes

10.1.1 KIVD (Kennisinstituut Duurzaam Verpakken)
The KIVD stands for Kennisinstituut Duurzaam Verpakkingen, the Dutch Institute for Sustainable Packaging. The organization advises companies on how to make their packaging system sustainable. This is done via the sharing of factual knowledge and practical tools. Afvalfonds Verpakkingen has funded KIVD for 10 years.

![Figure 18: Results marketed packaging and recycle rates 2017 (KIVD)](image)

10.1.2 Nedvang
Nedvang monitors and stimulates the collection and recycling of all packaging waste in the Netherlands. This includes household and industrial waste, sorted into paper and cardboard, glass, plastic, metal and wood.

Nedvang is an acronym for “Nederland Van Afval Naar Grondstof,” Dutch for “Netherlands from Waste to Raw Material”. Nedvang has been set up for and by producers and importers who place packaged products on the market. Producers and importers are required by law to keep track of their products and recycle the accompanying packaging waste. The foundation Afvalfonds Verpakkingen has since taken over this task. The Afvalfonds Verpakkingen has outsourced monitoring and stimulation of the collection and recycling of packaging waste to Nedvang.

Nedvang is part of the Waste Management Structure Packaging Waste. Together with their supply chain partners Afvalfonds Verpakkingen, Nederland Schoon, Kennisinstituut Duurzaam Verpakken (KIVD) and Verpakkingsketen BV (VPKT), Nedvang manages the collection, recycling and sustainability of packaging in the Netherlands.
Nedvang works intensively with the Dutch municipalities, waste companies, recyclers and the organizations that represent them. This is done according to the agreements in the Framework Agreement on Packaging, an agreement between the Dutch government, the municipalities and the packaging industry.

10.1.3 Afvalfonds Verpakkingen
Companies that bring packaged products onto the market are legally required to contribute to recycling. The Afvalfonds Verpakkingen (Packaging Waste) acts on behalf of the packaging industry and has various tasks, which are financed by the waste management fees paid by companies that sell goods with packaging. This also reimburses the costs for the collection and recycling of packaging for the municipalities.
The specific codes the packaging industry must adhere to are stated in the Packaging Management Decree of 2014. The agreements of the business community, municipalities and government are laid out in the Framework Agreement. The tasks and goals of the Afvalfonds Verpakkingen are also included in the Framework Agreement.

Afvalfonds Verpakkingen is responsible for:

1. The organization and maintenance of a waste management structure, which stimulates collection and recycling;
2. Levying a waste management contribution on all affiliated producers and importers and to connect all companies that are liable to pay contributions;
3. Reporting on all packaging placed on the market and the achieved recycling percentages;
4. Providing allowances (to municipalities) for the (separate) collection of packaging waste;
5. Stimulating activities and campaigns to prevent packaging litter;
6. Steering the material chain towards a circular economy: increasing the environmental yield and reducing costs.

Not all tasks and goals are carried out by the Afvalfonds Verpakkingen itself. Various activities are held at various organizations such as Nedvang and Nederland Schoon. Verpakkingsketen BV (VPKT) arranges for the sorting and recycling of (plastic) packaging by entering into contracts with post-separators, sorters, recyclers, transporters and storage and transfer stations. And the KIDV gives companies advice on making their packaging more sustainable.

10.1.4 Holland Circular Hotspot
The Netherlands Circular Hotspot was a campaign which positioned the Netherlands as an international circular economy (CE) hotspot during the time of the Dutch EU Presidency in 2016. As a result of its success the Dutch government decided to proceed with this campaign on a more permanent basis under the name of Holland Circular Hotspot (HCH).

Holland Circular Hotspot is a private-public platform in which companies, knowledge institutes and (local) authorities collaborate internationally with the aim of exchanging knowledge and stimulating entrepreneurship in the field of circular economy.
The activities of Holland Circular Hotspot are:

1. To stimulate cooperation between the private sector, think tanks, governments and other relevant parties;
2. To provide international visibility for Dutch CE innovations/best practices;
3. To assist foreign parties in partnering with relevant Dutch CE parties;
4. To establish an online community where both Dutch and foreign companies can post CE challenges and solutions, and generate business matches;
5. To facilitate access to Dutch and international (financing) instruments and programmes.

10.1.5 Thuiswinkel.org

Thuiswinkel.org is a Dutch pioneer in the world of sustainable online retail. As a quality mark for Dutch web shops, Thuiswinkel.org is focusing on multiple sustainability projects such as:

1. Research wasted space in packaging;
2. Monitoring environmentally friendly packaging;
3. Create a clear overview of environmental impact;
4. Help create solutions for an efficient intake of electronics bought online;
5. Lobby for ease-of-access websites;

With these projects, Thuiswinkel.org is positioning themselves as a key player in the Dutch circular economy with regards to e-commerce.

10.1.6 Nederland Schoon

Nederland Schoon (Netherlands Clean) is an institute set up 25 years ago to clean up litter in the Netherlands. Nederland Schoon is known for making a point to keep the country clean, sharing knowledge, supporting initiatives and influencing behaviour. A successful marketing campaign made Nederland Schoon’s a familiar logo in the Netherlands.

10.2 Key Dutch commercial players

10.2.1 Van Werven Rigid Plastic Recycling

Van Werven is a specialized service provider in the field of infrastructure and recycling. Van Werven has been founded 70 years ago in Oldebroek, the Netherlands. The company specialises in creating high-quality raw materials from post-consumer rigid plastics collected from construction waste, industrial waste and municipal recycling centres. Currently approximately 120,000 tonnes of raw materials are produced per year by van Werven, all originating from recycled plastic. These recyclate products include PR, PP, PE-PP, HDPE, PVC, ABS and PS plastics. Example products which are made from van Werven’s recyclate are plastic pipes used for construction. The restrictions by China on import of plastic for recycling created a great opportunity for van Werven.
10.2.2 Bollegraaf Recycling Solutions
Bollegraaf was founded in 1961 as “Machinefabriek en Plaatsnijbedrijf H. Bollegraaf”. The company started as a producer of vertical balers made from scrap metal and dismantled cars. Over the years Bollegraaf became a larger player in the recycling and waste processing equipment industry. Among the industries Bollegraaf focuses on, plastic waste is a major component. Installations made by this company with the aim of recycling plastic can separate, sort and process packaging materials such as PET, PE, PP from metals and others.

