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# **Establishing a Collaborative Innovation Platform in the Plastic Recycling Industry**

A Case Study Covering the Swedish Actors Within Plastic Packaging  
Recycling and Their View of a Collaborative Innovation Platform

Master's thesis in the Master's Programmes Supply Chain Management &  
Management and Economics of Innovation

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# Abstract

Plastic waste has lately become a more central topic where the negative consequences of it have become more evident. Companies, organizations, and regulations need to adopt a more circular economic mindset where all steps, from plastic manufacturing to recycling, are considered. To tackle the unsustainable handling of plastics, both Sweden and the European Union have set up goals for the upcoming years. In Sweden, the interbranch organization *The Swedish Food Retailers Federation* has set up the goal that all food packaging should be produced of renewable or recyclable plastic by 2030. An extensive contribution is required from all the different players within the plastic recycling industry. This study investigates whether a collaborative innovation platform can be suitable to drive change and collaboration between the actors within the food packaging industry. The purpose of a collaborative innovation platform is to promote and manage collaboration, knowledge-sharing and innovation among different actors to solve a predefined problem.

This case study is based on 12 interviews from various actors within the plastic industry. To get a better understanding of the market, an explorative research approach is used throughout the work process. Furthermore, an iterative process was applied during the data collection and research process. When analyzing the collected data, common factors and parameters were identified and categorized.

The study shows that many of the actors in the industry are currently cooperating. However, it also became more evident that the existing forums and groups are more for discussion than concrete collaboration for innovative solutions to specific issues. Actors participate in the forums due to reputation purposes rather than driving their innovation process. The study shows that most of the interviewees sought for something concrete. What is not needed is another forum for discussions. Furthermore, we can conclude that parameters such as composition, platform governance and platform PR are important for establishing a potential collaborative innovation platform. Finally, our findings suggest that a collaborative innovation platform could be suitable for driving innovation in the plastic recycling industry. However, further investigation is needed in order to understand how to practically establish a platform and increase the generalizability of the identified parameters.

*Keywords: collaborative innovation platform, collaborative innovation, circular economy, plastic packaging*





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# Terminology

## **Dagligvaruleverantörers förbund (DLF)**

An interbranch organization within the food and chemical industry. It is an interbranch organization for 160 companies that sell groceries, restaurants and mass caterers.

## **Fast-Moving Consumer Goods (FMCG)**

Products that have a high demand and relatively low price.

## **Granulates, flakes and agglomerates**

Different kinds of output material from recycling actors.

## **Large enterprises**

Companies consisting of more than 250 employees and annual turnover > EUR 50 million.

## **Norrskén foundation**

A Swedish foundation and coworking space for over 350 entrepreneurs in Stockholm.

## **Plastic packaging**

In this study, plastic packaging refers to plastic food packaging

## **RISE (Research Institutes of Sweden)**

An organization owned by the Swedish government. RISE aims to enable cooperation between business, academia and the public sector. RISE aims to increase society's number of innovations by developing services, products, and technologies that contribute to a sustainable future and a sustainable business life.

## **Small and medium enterprises (SMEs)**

Small enterprises (10-49 employees) and not exceed EUR 10 million in annual turnover. Medium enterprises (50-249 employees) and should not exceed EUR 50 million in annual turnover.

## **Swedish Environmental Protection Agency (Naturvårdsverket)**

A Swedish governmental authority in the environmental field and is actively working for the environment.

## **The European Commission**

The European Unions' executive branch which is responsible for the regulations and legislations. And also, responsible for following up these actions.

## **The Sustainable Development Goals (SDGs)**

The United Nations has stated 17 goals to promote prosperity and protect the Earth. These are (1) No poverty (2) Zero hunger (3) Good health and well-being (4) Quality education (5) Gender Equality (6) Clean water and sanitation (7) Affordable and clean energy (8) Decent work and economic growth (9) Industry, innovation and infrastructure (10) Reduced inequalities (11) Sustainable cities and communities (12) Responsible consumption and production (13) Climate action (14) Life below water (15) Life on land (16) Peace, justice and strong institutions (17) Partnership for all the goals

**The Swedish Food  
Retailers Federation  
(Svensk  
dagligvaruhandel, SvDH)**

An interbranch organization and together with its members constitutes for 97% of the Swedish food retail market. The members of SvDH are Ica Sverige, Axfood, IKEA food, Bergendahls food, Coop Sverige, Livsmedelshandlarna and Lidl Sverige. SvDH and DLF are part-owners of Swedish plastic recycling, FTI, GS1 Sweden, Returpack pantamera, Svensk GlasÅtervinning, Svenska Retursystem, and Från Sverige.

**Återvinningsindustrierna**

An interbranch organization consisting of Axfood, H&M, Houdini, IKEA, NCC, Spendrups Brewery, SSAB, and Tarkett. These actors jointly run the Circular Sweden corporate forum. The purpose of the interbranch organization is to go from linear economies to more circular economies.

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# 1. Introduction

## 1.1 Background

### 1.1.1 Circular economy

The Earth's resources are currently being depleted due to a growing population, a growing economy and non-efficient use of resources. During the early days of the Industrialization, the Linear Socioeconomic system was evolved and has been the standard ever since (Ellen MacArthur Foundation, 2013). Since resources on Earth are finite, the supply of resources will decrease over time which, resulting in increased prices. There has been a trend of increased resource prices ever since the end of the 20th Century (Ellen MacArthur Foundation, 2013).

In a linear economy, the value of a product ends when the customer decides to dispose of the product. This approach is one of the major causes of the depletion of the Earth's resources (Michellini, Moraes, Cunha, Costa, Ometto, 2017). However, in a circular economy, recycling is integrated, which closes the product cycle and keeps the resources within the ecosystem of the society (Swedish Environmental Protection Agency, 2019). Furthermore, making the transition from linear to circular economy implies a fundamental change in how businesses develop their products. As defined by Ellen MacArthur Foundation (2013), "*A Circular economy is an industrial system that is restorative or regenerative by intention or design*", with other words, a closed system whose main goal is to eliminate waste. Components in the system, such as materials and products, are designed accordingly.

There are some industries, especially *FMCG* industries, that are highly unlikely to implement a *user perspective*<sup>1</sup>. For example, the plastic packaging industry. A lot of the packaging related to the food industry has to be collected, sorted, washed and recycled before becoming a new plastic product or packaging. Therefore, in some industries, there is a need for collaboration between actors to achieve a circular economy.

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<sup>1</sup> In a circular economy a customer is more of a user who leases or rent the product and then return it to the greatest possible extent

### 1.1.2 Plastic

The unsustainable handling of plastic waste has gained increased attention in society. The handling of plastic has become a global concern and plastics have become associated with pollution. The awareness among society can be seen in Figure 1, an extract from Google trends which illustrates the number of searches on “plastic pollution” from 2004 until today.

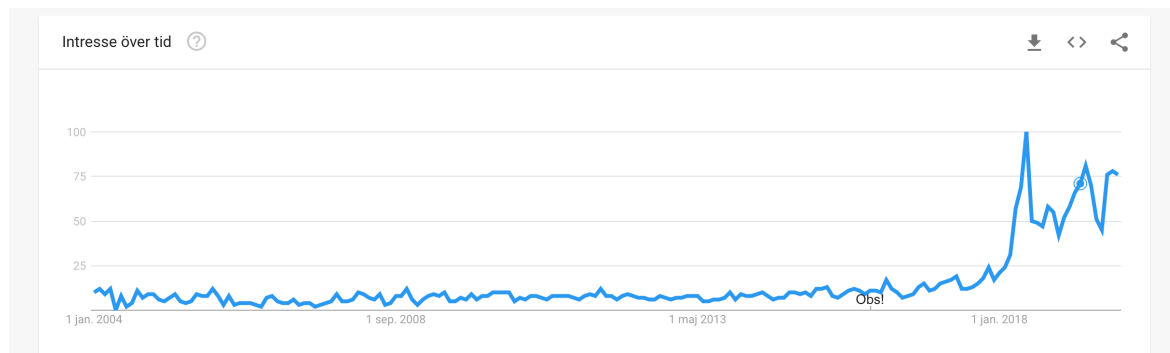


Figure 1. Number of searches on “plastic pollution” on Google from 2004 until 2019. Source: Google trends.

Plastic recycling is possible, but obstacles complicating the process and, therefore, limits the rate of recycling. The design of the packaging, limited demand, variation in quality, low market-price, and low price of oil-based plastics are factors that affect today’s recyclability rate (Swedish Environmental Protection Agency, 2019). Plastic packaging represents 40% of plastic production (National Geographic, 2018). In 2018, approximately 40% of the plastic packaging was recycled within the countries of the European Union (Plastics Europe, 2019). However, by 2030 the European Union targets to increase the recycling of plastic packaging to 55% (European Commission, 2015). To be able to reach such a recycling rate, it requires that the packaging is made out of recyclable material. Therefore, the European Union’s circular economy program demands that by 2030 all packaging put on the EU market should be reusable or recyclable in a cost-efficient way (The Swedish Food Retailers Federation, 2018).

In Sweden, the interbranch organization *The Swedish Food Retailers Federation* has established more ambitious goals than the European Union and developed an action plan to make all plastic packaging material recyclable already by 2022. Additionally, in 2030 the plastic packaging should be made out of recycled plastics or renewable resources (The Swedish Food Retailers Federation, 2018). Figure 2 illustrates the spread of different types of plastic packaging collected in Sweden today. The green part (39,4%) represents plastic which could be recycled; the yellow part (24,6%) represents plastic which could be recycled but where there is currently no demand; the red part (36%) represents plastic which could not be recycled.



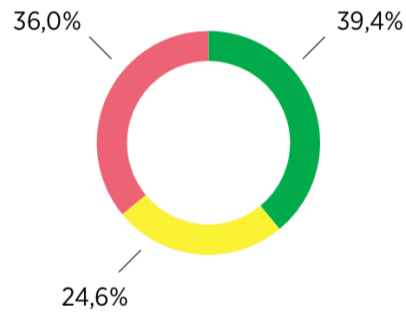


Figure 2. Information regarding the share of plastic packaging that could be recycled on the Swedish market. Source: The Swedish Food Retailers Federation, 2018.

In Sweden, the actors who put packaging on the market also have the responsibility to ensure it is being collected and recycled, called producer responsibility. The legislation is based on the European Parliament and Council directive on packaging and packaging waste (EC, 94/62/EC). However, the directive is vague and currently act more as a guidance for the EU countries, for example *“EU countries should ensure that systems are set up for the return and/or collection of used packaging and/or packaging waste and for recycling or recycling, including material recycling of the packaging and/or packaging waste collected.”*.

The majority of plastic packaging put on the Swedish market is first collected by Förpacknings & Tidningsinsamlingen (FTI), and then sent to the plastic sorting facility in the Swedish city Motala, operated by *Swedish Plastic Recycling*. *The Swedish Food Retailers Federation* is part-owner of both FTI and *Swedish Plastic Recycling*. However, to expose competition on the waste collection industry, the *Swedish Competition Authority* (2019) has forced FTI to let other actors operate on their recycling stations. TMR Recycling (TMR), is therefore also operating as a waste collector and offers producers the service of collection and recycling their packaging. Thus, producers buy the service of collecting and recycling either from FTI or from TMR to fulfill the producer responsibility.

After sorting, the plastic is sold to an actor who washes and recycles the material. After this step, the material becomes a new plastic resource which could be used in packaging or other plastic products. The plastic, which cannot be recycled or is wrongly sorted by households ends up at the energy recovery actor, where it is burned to extract energy (*Swedish Plastic Recycling*, 2019).