10.2.3 Suez
Suez is a water and waste management company, with 150 year’s experience. The company is active in many fields, such as waste sorting and water treatment. A high-tech waste sorting facility is located in Rotterdam, where high quality homogeneous plastic material is sorted. This homogeneous plastic waste can then be recycled into recyclate. 2/3rds of the Netherland’s plastic packaging is processed in this Suez plant in Rotterdam. Suez is already active in China in Shanghai. The local authority of the Shanghai Chemical Industry Park contacted Suez in 2002 to build and design the water treatment plan. Suez is currently, amongst others, managing the hazardous waste and treating the effluent. The area treated is 29.4 km². 50.000 m³ of water is treated every day.

10.2.4 Renewi
Renewi is a waste to product company created in 2017, following the merger of Shanks Group plc with Van Gansewinkel Groep BV. Renewi focuses on waste management solutions for commercial and municipal areas. In the Benelux waste is transported from businesses and households to be sorted, treated and processes. Plastic pallets and plastic end products are among the results of Renewi’s waste treatment. There are currently 81 sites in the Benelux where Renewi is active.

Renewi is also active in recycling electrical and electronic appliances in the Netherlands. With this division, the company creates recycled plastic, as well as ferrous and non-ferrous metals.

10.2.5 Royal DSM
Royal DSM is a Dutch multinational active in the fields of health, nutrition and materials. The company is headquartered in Heerlen. As one of the business groups, DSM focuses part of their time and energy on materials. Plastics, Resins and Dyneema fall under this material group. One of DSM’s products is Niaga, a carpet with 100% recycling in mind. This results in a mono-material polyester carpet. This allows the end product to be fully recycled in the same product. The recyclate can then be used for other industries or again for carpets.

10.2.6 Ioniqa
Ioniqa is a high-tech chemical company from the Eindhoven region founded in 2009 and specializes in the development of Magnetic Smart Processes, which includes Magnetic Smart Materials and Separation Processes. It is a spin-off from the Eindhoven University of Technology and the Dutch Polymer Institute. The company’s technology can be used to take out the color recycle of any kind of PET and create colourless raw material, similar to PET made from crude-oil. This technique helps solve two problems: to reduce the amount of PET waste and becoming less dependent on raw resources.
10.2.7 Avantium

Avantium was founded in February 2000 as a spin-off from Shell. Avantium is a chemical technology company in renewable chemistry. The company has developed the YXY technology. This technology can produce a new type of molecule, called polyethylenefuranoaat or PEF. PEF can be compared to PET, but it is made from plant based materials. Together with BASF, Avantium already planned to make a factory in Antwerp to make PEF bottles in 2016. A benefit of PEF is that the product is 100% recyclable and that it can be made from sugar molecules, which can be obtained relatively easily.

10.3 Key Dutch upcoming expertise

10.3.1 Great Bubble Barrier

The Great Bubble Barrier is addressing the problem of plastic pollution in oceans by helping plastic does not come from the ocean’s source, which are rivers channels and canals. The initiative started in 2016, by Anne Marieke Eveleens, Francis Zoet and Saskia Studer. The Great Bubble Barrier is a pipe line with holes across the bottom of rivers, canals and channels. Through this pipe air is pumped, which exits through the holes along the pipe. This creates a curtain of bubbles, which catches debris traveling lower in the water. His upward flow of the bubble barrier brings waste to the surface of the water where it can be guided for collection and accessible removal. The initiative has won prizes from Rijkswaterstaat and PWN and passed the crowdfunding phase in 2018. The Great Bubble Barrier is planned to go international in 2021 to Asia.

10.3.2 The Ocean Cleanup

The Ocean Cleanup is a non-government engineering environmental organization based in Netherlands, that develops technology to extract plastic pollution from the oceans. The organization was founded in 2013 by Boyan Slat, a Dutch-born inventor-entrepreneur. The approach involves placing barriers in ocean gyres to scoop up marine debris as the barrier is pushed by wind and current. The project aims to launch a total of 60 such systems in the patch by 2021. They predict this capability could clean up 50% of the debris in the Great Pacific Garbage Patch in five years. The model is currently being revised after a test in front of San Fransisco. Before the retreat from the open water, the system had captured some 2,000 kg of plastic floating in the ocean.

10.3.3 Technical University Delft

The Technical University of Delft in the Netherlands is working on an industrial system that uses resources either in a bio-cycle or in a techno-cycle, meaning that technical resources are designed for mixed use. This requires a shift from a business perspective, supply chain management, and also product design. The TU makes a difference between design for sustainability and design for circular economy. The first is focused on minimizing eco-impacts while maintaining the value of the product and human quality. The latter focuses on optimizing economic potential while restoring natural resources.

10.3.4 TNO

TNO is an independent Dutch research organization. The company focuses on nine social themes, including circular economy. TNO advises businesses, economic sectors and the public sector on the economic possibilities
and consequences of circular economy for technology development and the environment. Specifically, TNO
advises on:

1. How product chains can be modified;
2. How circular processing and recycling can be implemented;
3. Material compositions;

TNO has databases and models that provide insight into these topics on a European, national and regional scale. Policymakers can make use of that knowledge to formulate plans to improve a given circular economy.