### 1.1.3 Demand for collaboration

Based on the challenges related to plastic usage our initial thought was that cross-border collaboration among actors within the plastic industry might be beneficial. Today several forces are working on the plastic recycling industry such as regulations, society's point of view, own initiatives among others. To turn, today's unsustainable handling of plastic to something sustainable, thus, broad collaborations and agreements would be beneficial. Herzog (2008), argues that industry convergence forces companies to look beyond the company's frames to stay competitive. Herzog (2008) further explains that industry convergence could be a consequence of converging value propositions. Since most actors within the plastic industry have to take sustainability and recyclability into consideration, due to the factors mentioned above, the industry can be seen as converging around value propositions. Additionally, Bogers, Chesbrough and Moedas (2018) argue that the *Sustainable Development Goals* (SDGs) derived by the United Nations, which includes climate action, can be a factor empowering the development of open innovation. This study has therefore focused on the relevance and applicability of open innovation, further collaborative innovation and collaborative innovation platforms for the plastic recycling industry.

Collaborative innovation implies that companies collaborate to share information and knowledge and together develop innovations (Gallaud, 2013). The usage of collaborative innovation has rapidly increased during the last decades due to that products and processes becoming more sophisticated (Feranita, Kotlar, & De Massis, 2017; Fawcett, Jones & Fawcett, 2012; Yström, Ollila, Agogue Coghlan, 2018). Complicated innovations demand companies shifting from a "firm-centric" to a "network-centric" perspective. To achieve a higher rate of recycling, it is clear that independent actors within the plastic industry need a broader holistic view than exclusively their operation.

Collaborative innovation platforms, also referred to as open innovation arenas (Ollila & Elmquist, 2011), enables collaboration among actors within the innovation process. However, in this study, these arenas are referred to as collaborative innovation platforms. Compared to an intermediary, explained by Howells (2006), the collaborative innovation platform has its own goals and visions. Agogue, Yström & Masson (2013) argue intermediaries can be of great value when it comes to challenges requiring new perspectives and extensive understanding. Due to the fact, there is a need for extensive collaboration to find a solution. The plastic industry

took off in the 1950s; however, the perspective of recycling is relatively new, and currently, there are significant knowledge gaps among the established actors.

## 1.2 Purpose

Based on sustainability challenges and need for innovation in the plastic recycling industry, this master thesis aims to study whether a collaborative innovation platform would be suitable, and what parameters that are essential for a platform. The purpose of this case study is to further develop a deeper understanding of how to establish collaborative innovation platforms within a specific industry. Additionally, elaborate on vital parameters, and clarify whether a collaborative innovation platform is suitable in the plastic recycling industry. Although there are studies on collaborative innovation platforms in other industries, according to our understanding, there is a lack of research on whether a collaborative innovation platform is suitable in the plastic recycling industry.

Previous research has shown the benefits of using collaborative innovation platforms within several different industries (Dyckmans & Rooney, 2015; Ollila et al., 2011). Bogers et al. (2018) argue that both technological trends and the Sustainable Development Goals are two factors that could drive the development of open innovation. This opens up the possibility that a collaborative innovation platform might be suitable in the plastic recycling industry.

The research question of this thesis is the following:

*What are critical parameters when establishing a collaborative innovation platform in the plastic recycling industry?*

## 1.3 Delimitations & Limitations

The plastic recycling industry will be the main focus of this master thesis. Although plastic is a global challenge and the European Union sets the directives/legislation/regulations, this thesis will only look into Swedish actors.

In reality the plastic recycling industry cover, apart from plastic food packaging, also industrial plastics, plastic products, among others. However, the focus of this study has been limited to plastic food packaging. Plastic packaging constitutes 40% of all plastic produced today.

During the study, we identified an actor chain consisting of plastic manufacturers, producers, waste collectors, recycling actors, and energy recovery actors. The plastic material that goes to an energy recovery actor will go to incineration. Incineration does not fit our perception of a circular economy, energy recovery actors will, therefore, be disregarded in this study.

## 2. Theoretical framework

### 2.1 Open innovation

The concept of open innovation was introduced by Chesbrough, in the early 21st century, explains a shift in a company's innovation process (Chesbrough, Vanhaverbeke & West, 2006). Instead of limiting the development of products and technologies to the boundaries of an entity, also called closed innovation, open innovation proposes a more holistic way of innovation. Sources of innovation could be both internal and external. The development, refinement and alternative market entry of products and technologies should not be seen as pure inhouse activities. Open innovation is about using in- and outflows of knowledge to accelerate the internal innovation process and potentially expand innovations to markets not considered before (Chesbrough et al., 2006). The authors explain that the fundamental idea behind open innovation is that by combining internal core competence with external expertise, there is a higher potential for value creation compared to if R&D is limited to within a company. By having access to both internal and external competencies, a firm has a better chance of securing its existence over time. Bogers et al. (2017) have developed the definition further and argue that open innovation *“provides insights into how firms can harness inflows and outflows of knowledge to improve their innovation success”*.

Furthermore, in an environment of open innovation, all the independent actors must adjust their business model to be able to capture the value that comes with the increased transparency (Chesbrough, Vanhaverbeke & West, 2006). However, Bogers et al. (2018) argue that one main challenge with innovation policy is uncertainty. The uncertainty is, among other things, connected to the actual impact of the innovation and the fact that the effects can differ for different organizations (Bogers et al., 2018). Being open and transparent does not, by definition, imply success. Dahlander and Gann (2010) argue that openness increases the risk of others exploiting the company's resources and other difficulties such as protecting and obtaining the benefits of the company's intellectual property.

#### 2.1.1 A complement to closed innovation

Several industries are currently affected by increased technology intensity and more complex innovation processes (Herzog, 2008). The result is a combination of higher risks and increased costs; this, in turn, implies that firms are more unlikely to rely exclusively on internal R&D.

Another factor that forces companies to look beyond the company boundaries is industry convergence (Herzog, 2008). Industry convergence refers to blurring out the demarcations around the industry and is a result of a convergence of value proposition, technologies, and markets (Herzog, 2008). According to Bogers et al. (2018), technological trends and the Sustainable Development Goals can both be factors empowering the development of open innovation.

During the last decades, the usage of external networks has increased rapidly among firms of all sizes (Narula, 2004). Whether or not the size of the company matters to the applicability of using open innovation is brought forward by, among others, Lee, Park, Yon and Park (2010) in their study of open innovation on SMEs. SMEs often don't have the same resources as bigger corporations. Still, there is not statistically evident that smaller companies would be worse at applying, as Lee et al. (2010) put it, "*New-to-the-world*" type of innovation. Lee et al. (2010) further argue that since they lack the resources, capacity, and capabilities of controlling the whole innovation process, they are more open for collaboration. Smaller firms have a high level of flexibility compared to larger ones, which is a competitive advantage (Narula, 2004). Capabilities and resources can be R&D, distribution, manufacturing etcetera. The application of open innovation tends to differ between larger and smaller firms. Larger firms often use open innovation as a complement to their internal R&D process while some SMEs, have higher R&D productivity due to their ability to exploit knowledge outside the company's borders (Narula, 2004), but lack the capabilities of taking the innovation to the market (Lee et al., 2010). A parallel can be drawn to Teece's (1986) findings on the importance of having complementary assets, such as competitive manufacturing, distribution, and services, to profit from technological innovation.

## 2.2 Collaborative innovation

Collaborative innovation describes a coalition of actors that together develop and create products, processes, and services (Kodama, 2015). By using collaborative innovation, the innovation process can be speeded up (Kodama, 2015). Open innovation and collaborative innovation are closely connected and therefore, hard to separate (Gallaud, 2013). Gallaud (2013) explains collaborative innovation as the process when companies together develop innovations. The companies work together, gathering and sharing resources to develop knowledge and information. Davis and Eisenhardt (2011) argue that for collaborative

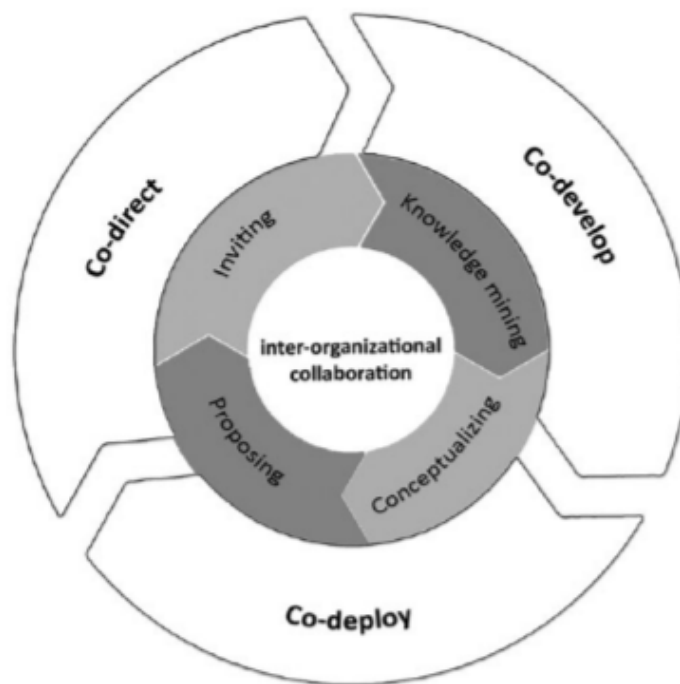
innovation to work, companies must have mutually independent operations. The authors take the example of Intel and Microsoft, two companies with independent operations producing different products. In order to develop innovations together, they need to access their complementary assets and innovation ideas to come up with a solution. To develop ideas and innovations together, these companies need to access their corresponding competence. In today's society, where products are becoming more and more advanced, boundaries are currently blurring out between the actors (Fawcett et al., 2012; Yström et al., 2018). The innovation processes need to be organized further to create the best products and services (Yström et al., 2018). Both Yström et al. (2018) and Kohn Rådberg & Yström (2017) argue that companies and organizations transition from a more "firm-centric" perspective to a "network-centric". Exploiting the industry network and co-creating value with other companies have become more critical due to an increase in the complexity of innovations. Keys & Malnight (2012) agree and further explain that it is a way of fulfilling the increased demand of complex innovations.

To achieve sustainable results, companies often have to open up their operations to a greater extent compared to before (Coghlan & Coughlan, 2015). According to Tekic and Willoughby (2017), companies and organizations rely more on researchers and students today than in the past. The authors mean that these actors can contribute and foster innovation in the initial phase of the innovation process with their expert knowledge within the field. Using experts lets a company exploit external sources of innovation and gain a deeper understanding, which could be vital for the R&D process and breakthrough innovations (Tekic & Willoughby, 2017).

Several studies from different sectors highlight the potential benefits of collaborating with external partners, especially when something is completely new and not yet implemented. The examples are from the automotive sector (Yström et al., 2018), built environment (Gluch, Kadehors & Kohn Rådberg, 2019), but also related to the establishment of innovation arenas (Kohn Rådberg 2018). The focus of Yström et al. (2018) study on the automotive industry, was to analyze a network of actors. The benefits of making a study on the automobile industry are that the actors are used to collaborate. However, the authors believe that the more established markets do not get the same benefits because the actors are more resilient to collaboration.

Yström et al. (2018) argue that undergoing certain phases are a prerequisite for achieving collaborative innovation, see Figure 3. During the first phase, co-directing, it is essential that the different counterparts understand the benefits of collaborative innovation and the reason

why collaborative innovations have been successful earlier in other cases. In the second phase, co-developing, the authors point out the importance of engaging the management to get a better overview of their business, but also to understand their position and the competitors. Lastly, co-deploying, to deepen the collaboration, the authors point out the importance of having workshops with the actors. The purpose of having workshops are that the actors can exchange explorative ideas and share their expertise. By following the steps proposed in the model by Yström et al. (2018), there is likely that a collaboration characterized by fear can develop into a collaboration characterized by shared goals and commitments. Also, some actors might have had bad experiences of collaborating, and thus barriers exist, which problematize the development of collaborative innovation (Yström et al., 2018). How to achieve collaborative innovation is further explained in Figure below (Yström et al., 2018). By successfully going through the steps of the inner circle; inviting, knowledge mining, conceptualizing, and proposing, a collaboration goes from co-directing to co-deploying (Yström et al., 2018).