10.3.5 University of Twente
Circular economy is one of the main research themes at The University of Twente. The university is conducting research on energy and material savings (through new and improved separation methods and sustainable energy), reduction of by-products and scrap, and recycling of key components from waste streams (e.g. minerals from paper sludge, carbon black from used tires). The University of Twente is working on predictive process modelling tools that allow for robust optimization of manufacturing processes. Lastly, the university is focusing on creating new business models that consider both the importance of the natural ecosystem as well as the change in relations between stakeholders.

10.3.6 Vrije Universiteit Amsterdam
The Vrije Universiteit of Amsterdam has a specialized faculty of science that focusing on many research topics of value to a circular economy. These are:

1. Sustainable use of chemicals;
2. Emerging chemicals;
3. Plastics and human health;
4. Plastics and the environment;
5. Microplastics in drinking water.

Besides the above mentioned topics, one of the research themes is circular economy itself. Relevant research areas include:

1. Developing and applying effective techniques to identify and measure emerging and legacy chemical additives in plastic products and waste stream and recycling material flows;
2. Seeking safer substitute chemicals;
3. Understanding toxicity of plastics and chemical additives to humans and ecosystems;
4. Analysis of microplastics and other contaminants in wastewater treatment plants and sewage sludge that are often made into biosolids for fertilizer;
5. Collaborating in teams to remove toxic chemicals from the product design process;
6. Analysis and policy advice for the public sector (e.g. European Parliament, G20).
10.3.7 Wageningen University & Research

Wageningen University & Research is working on solutions to make the circular, bio-based economy a reality. The university is investigating what components are contained in recyclable and non-recyclable waste streams and how these can be made suitable for reuse. With insights such as these, parties throughout the value chain—waste and material management employees, government authorities, and manufacturers of consumer products—are able to develop the circular economy. Together with them, Wageningen experts are able to implement solutions for the increasing scarcity of natural resources in the world. The Wageningen University & Research is also working along the lines of policy consulting, the development of sustainability indicators, and business and supply chain strategies as well as on closing the resource cycle and integration into the landscape.

Wageningen University & Research also focuses on the development of all kinds of renewable products made from biomass. Some examples of the materials and products which they are working on are bioplastics, bio-based chemicals, bioenergy, and all types of applied materials: ranging from casings for consumer electronics to textiles, inks and coatings, construction and biomedical materials, and sustainable packaging.

11 Appendix II: General Information in China

11.1 General Information in China

This part of the appendix will introduce basic information about China, including general characteristics, a demographic profile, Chinese cities and commercial environment. The “General Characteristics” section explains how the Chinese government administers China in the geographic sense. The demographic profile breaks down the population by age and gender. “Chinese Cities” illustrates how cities are classified into different tiers based on special qualifications, and the commercial environment demonstrates Gross Domestic Product (GDP), purchasing power, saving habits, the growing middle class, and challenges in China.

11.1.1 General Characteristics

China, officially the People's Republic of China (PRC), with a population of over 1.39 billion people (2017), is the world's most populous country. Covering approximately 9.6 million square kilometres, the East Asian state is the world's second-largest country by land area, and the third or fourth largest in total area, depending on the definition of total area.

The PRC is a single-party state governed by the Communist Party of China (CCP). The CCP exercises jurisdiction over 22 provinces, five autonomous regions, four directly controlled municipalities (Beijing, Tianjin, Shanghai and Chongqing), and two mostly self-governing special administrative regions (Hong Kong and Macau). The capital city is Beijing. Taiwan—claimed by the Republic of China (ROC), a separate political entity—is also claimed by the PRC as the 23rd province, due to the complex political status of Taiwan and the unresolved Chinese Civil War. Taiwan is not currently an official province of the PRC.
11.1.2 Administrative Divisions

Due to China's large population and area, the administrative divisions have consisted of several levels since ancient times. The constitution of the People's Republic of China provides for three levels of government. Currently, there are five practical levels of local government. They are: province, prefecture, county, township, and village (from largest to smallest).

Provincial boundaries in China have remained largely static since the seventeenth century. Major changes since then have led to the reorganization of provinces in the northeast after the establishment of the People's Republic of China, and the formation of autonomous regions, based on Soviet ethnic policies. The provinces serve an important cultural role in China, as people tend to identify with their native province.

### 22 Provinces

- A provincial committee, headed by a secretary, nominally leads a standard provincial government. The committee secretary is first in charge of the province, superior to the governor of the province.
- Anhui, Fujian, Gansu, Guangdong, Guizhou, Hainan, Hebei, Heilongjiang, Henan, Hubei, Hunan, Jiangsu, Jiangxi, Jilin, Liaoning, Qinghai, Shaanxi, Sichuan, Yunnan, Zhejiang

### 5 Autonomous Regions

- A minority subject has a higher population of a particular minority ethnic group along with its own local government, but an autonomous region theoretically has more legislative rights. In practice, they only have the right to appoint the governor (from the local minority).
- Guangxi, Inner Mongolia, Ningxia, Tibet, Xinjiang

### 4 Municipalities

- The highest-level classification for cities used by Chinese governments, with a status equal to that of the provinces.
- Beijing, Chongqing, Shanghai, Tianjin

### 2 Special Administrative Regions (SARs)

- A highly autonomous and largely self-governing subnational subject of the People's Republic of China. Each SAR has a gubernatorial chief executive as head of the region and head of government.
- Each region's government, however, is not fully independent, as foreign policy and military defense are retained as the province of the nation and its central government.
- Hong Kong, Macao (Macau)

### 1 Unofficial Province

- The island of Taiwan and its surrounding islets, including Penghu, as "Taiwan Province." The territory is controlled by the Republic of China (ROC, commonly called "Taiwan")

11.1.3 Demographic Profile

With a population of over 1.39 billion, growing about 0.55% each year, China is very concerned about its population growth and has attempted, with mixed results, to implement a strict birth limitation policy. China's 2002 Population and Family Planning Law and policy permits one child per family, with allowance for a second child under certain circumstances. Rural families, and ethnic minorities with small populations are typically subject to looser regulation. Enforcement varies and authorities rely on "social compensation fees" to
discourage extra births. However, considering China’s low birth rate, rapidly aging population and imbalanced sex ratio, the government has since promulgated a “second child policy.” The government’s goal is to stabilize the population in the first half of the 21st century, and current projections are that the population will peak at around 1.6 billion by 2050. The age breakdown below shows the age breakdown, with cumulative numbers between 5 and 64.