*Figure 3. A collaborative innovation model of how to go from co-directing to co-deploying. Source: Yström et al. 2018.*

Several studies within collaborative innovation point out the importance of having shared goals (Fayard & Metiu, 2014; Huxham & Vangen 2013). Huxham & Vangen (2013) argue that collaboration across boundaries is not always easy, especially when the actors come from different countries. Then there are boundaries such as culture, language, time-zones affecting these collaborations. To achieve a high degree of collaborative innovation, the companies must understand the dynamic and nature of trust-building (Fawcett et al., 2012; Dyckmans &



Rooney, 2015). Dyckmans & Rooney (2015) further explain trust-building is crucial to attracting actors and for them to share knowledge.

In addition to the theory on open innovation, additional literature from the network theory have been used as a complement, to cover aspects of long-term collaboration. According to Jiang, Bao, Xie and Gao (2016), the main reason to collaborate with other companies or organizations is to gain useful knowledge from the other parties. These skills can be marketing, technological, manufacturing and other potential skills (Jiang et al., 2016; Oxley & Sampson, 2004; Granstrand, Patel & Pavitt, 1997; Das & Teng 2000).

## 2.3 Collaborative innovation platform

Bogers et al. (2017) argue that only limited research has been done on the extension of network collaborations within open innovation. Network collaborations refer to how companies can develop, create and capture value together through a network, e.g. through platforms (Bogers et al., 2017).

Actors that take on the role of enabling collaboration between other actors within the innovation process can take several different shapes and forms. Howells (2006), refer to these actors as intermediaries, which is further developed by Ollila et al. (2011) and Kohn Rådberg et al. (2017). The authors claim that some of these actors strive to be key players in enabling open innovation within a specific field of expertise compared to Howells' definition of intermediaries which have more supportive characteristics. Ollila et al. (2011) refer to these constellations as "open innovation arenas". According to Yström, Aspenberg & Kumlin (2015), intermediaries are often companies with more specified roles or tasks such as brokers or network facilitators. Open innovation arenas exist because of the composition of the actors rather than being independent operating organizations. The arena may even sometimes have its own goals and visions, and strategies for achieving them. The open innovation arena actor also provides a facility for the participating partners/actors (Ollila et al., 2011). Intermediaries can, therefore, be seen as more of a supporting actor while an open innovation arena is a key player with an agenda within the innovation process (Yström et al., 2015).

The participants in the innovation arena, henceforth called partners, are not seen as suppliers to one another but rather as peers, who commonly come up with projects within the scope of

the platform. According to the study of Ollila et al. (2011) on open innovation arenas, there are often managerial challenges for the platform. The arena that they investigated, called SAFER, was located in Gothenburg (Sweden) with the primary objective of making Sweden world-leading in vehicle safety and reduce the number of traffic accidents and injuries. Ollila et al. (2011) identify several managerial challenges connected to the arena. The partners will not give up information if the goals of the arena are too similar to their own. Some of the partners do not see the potential of open innovation. They know the arena most as a beneficial tool if you gain more than you give, acting opportunistically. Therefore, arena managers must support open culture between the partners. In the case of SAFER, there was uncertainty about SAFER's role from some of the partners, which contributed to issues related to expectations and affiliation. Ollila et al. (2011) propose that by communicating the objective and characteristics of the arena can lead to reduced uncertainty. Kohn Rådberg et al. (2017) argue that managers need to have complementary roles to support the co-creation between the actors to achieve collaborative innovation. The managers can open up for joint actions with their involvement.

Science parks, similar to open innovation arenas, are defined in the paper of Phan, Siegel, and Wright (2005) as *“property-based organizations with identifiable administrative centers focused on the mission of business acceleration through knowledge agglomeration and resource sharing”*. Kohn Rådberg et al. (2017) identified another managerial issue in their study of science parks, namely the struggle with rather unmeasurable goals. A traditional intermediary could have a somewhat accurate measurement of performance such as the number of deals brokered, or patents filed. However, the value of being a part of a science park is rather hard to measure with the traditional quantitative measures. The consequence of difficulties related to assessing the value could be both loss of projects and lack of funding (Kohn Rådberg et al., 2017).

In situations that require a big leap of understanding and a new way of looking at a problem, Agogu   et al. (2013) emphasize the importance of an intermediary, since there is a need of more than one actor to find a solution. Finding a solution to problems with high societal demand often requires extensive collaboration among different actors. The intermediary can take on the role of creating a platform, to establish and manage the collaboration among the various actors (Agogu   et al., 2013). Furthermore, Agogu   et al. (2013) conclude that intermediaries can be valuable assets in the innovation process when there is a need for collective action both, pre and post the markets, technologies and actors are in place.

Furthermore, prior studies have been done on collaborative innovation platforms within different industries, for example, the case of SAFER and the automotive industry (Yström et al., 2018; Ollila et al., 2011; Yström et al., 2015). However, these studies target existing platforms and identify their current challenges and critical aspects rather than the applicability of a new collaborative innovation platform within a specific industry. Success factors are open climate, clear communication of the platform's objectives and trust (Ollila et al., 2011; Dyckmans & Rooney, 2015). Challenges related to platforms are information sharing, knowledge transparency and unmeasurable goals (Yström et al., 2015; Kohn et al., 2017).

That being said, the thesis aims to further investigate *What are critical parameters when establishing a collaborative innovation platform in the plastic recycling industry?*

### 3. The case - Actors within the plastic recycling industry

In order to determine what parameters are vital when establishing a collaborative innovation platform in the plastic recycling industry, identifying the different actors were crucial. The actors we have included here are illustrated below in Figure 4 and are grouped into producers, manufactures, waste collectors, recycling actors and energy recovery actors. Furthermore, Table 1 illustrates the interviewed actors and their role in the identified value chain.

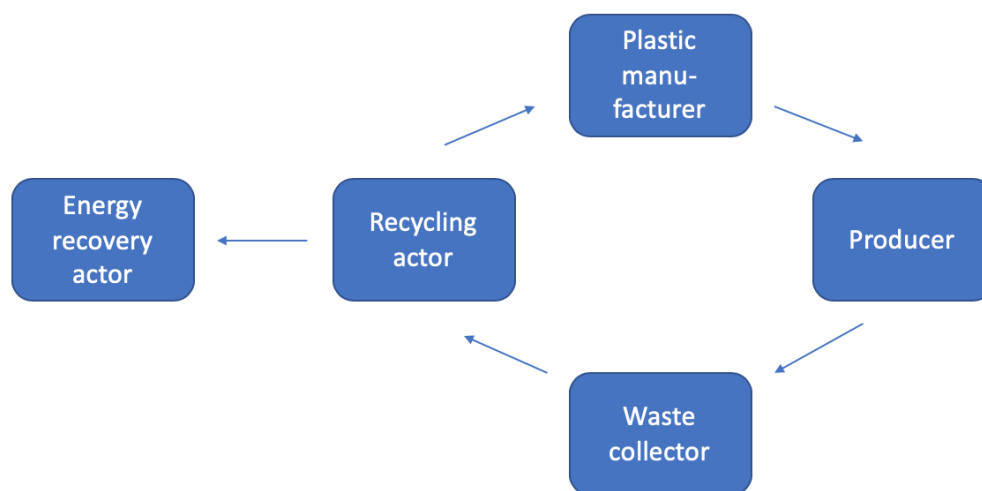


Figure 4. Identified chain of actors within the plastic recycling industry.

Plastic manufacturers use various plastic resources as input material, and the output is a container partly or only made of plastic. Input material is today most often of virgin material, oil-based, but also some recycled and renewable material.

Producers are both the ones filling up the container with a product and the ones making it available on the consumer market. In Sweden, most producers are a part of the interbranch organizations *The Swedish Food Retailers Federation (SvDH)* and *Dagligvaruleverantörers förbund (DLF)*.

Waste collectors collect the waste that the producer put on the market. As mentioned in the introduction, the producers putting plastic packaging on the market are responsible for that packaging to be collected and recycled, called producer responsibility. In Sweden, producers finance the operation of collecting, sorting and recycling through packaging fees charged to consumers.

Recycling actors include both sorting and recovery of the plastic. Recycling actors make it possible for used resources to become new. After the material is collected, it goes to sorting. After sorting, it proceeds to recovery. Which recovery process that suits the specific plastic fraction depends on the quality and type of material. The demand differs for different types of plastics. If there is a market for the material and the quality is good, then the material will be recycled. Still, a large amount of plastic goes to energy recovery. However, in Sweden, no plastic packaging from food goes to landfill. The output from recycling actors is usually plastic flakes, granulates or agglomerates.

No.	Role	Description
1	Plastic manufacturer	Global and large enterprise, that is not focusing on food packaging
2	Plastic manufacturer	National and medium Enterprise
3	Plastic manufacturer	Global and large enterprise, the company's main business is not plastic
4	Producer	Global and large enterprise
5	Producer	Global and large enterprise
6	Producer	Global and large enterprise
7	Waste collector	A regional actor within Sweden and a medium enterprise
8	Waste collector	Mainly national and large enterprise
9	Recycling actor	Global and large enterprise
10	Recycling actor	Global and large enterprise
11	Recycling actor	Municipal company
12	Recycling actor	National and medium enterprise

*Table 1. List and description of the interviewed actors*

## 4. Methodology

### 4.1 Research Strategy and Design

The research strategy is divided into two different categories qualitative and quantitative. A qualitative study is preferred when it is essential to get a deeper understanding, while quantitative is commonly used when analyzing numerical data (Bryman & Bell, 2015). The research design refers to the research method and how the information and data were conducted (Creswell, 2008). A qualitative study is more advantageous to apply when the goal is to gain a deeper understanding of something in a specific context (Patton, 2002; Justesen & Mik-Meyer, 2011). Thus, a qualitative method is suitable for this study. The goal is to gain a deeper understanding of how a collaborative innovation platform would work within the plastic recycling industry rather than analyzing quantitative data.

Furthermore, the research method is usually divided into either deductive or inductive approach (Bryman & Bell, 2015). A deductive approach uses research that already exists while inductive research allows a more explorative strategy and is applied when new understandings is the result of the study (Bryman & Bell, 2011). On the other hand, a deductive approach aims to test theory that is already existing (Bryman & Bell, 2011). The thesis is explorative and inductive, since the aim of the study is to find out critical parameters when establishing a collaborative innovation platform in the plastic recycling industry.

We have chosen to apply a case study as study design, where the set of actors and its collaborative intentions can be seen as the case. A case study is advantageous when performing a detailed analysis of a single case and where the goal is to understand a phenomenon that contains large amounts of relationships and variables (Stake, 1995; Bryman & Bell, 2011).

The study took off in August 2019 after a meeting with our external supervisor, where we gained better insight into the industry of plastic recycling. After that, the research began to get a better understanding of how collaborative innovation platforms are currently applied, and challenges of the plastic recycling industry. Even if the aim of the master thesis was not articulated until mid of the process, it was set relatively quick after a couple of meetings with

our supervisor, namely investigating if a collaborative innovation platform would be suitable for the plastic recycling industry.

## 4.2 Data collection

The data have been collected through semi-structured interviews. To enable a comprehensive overview, representatives from all different actors within the plastic recycling industry were interviewed. A chain of actors covering all steps in the plastic recycling process was identified, see Figure 4. Subsequently, at least two actors were contacted in each defined step in the chain of actors to obtain a more representative response. However, there is still a risk that the respondents are not representative of the entire set of actors within each step.