![China Population Pyramid 2017](image)

Figure 19: China Population Pyramid 2017

**Chinese Population Statistics:**

<table>
<thead>
<tr>
<th>Metric</th>
<th>Total</th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Median Age</strong></td>
<td>0.36% (2017 est.)</td>
<td>Ranking in the world: 164</td>
<td></td>
</tr>
<tr>
<td><strong>Population Age</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Birth Rate</strong></td>
<td>11.73 births/1,000 population (2017 est.)</td>
<td>Ranking in the world: 167</td>
<td></td>
</tr>
<tr>
<td><strong>Death Rate</strong></td>
<td>7.11 deaths/1,000 inhabitants (2017 est.)</td>
<td>Ranking in the world: 106</td>
<td></td>
</tr>
<tr>
<td><strong>Net Migration</strong></td>
<td>0.31 migrant(s)/ 1,000 population</td>
<td>Ranking in the world: 141</td>
<td></td>
</tr>
<tr>
<td><strong>Urbanization</strong></td>
<td>Urban population: 57.96% of the population (2017)</td>
<td>Rate of urbanization: 3.5% annual rate of change (2012-17 est.)</td>
<td></td>
</tr>
</tbody>
</table>

Figure 20: Chinese Population Statistics
11.1.4 Chinese Cities

China has the highest population in the world. Chinese living in the countryside account for more than 18% of the world population. A majority of the population has moved to the cities where the population continues to balloon and grow denser. With this boom in population and density, China is facing a lot of opportunities and challenges.

In the 1980’s the Chinese government started to rank cities by tier, based on government development priorities. Over time, the priorities and measurements changed, as did the rank of certain cities. There is no official list of all cities and their respective tiers, but there are criteria that correspond with each tier.

The ranking systems of tier cities can be broken done into 5 tiers;

- A tier 1 city represents the most developed areas of the country and often receives the most attention from foreign and domestic investment. The tier 1 cities are: Beijing, Shanghai, Guangzhou, Tianjin and Shenzhen.
- A few years ago, tier 1.5 was added to the list. These cities are developing to become a tier 1 city, but do not have the status yet. Tier 1.5 cities have a large economic influence, a large population and growing international trade & investment. Examples of tier 1.5 cities are: Chengdu, Nanjing and Xi’an. Some research outlets included other cities as tier 1, but this explanation will adhere to the original and still most widely accepted 4 cities (Beijing, Shanghai, Guangzhou, and Shenzhen).
- A tier 2 city is often a smaller city compared to a tier 1 or 1.5, but still experiences fast growth. These cities have less economic influence than tier 1 cities, but still play an important role in international trade and transport. Examples are: Qingdao, Xiamen and Ningbo.
- Tier 3,4 and 5 cities are also ranked. Around 2013, tier 5 was added due to the fast urbanisation in China. Each of the tier numbers represents a certain stage, focusing on at the priorities and measurements set by the government.

11.1.5 Size of Chinese Cities

In March 2017, The Guardian published an article stating that China at this moment has more than 100 cities with over a million habitants in each city. For the future, this is expected to grow even further. According to Statista, a leading research and analytics company, the amount of people per household in China is approximately 3.1. With 16 million households in tier 1 cities, 38 million households in tier 2 cities, 75 million households in tier 3 cities, 86 million in tier 4 and around 75 million households in rural areas. China’s rising population has produced an abundance of opportunities. Figure 22 illustrates the population living in tier 1, tier 1.5 and 2 cities, versus the percentage of the population in other urban areas and the countryside. At this moment, an estimated 600 million people still live in rural areas, but an additional 170 million people are expected to move to the city, as urbanization reaches 70% by 2025.
11.1.6 The Chinese Commercial Environment

Since the late 1970s, China has moved from a closed, centrally planned economic system to a more market-oriented one that plays a major global role. In 2010, China became the world's largest exporter. Economic reforms began with the phasing out of collectivized agriculture. It expanded to include the gradual liberalization of prices, fiscal decentralization, increased autonomy for state enterprises, the creation of a diversified banking system and stock markets, rapid private sector growth, and opening to foreign trade and investment. China has implemented these reforms gradually to ensure stability.

Gross Domestic Product (GDP) measures national income and economic output. The GDP is equal to the total expenditures for all final goods and services produced within the country over a given period of time. China’s GDP, as can be seen in figure 4, has seen yearly growth since 1990. However, China’s GDP growth for 2017 was only 6.9%, one of the lowest rates since 1990. Although the growth rate was the lowest since 1990, China’s numbers for 2017 were quite strong for a nation that is losing steam and facing increasing debt.
11.1.7 Purchasing Power

Since the introduction of market-based economic reforms in 1978, China has become the world’s fastest growing major economy. Up until 2011, the economic growth was over 10%, but growth in 2016 was just 6.7%. However, opportunities for foreign companies in China are plentiful, especially when looking at the potential of the market owing to its sheer size. According to the Purchasing Power Parity (PPP), a measure that adjusts countries’ GDPs for differences in prices, both the IMF and the World Bank categorize China as the largest economy. According to Boston Consulting Group, it is expected that Chinese consumers’ economy will expand from USD 4.2 to USD 6.5 trillion between 2015 and 2020. The dramatic growth of USD 2.3 trillion alone during the next five years will be the same as the entire projected consumption for Germany in 2020. Chinese consumers will still have strong financial power to buy commodities in the foreseeable future.
Growing Middle Class

The middle class in China is growing. According to a study by consulting firm McKinsey & Company, the middle class in China is 76% of China’s urban population. This 76% are working citizens with an annual salary between the USD 9,000 and USD 34,000 (CNY 61,200 and CNY 231,200). In 2000, only 4% of the population earned a salary in this range. In 2015, the percentage of the population who did make an annual salary between USD 9,000 and USD 34,000 went up to 68%, and that percentage is expected to rise to 75% by 2022. The middle-class mainly lives in coastal cities (87% vs. 13%), though, by 2022, that is expected to change to 61% middle class vs. 39%. The biggest change will occur in tier 3 cities, being that 15% of the total middle class will eventually become 31% of the total.