Furthermore, the plan was to identify and interview the individuals with the most exceptional knowledge and insights about the company's standing regarding sustainability, recyclability and circular economy. If this was not possible, the CEO or other C-level people were targeted. There is a risk that subjective answers could affect the results, especially when it comes to main challenges since they might have biases toward their department. Also, there is a risk that the interviewees will not answer the questions quite honestly, which may affect the research (Ryen, 2004).

An interview template was developed before the interviews took place, which was then used as a guideline during the interview. The questions were predetermined, but there was some flexibility to come up with follow-up questions. Bryman & Bell (2011) emphasize the importance of creating a particular sequence of questions. However, it is crucial not to ask leading questions to avoid biases. Semi-structured interviews were advantageous in this study since, Bryman & Bell (2011) argue, semi-structured interviews allow the respondent to think in both exploration and explanation terms. Bryman & Bell (2011) further argue that the advantage of using a semi-structured because it is easier to refine the interview template for the following interview. Also, more general questions were carried out to the people who were more reserved during the beginning of the interview. To test and validate the interview guide we interviewed each other before we started doing the real interviews.

According to Bryman & Bell (2011), the consent of the participating persons must be confirmed. Since the study might process sensitive information, the respondents were in all

interviews informed what participating in the interview would mean for them. Further, the respondents were asked if the interview could be recorded. The reliability of the study increases when the participants are being recorded since they are most likely to give honest answers, which would mean reaching higher level of data quality (McGonagle, Brown & Schoeni, 2015). Recording the interviews strengthened and facilitated the interview process as one of us instead of writing notes, could focus on asking follow-up questions. After each interview, the recording was transcribed. According to Alvehus (2013), there are two ways to doing the transcription process either a literal transcription or rewrite to written language. In this study, the second method was applied to facilitate analysis writing at a later stage. Also, the interviews were translated from Swedish to English, which also could affect perceptions and the result. If it was revealed that any information had been missing, the person was contacted again.

In total, twelve interviews were conducted, where the interviews were of varying nature, in person, skype or telephone. Due to geographical distances, all except one interview were conducted over telephone or skype. Block & Erskine (2012) argue that telephoning is more beneficial because the anonymity is higher compared to having a conversation face-to-face. That way the participants are more open to share sensitive information. However, there are several benefits of having an interview in person (Bryman & Bell, 2011; Waller, Farquharson & Dempsey, 2015). Having the interviews in-person lets the researchers analyze the interviewees' body language and the tone in their voice (Waller et al., 2015). We were extra careful that the interviewees understood the meaning of our questions to compensate for any disadvantages of conducting interviews over the telephone.

In the planning of the interviews, it was estimated that the interviews would take around 60 minutes. But when the interviews were conducted, they took between 29-70 min, the actual length of each interview is shown in Table 2. The variation in interview lengths was mainly due to variation in respondents' responses. However, some respondents did not assume that it would take a full hour even if it was well communicated beforehand. Ten out of twelve interviews were conducted with both students. Both students asked questions and follow-up questions to the respondents. Bryman & Bell (2015) mention that it is advantageous to be more than one interview when conducting data because it can lead to a more relaxed atmosphere.

Furthermore, we thought that only by describing the concept of a collaborative innovation platform, it would give the interviewee enough information to elaborate on possible benefits



and obstacles of a potential platform. However, this was not always the case. Some interviewees did not see the purpose of a potential platform when only describing the concept. Therefore, a possible problem for the platform was articulated; namely, the goal set by The Swedish Food Retailers Federation “By 2030 all plastic packaging be made out of recycled or renewable plastic”.

No.	Role	Type (time)
1	Plastic manufacturer	Telephone (67 min)
2	Plastic manufacturer	Telephone (42 min)
3	Plastic manufacturer	Telephone (61 min)
4	Producer	Telephone (41 min)
5	Producer	Telephone (29 min)
6	Producer	Telephone (30 min)
7	Waste collector	Telephone (50 min)
8	Waste collector	Face to face (70 min)
9	Recycling actor	Telephone (50 min)
10	Recycling actor	Telephone (39 min)
11	Recycling actor	Telephone (29 min)
12	Recycling actor	Telephone (54 min)

*Table 2. List and interview length of the interviewed actors*

### 4.3 Data analysis

In an initial phase, once the interviews had been completed, all interviews were transcribed. Secondly, after transcription was done, the quotes were analyzed and codified based on similarities. Codifying is done to obtain a higher conceptual level (Denscombe, 2009). Based on the quotes, different aspects were identified to represent the opinions of the interviewed

actors. These aspects were then merged into parameters and factors to get a better overview. For example, several actors mentioned the culture as a critical factor for a successful platform; these quotes were covered by the aspect “culture/environment” which then was covered in the parameter “platform governance”. Graneheim & Lundman (2004) conclude that by dividing parameters into aspects is a successful way of obtaining a result of a high conceptual level.

## 4.4 Research Quality

The concept of research quality aims to arrange and design the research in such a way that research is achieved in the greatest possible way. To get a study of high quality, factors like credibility, transferability, confirmability and dependability needs to take into consideration (Bryman & Bell, 2011).

*Credibility* means that the results are credible and valid (Lincoln & Guba, 1985; William, 2006). Furthermore, Guba (1981) argues that triangulation should be applied to increase the research quality and credibility. Triangulation means that information from more than one source is used. In order to increase the credibility in the data collection of this study, at least two actors within each step of the actor chain was interviewed.

The study has used a strategy described by Guba (1981) to increase *transferability*. Guba’s strategy aims to collect “thick” data to make it easier to transfer the results to another context, situation or population. To strengthen the reliability, the thesis includes an extensive method chapter. The chapter creates transparency regarding how the study has proceeded.