The dramatic growth of China’s middle class will continue. Overseas companies should target middle class consumers with robust purchasing power and high standards for goods and services they buy. Quality products will ultimately enjoy the most success with this demographic.
The geographic center of middle-class growth is shifting.

### Share of middle class, by geography, %

<table>
<thead>
<tr>
<th>Region</th>
<th>2002</th>
<th>2022</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inland China</td>
<td>13</td>
<td>39</td>
</tr>
<tr>
<td>Coastal China</td>
<td>87</td>
<td>61</td>
</tr>
</tbody>
</table>

*Figure 24: The Geographic Center of Middle-Class Growth*

### Share of middle class, by type of city, %

<table>
<thead>
<tr>
<th>Type</th>
<th>2002</th>
<th>2022</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tier 1</td>
<td>40</td>
<td>16</td>
</tr>
<tr>
<td>Tier 2</td>
<td>43</td>
<td>45</td>
</tr>
<tr>
<td>Tier 3</td>
<td>15</td>
<td>31</td>
</tr>
<tr>
<td>Tier 4</td>
<td>3</td>
<td>8</td>
</tr>
</tbody>
</table>

*Figure 25: Share of the Middle Class by Type of City*
11.1.9 Saving Habit

Saving money for emergencies is a traditional habit among Chinese. According to figure 27, the percentage of gross savings as a share of Gross Domestic Product (GDP) is 49.8%. This number is two times larger than that of the United States. Thanks to China’s economic growth, which promotes citizens’ income and the government’s tax receipts, Chinese citizens have more opportunities to increase their disposable income. This disposable income can be used to purchase products. Since the habit of saving money is so ingrained into the Chinese culture, spending their disposable income might be harder than in other countries.

![Gross Savings as a Share of GDP (2017)](image)

Figure 26: Gross Saving as a Share of GDP
12 Appendix III: Ecommerce and Express Market in China

The e-commerce and CEP industries in China are growing at a rapid pace. USD 752 billion of goods are sold via Chinese retail websites in 2016. In 2017, the total value of social logistics goods sold in China was over CNY 252.8 trillion. This represents an increase of 6.7% from 2016. An estimated increase of 6.5% for 2018 is expected. Moreover, this boost is expected to satisfy the wishes of both the Chinese government and an increasing amount of the Chinese population to increase sustainability, bolster the circular economy and fast-track recycling.

12.1 Key E-commerce Platforms

In China online platforms are already the main marketplace where people buy all goods. Almost every big brand that sells in China has a shop on those online platforms. The Alibaba Group has been a large contributor in shaping the online platform market in China since 1999, such as developing one of the largest client-to-client (C2C) markets, Taobao, and developing the largest business-to-client (B2C) market, T-Mall. Many online platform companies have looked to the online platform model the Alibaba Group has designed to create their own online shopping experience for Chinese consumers. The following sections will discuss the basic information about the four main shopping platforms for consumers in China.

In China, many companies resemble omnichannels, a model that integrates both online and offline retailers under one umbrella platform. This differs from the European strategy, where a lot of stores have their own web shops. Consequently, all major shopping platforms in China mentioned below are omnichannels and sell both their own and third-party products.

![Chinese B2C online shopping market share in 2017Q4](image)

Figure 27: Chinese B2C online shopping market share in 2017Q4
12.2 Courier Express & Parcel Industry in China

The Courier, Express & Parcel (CEP) industry has achieved huge business growth due to the growing of e-commerce industry. In 2018, it is estimated that almost 60 billion parcels will be delivered. Despite the huge volume, the next phase of the industrial development will be focused on the improvement of operations quality. Since costs and environmental efficiency are driving the entire logistics industry, the industry is especially expected to receive a boost of technology revolution and implementation of sustainable strategies.

12.2.1 General Logistics Industry Overview

All kinds of industries and sectors started to develop in China after entrepreneurs noticed the country’s economic growth. The logistics market is stabilizing after a period of rapid development beginning in 2000. Between 2001 to 2008, the average annual growth on the total value of social logistics goods was greater than 20%. The 2008 global economic crisis significantly dampened this breakneck growth. Between 2012 and 2016 the average annual growth rate for the logistics industry dropped to 8%.

![Figure 28: Growth rate of Total Value of Social Logistics goods 2001 – 2017](image)

However, like in most other industries, new technologies, new market players, new expectations from clients and new business models are revolutionizing the logistics and transporting space. In July 2016, Chinese Prime Minister Li Keqiang hosted an executive meeting of the State Council; during the meeting, he stressed the importance of promoting “Internet +” effective logistics. Beside the development of the new technologies, sustainable development is always a critical subject for the logistic sector as well, especially regarding packaging waste treatment.
12.2.2 CEP Industry

In the 1980s, China Post became the first entrant into the Chinese CEP business. China Post’s CEP arm goes by the name of EMS. With the cooperation with TNT Express, EMS has developed domestic and international delivery businesses. Meanwhile, international CEP companies (including DHL, UPS, FedEx, TNT Express, OCS, Airborne, AAE, etc.) entered the Chinese market by cooperating with local Chinese companies. These foreign companies mainly focused on international delivery because of their relative competence and higher revenue in that area.

The CEP industry in China has also seen tremendous growth during the last few years. The CEP business, and not the post office, contributes the majority of revenue for the postal industry. CEP service companies handled over 10 billion pieces of mail in 2014, then 30 billion in 2016, and finally 40.1 billion by the end of 2017. According to the State Post Bureau of China, the total revenue of the postal industry in China is CNY 662.26 billion in 2017. CEP service companies contributed a total of CNY 495.71 billion to the postal industry, which was about three-quarters of the total revenue.

China’s CEP business and business income have increased year-on-year since 2011. According to a report published by the State Post Bureau, approximately 40.1 billion units were delivered by express in 2017, up by 28.2% from the previous year; express delivery business revenue totalled CNY 495 billion, an increase of 24.5% year-over-year.

In 2018, 52.4 billion parcels have been delivered in the first three quarters. During the Double 11 online shopping festival, over 1.9 billion parcels shipped in one single day. As it can be seen in Figure 30, compared to 2017, the average growth rate is around 28%.

![Figure 29: Courier traffic in China in 2012 – 2017 (in Billion Pieces)](image-url)
12.2.3  Courier Traffic Analysis in Different Regions
The top 15 cities with the most courier traffic are Guangzhou, Shanghai, Shenzhen, Beijing, Hangzhou, Jinhua (Yiwu), Dongguan, Suzhou, Chengdu, Wenzhou, Quanzhou, Wuhan, Ningbo, Taizhou and Nanjing. They generate about 60% of the total courier traffic. In Figure 31, it becomes clear that cities in the Pearl River Delta and Yangtze River Delta regions account for more than 70% of the total, combined. Many enterprises from Guangzhou and Shanghai region are actively taking lead in research and innovation of green packaging technologies and package waste recycling.

<table>
<thead>
<tr>
<th>Rank</th>
<th>City</th>
<th>Courier Traffic (in billion pieces)</th>
<th>Region</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Guangzhou</td>
<td>3.93</td>
<td>Pearl River Delta</td>
</tr>
<tr>
<td>2</td>
<td>Shanghai</td>
<td>3.11</td>
<td>Yangtze River Delta</td>
</tr>
<tr>
<td>3</td>
<td>Shenzhen</td>
<td>2.56</td>
<td>Pearl River Delta</td>
</tr>
<tr>
<td>4</td>
<td>Jinhua (Yiwu)</td>
<td>2.55</td>
<td>Yangtze River Delta</td>
</tr>
<tr>
<td>5</td>
<td>Hangzhou</td>
<td>2.32</td>
<td>Yangtze River Delta</td>
</tr>
<tr>
<td>6</td>
<td>Beijing</td>
<td>2.27</td>
<td>Beijing-Tianjin-Hebei Region</td>
</tr>
<tr>
<td>7</td>
<td>Dongguan</td>
<td>1.22</td>
<td>Pearl River Delta</td>
</tr>
<tr>
<td>8</td>
<td>Suzhou</td>
<td>1.04</td>
<td>Yangtze River Delta</td>
</tr>
<tr>
<td>9</td>
<td>Chengdu</td>
<td>0.82</td>
<td>Mid China</td>
</tr>
<tr>
<td>10</td>
<td>Quanzhou</td>
<td>0.74</td>
<td>Yangtze River Delta</td>
</tr>
<tr>
<td>11</td>
<td>Wenzhou</td>
<td>0.72</td>
<td>Yangtze River Delta</td>
</tr>
<tr>
<td>12</td>
<td>Wuhan</td>
<td>0.70</td>
<td>Mid China</td>
</tr>
<tr>
<td>13</td>
<td>Ningbo</td>
<td>0.64</td>
<td>Yangtze River Delta</td>
</tr>
<tr>
<td>14</td>
<td>Nanjing</td>
<td>0.63</td>
<td>East China</td>
</tr>
<tr>
<td>15</td>
<td>Jieyang</td>
<td>0.58</td>
<td>Pearl River Delta</td>
</tr>
</tbody>
</table>

Figure 30: Top 15 cities and their courier traffic amount in 2017

12.2.4  Key Innovations
Both market demand and business volumes are growing; however, revenue growth is declining. Due to the rising cost of manpower, the leading market players have started seeking innovative technologies to optimize their operations and to make the business become more economically sustainable. On the other hand, a number of market leaders have put in capital and manpower on technology and research in order to follow the new rules and regulations regarding green logistics and sustainable packaging initiatives. Sustainable packaging technologies will be introduced in Chapter 6.

In recent years, the intelligent logistics market has been growing rapidly with the introduction of various high and new technologies under the initiatives of Industry 4.0 and Made in China 2025 plans focusing on automation and industrial technologies. In 2017, value of China’s smart logistics industry reached CNY 338 billion, an increase of 21.1% since 2016. It is predicted that the market scale of China’s intelligent logistics industry will maintain a sustained and rapid growth. By 2020, the market size of China’s intelligent logistics industry will reach CNY 585 billion, an increase of 19.6% over the same period last year.
The CEP industry has already applied some autonomous technologies, such as automated warehouses, intelligent unitized storage devices, smart shelves, radio frequency identification (RFID), infrared sensors, laser scanning, ERP, WMS and other systems, hanging conveyor chains, stackers, shuttle cars, automatic guided vehicles (AVG), automatic guided carts, machine vision, AR/VR and other technologies, PDA and other intelligent picking equipment, and DPS selection systems. Besides automation technologies and equipment, the industry has also applied big data, IoT (Internet of Things) and sustainable recycling technologies.

12.2.5 Key Logistic Companies
The key players in the CEP market are big logistics players. Figure 32 below shows that just 5 local players dominate almost 60% of the market.

Figure 31: Market share of the CEP companies from 2015 – 2017
13 Appendix IV Degradable Plastics

Through vast research and development activities, a number of new technologies and new materials have been invented in China. Driven by the encouragement and industrial trends, degradable plastic innovation is the most popular topic in China, especially biodegradable. The application of the following new materials will help China to eliminate a large amount of traditional plastic packaging, and also saves a large amount of non-renewable original resources. Three examples are given below:

Stone-plastic

Through technological innovation, scientists have developed a new environmentally friendly and degradable material, stone-based material, which uses stone as the main raw material and petroleum as the auxiliary material. The proportion of inorganic powder in the stone-plastic master batch is as high as 70%-90%, and the inorganic powder in the finished product accounts for 40%-60%. It has high filling, high performance, high environmental protection and low cost. At the same time, the performance of stone-plastic materials can be compared with traditional plastics, and it has advantages in bearing capacity and safety, and can completely replace the plastic packaging of existing e-commerce.

Starch-plastic

A new method has been developed in China for degrading starch properties in packaging materials, guided by technologies used to process tomato sauce. In 2006, he successfully developed and commercialized all-starch biodegradable plastic packaging materials for the first time in the world. With the support of this innovative technology, a company that produces degradable packaging materials, which produces inner packaging for foods such as candy, biscuits and chocolate, is now available in London.

Nano-plastic

Nano-modification of plastics facilitates the reduction of packaging and facilitates the degradation of plastic materials. Nano-composite packaging materials, nano-antibacterial packaging materials, nano-substrate packaging materials, and nano-barrier packaging materials all provide good application prospects for the greening of plastic packaging materials.
The relevant state organs have successively issued the “Implementation Plan for Promoting Green Packaging Work in Express Delivery Industry,” “Guiding Opinions on Collaborative Promotion of Green Packaging Work in Express Delivery Industry” and “Provisional Regulations for Express Delivery” beginning in 2016. The promulgation of new regulations has promoted the green development of the express delivery industry. According to the “Report on the Status and Trends of Green Packaging Development in China’s Express Delivery Industry (2018),” as of the end of 2017, 21 billion sheets of traditional paper express delivery orders were saved, 6.4 billion meters of packaging tape was saved, and 400 million medium-speed woven bags were saved.

14.1.1 Circular Economy Promotion Law of PRC
In August of 2008, Circular Economy Promotion Law of PRC was published and was put into effect on January 1st, 2009. The law emphasizes on packaging recycling and the encouragement to packaging material manufacturers to use recyclable materials. In Article 19, it states that “in the design of processes, equipment, products and packaging materials, materials and design schemes that are easy to recycle, easy to disassemble, easily degradable...” and “design product packaging should implement product packaging standards to prevent waste of resources and environmental pollution caused by excessive packaging.”

14.1.2 Guidance on Collaboration of Promoting Green Packaging in Courier Express Parcel Industry
The Guidance was published on November 2nd, 2017. The Guidance has clarified three major goals needed in the green packaging work of the express delivery industry during the 13th Five-Year Plan period. They are: greening, reduction, and recycling. It is proposed that the use of reusable equipment such as transfer boxes and cages will increase, the use of woven bags and tapes will be further reduced, and a special express packaging recycling system will be basically established by 2020.

It is also proposed that usage proportion of degradable green packaging materials will reach 50% by 2020, and the packaging materials with special materials such as heavy metals will be basically eliminated. The use rate of electronic waybills will reach over 90%, and the average cost per package will be reduced by more than 10%.

14.1.3 Implementing Scheme of Promoting Green Packaging in Courier Express Parcel Industry
The National Post Bureau of China announced a scheme in mid-2016 that proposed the avoidance of over-packaging through improved training and standardizing operational procedures. In addition, with the important role of big data, the scheme can strengthen the integration of express delivery companies with e-commerce, manufacturing and service industries, therefore significantly reducing unnecessary secondary packaging.

The scheme incorporates the policies and regulations regarding recycling and reusing of packaging materials to the “Provisional Regulations for Express Delivery” and the “The Law on Promotion of Circular Economy.” In practice, through establishing a socialized express packaging recycling system, the scheme encourages express delivery enterprises to use recycle friendly packaging materials, and promotes a joint effort between producers,
customers and end consumers to classify and reduce packaging. The scheme proposes that a socialized express package packaging recycling system will be virtually complete by 2020.

The plan was published on March 23rd, 2016. It has listed the “Electric Business Logistics Green Cycle Project” as one of the eight major projects. This will undoubtedly play a huge role in promoting the development of e-commerce express green packaging. The main content includes:

1. Encourage e-commerce logistics express enterprises to use the distribution channels to recycle waste packaging materials;
2. Carry out standardization and classification and recycling of e-commerce logistics industry to improve utilization efficiency;
3. Promote the use of new e-commerce logistics packaging technologies and materials to achieve packaging reduction and recycling, as well as packaging wastes are easily degradable and harmless;
4. Strengthen environmental public welfare propaganda through media such as the Internet, TV, newspapers, etc., and establish rational packaging and green packaging concepts.

14.1.5 Circular Development Leads Action
The “Circular Development Leading Action,” published on May 4th 2017, advised: “select the express delivery industry as the entry point; carry out the logistics industry pilot projects for packaging standardization, classification and recycling; promote the use of degradable tape, environmentally friendly fillers, renewable paper and environmentally friendly ink printed package materials; encourage enterprises to recycle the packaging boxes and transfer bags to improve recycling rate.” In particular, it is necessary to promote the standardization of express packaging for packaging items that are often recycled and reused, such as packaging boxes and transfer plastic woven packages.

14.1.6 Environment Protection Tax Law
The Environment Protection Tax Law was passed on December 25th in 2016 and was put into effect on January 1st, 2018. What was previously collected was the sewage charge, not the tax. In this way, environmental protection will be changed from fees to taxes. Article 12 of the law states that the tax can be deducted if companies utilize solid waste comprehensively and meet the national and local environmental protection standards.

14.1.7 Industrial Standard of Waste Plastics Comprehensive Utilization
The Industrial Standard of Waste Plastics Comprehensive Utilization was put into effect on January 1st, 2018. It clearly stated that industry and market entry barriers for the treatment ability of waste plastics for newly building and built companies, which mainly includes PET recycled bottle enterprises, waste plastics crushing and cleaning sorting enterprises, and plastic recycling granulation enterprises. Moreover, it clarifies the “comprehensive utilization of resources and energy consumption,” such as, “it is not allowed dumping, incineration and landfill” of the recycling of waste plastics; during the process of reproduction, every ton of waste plastic could consume comprehensively no more than 55 kWh; for PET Recycling bottle enterprises and
waste plastics crushing, cleaning, sorting enterprises, the total new water consumption per ton of waste plastics must be less than 1.5 tons.

14.1.8 Provisional Regulations for Express Delivery
The Provisional Regulations for Express Delivery were implemented on May 1st, 2018. Regulation encourages companies and senders to use environmentally friendly packaging materials that are degradable and recyclable. At the same time, it encourages enterprises to take initiatives to recycle express packaging materials in order to achieve the reduction and utilization of packaging materials and reuse. This regulation indicates a direction of green development for the industry.

The "Provisional Regulations for Express Delivery" will be the first highest-profile legal document in China's CEP industry upon its implementation. Under the guidance of the national green development concept, the standardized governance and supervision of express packaging is also expected to move toward legalization.

14.1.9 National Standard for Parcel Packaging Products
The newly revised "National Standard for Parcel Packaging Products" was implemented on September 1st, 2018. For the first time, the policy clearly stated that “plastic packaging bags should be biodegradable plastics,” and strengthened requirements for packaging reduction. On the one hand, the policy reduces the quantitative requirements on the material for envelope paper, and it reduces the thickness requirements of the plastic packaging material. On the other hand, it is no longer stipulated on the choice of single and double corrugated materials of the express package. As long as the material meets the resistance, pressure and puncture strength and other indicators, then the material is allowed to be used. The new version of the national standard also increases the relevant requirements for second use of express envelope. Under the premise of meeting the standard, the express packages can be reused. For different express packaging products, recyclable signs, reusable signs or plastic product marks should be printed for easy recycling.

Zhou Xiaowei, chairman of Tianyuan Group, said that due to the continuous development and application of new technologies and new materials, express packaging bags can still maintain good toughness even when the thickness is reduced, so the 2009 Standard is not suitable for the market any more.

14.1.10 Guidance of Express Delivery Green Packaging (Trial)
The Guidance was issued on December 17th, 2018 and became the most recent industry regulation. It aims to regulate the goals of packaging standardization, material usage minimization and recycling, to enhance the cooperation within the supply chain, and to gradually achieve the minimization and reuse of the packaging materials. The Guidance also encourages enterprises to consider biodegradable plastic when they purchase and use plastic packages in order to gradually increase the purchasing ratio of sustainable plastic packages. Companies are supposed to build promotion initiatives on the application of green packages and to actively provide a green packaging option for customers. The Guidance requests express delivery companies to set up and promote recycling containers in their sorting centers and service centers.
Appendix VI: Relevant Associations for China’s Plastic Packaging Industry

The following associations have an impact on the plastic packaging industry and the circular economy in general in China. Furthermore, the associations listed below are national-level. They have provincial-level associations as the branches, and those branches play an important role in implementing the local regulations and incentives. Here only listed the national-level associations.

15.1.1 China Scrap Plastics Association (CSPA)
CSPA is a non-profit organization which operate in the plastic recycling industry engaging in the research and development of this industry and its technology. The organization has held big conferences bringing together local and international companies and professionals.

15.1.2 China Plastic Recycling Association (CPRA)
CPRA, full name China Plastic Recycling Association, is a branch organization of China National Resources Recycling Association. Founded in May 2014, CPRA aims to unite and lead the enterprises and institutions in the plastic recycling industry to upgrade the status and image of the industry and build an influentially healthy industry by abundantly using all the advantageous resources and optimizing the platform of the China Plastics Recycling Association. CPRA offers its members timely information about China’s significant events, international recycling markets, legislative context and the latest technologies.

15.1.3 China National Resources Recycling Association (CRRA)
CRRA was founded in 1993. It is a national organization voluntarily formed by organizations and individuals engaged in the recycling of waste materials, such as professional recycling companies, industrial and mining enterprises, and related scientific research, academic and social organizations. It is also an economic organization in the recycling industry. It is a social organization approved and registered by the Ministry of Civil Affairs of the People's Republic of China.

15.1.4 China Association of Circular Economy (CACE)
CACE is a national organization that crosses different regions and spans various industries. The organization was approved by the Ministry of Civil Affairs on August 15th, 2013 and carries out the government policy of resource conservation and environmental protection and implements the Law on Promotion of Circular Economy. CACE also “bridges and links” to build the resources recycling system. CACE upholds the core value of solidarity, innovation, dedication and service, provides services for governments, industries and enterprises, assists governments in implementing the policies and helps enterprises execute their projects.

15.1.5 China Plastic Processing Industry Association (CPPIA)
CPPIA was founded in 1989 as an industrial organization in the field of plastics processing. The Association is a non-profit entity, and comprises companies, institutions, social groups, scientific research institutes, universities and colleges, and individuals who volunteer to engage in the plastics processing industry and related industries.
CPPIA is guided and supervised by the state-owned Assets Supervision and Administration Commission of the State Council, along with the China National Light Industry Council.

15.1.6 *China Synthetic Resin Association Plastic Recycling Branch*

China Synthetic Resin Association was established at the end of 2011. It is an independent legal entity approved by the Ministry of Civil Affairs of the People's Republic of China. China Synthetic Resin Supply and Marketing Association is a new association established after the merger and reorganization of China Engineering Plastics Industry Association and China Chemical Supply and Marketing Association. The association has different professional branches that correspond with industry divisions, one of which is the plastic recycling branch. The branch was established at the end of 2017 and is expanding.