*Confirmability* implies that the researcher ensures that the researchers have acted in good faith and no biases within the study (William, 2006). Personal values and opinions should not affect the result and analysis. According to Shenton (2004), biases are difficult to avoid when doing a case study. It is difficult to achieve full objectivity in a study, for example, the questions are made up by the researchers, and there is always a form of bias associated with each individual (Miles & Huberman, 1994). However, the researchers have tried consistently to be as objective as possible throughout the process.

*Dependability* means that a similar result could be achieved if the research was done by other researchers at another time (Bryman & Bell, 2011; William, 2006; Florio-Ruane, 1991).

However, Florio-Ruane (1991) argues that problems lie in the fact that observations lie in connection with time and the situation. The theory behind the collaborative innovation platforms is continuously evolving. There may, therefore, be difficulties to achieve exactly similar results if conducting this study later.

## 4.5 Ethical aspects

Several factors could affect how the interviewees answer the questions. For example, Bryman & Bell (2011) argue that there is a risk that the participants experience a high degree of stress during the interviews, which could affect the result.

According to Bryman & Bell (2011), it is generally considered that the anonymity of the participants is an essential part of achieving ethically correct study. The respondent's names and title included in this study is therefore anonymous, and only identified as what actor they represent. The study includes only partial information about the participants to avoid complications of recognition (Grinyer, 2002).

## 5. Result and analysis

This chapter presents the data and findings of the study. The data presented is based on all of the conducted interviews. The findings are further divided into two parts, factors, and parameters. The factors illustrate the actors' current view on innovation, collaboration, and their value proposition. The parameters, platform governance, composition, and platform PR were derived after analyzing the actors' opinion of a collaborative innovation platform.

### 5.1 Factors and parameters

The objective of the interview design, see appendix A, was to cover the actors' current position regarding collaboration, innovation process, and main challenges; but also, what they would value of a potential collaborative innovation platform.

Table 3 below illustrates the actors' current view of collaboration, innovation, and main challenges. The purpose of retrieving data regarding these factors was that it might be an indication of their demand and need for a potential collaborative innovation platform.

<b>Factors</b>	<b>Aspects</b>	<b>Main findings</b>
Innovation	<ul style="list-style-type: none"><li>• How is it done today</li></ul>	<ul style="list-style-type: none"><li>➤ Mixed character</li><li>➤ Majority still see innovating as an in-house process</li><li>➤ Important to take external perspectives into account</li></ul>
Collaboration	(A1) - Type of collaborations with other actors (A2) - Competitors in the actor chain	<ul style="list-style-type: none"><li>➤ Mainly collaborating with the actors closest in the identified actor chain</li></ul>
Value proposition	<ul style="list-style-type: none"><li>• Main challenges of the actors</li></ul>	<ul style="list-style-type: none"><li>➤ Sustainability, recyclability &amp; Circularity are mentioned being highly relevant challenges</li></ul>

*Table 3. Factors describing current view of collaboration, innovation and main challenges.*

A set of parameters, see Table 4, was constructed based on the output of the interviews. The purpose of the parameters is to visualize the main findings of what is of importance when establishing a collaborative innovation platform in the recycled plastic industry.

Parameters	Aspects	Main findings
Platform governance	(A1) - Goals of platform (A2) - Value creation for all actors (A3) - Culture/Environment	<ul style="list-style-type: none"> <li>➤ Setting goals, with relative high level of concreteness, with the aim of solving common Industry-wide challenges</li> <li>➤ Create an inviting open environment</li> </ul>
Composition	(A1) - Competence (A2) - Scope of actors	<ul style="list-style-type: none"> <li>➤ There exist knowledge gaps between the identified actors</li> <li>➤ Important to get the right “people” from the industry</li> </ul>
Platform PR	<ul style="list-style-type: none"> <li>• Communicating the value and concept of the platform</li> </ul>	<ul style="list-style-type: none"> <li>➤ Highly important to communicate the value of being a part of the platform and how it differs from existing forums for discussion</li> </ul>

Table 4. Parameters derived from the study illustrating the opinions of a potential collaborative innovation platform.

The analysis is structured in accordance with Table 3 and Table 4 above. Data will be provided for each factor and parameter to illustrate the basis of the findings.

### 5.1.1 Innovation

To get a better understanding of the applicability of a collaborative innovation platform, the study investigated the current innovation processes used among the different actors. The majority of the participants were mostly sticking solely to internal driven innovation. However, several actors highlighted that they are starting to see the importance of also using external sources for innovation, especially as a complement of today’s innovation process.

Actor (6), a producer, says *“Traditionally, innovation has been an inhouse process, but we are currently trying to become better and using external options. We have initiated a cooperation with Norrskan to find new solutions, for example, food packaging”*. Actor (2), plastic manufacturer, say *“I see a higher demand for that kind of innovation, but we are relatively bad at it .... Open innovation will be needed in the future”*, and adds, *“It never happens that someone approaches us and ask how we together can develop a totally new product”*. The same plastic manufacturer argues that the current innovation process is a result of strict management from owners *“We work less with R&D than what we want, our owners are strictly*

*communicating that they want to secure the demand from a certain customer before investing in R&D*". Another producer, Actor (5), adds *"We are very customer-driven, collecting customer insights, spotting trends and demand, and develop our packaging from there"*. Actor (4) is more negative about the concept and argues that *"We have tried open innovation ideas, but I don't know if that has been of much value. The ideas are more or less crazy and unrealistic. Then it is better to work closely with suppliers because it is a more realistic collaboration and not so much focus on design"*. The waste collectors are service companies and don't work with innovation to any greater extent.

However, some of the actors use external sources in their innovation process. Actor (5), who described their innovation process was customer-driven, explains a process innovation done with a plastic manufacturer *"We work closely with our suppliers, one time we realized that we could make our logistics more efficient by inflating the plastic packaging first when it arrived at our facility"*. Actor (10), a recycling actor, argues that their innovation process uses both external and internal sources and adds *"I believe that we have developed innovations with other companies, but I can't come up with an example right now. However, if it is possible, we often purchase the company that we are collaborating with"*. Actors (10) also describes their internal innovation process in further detail *"We have an internal, but still independent, innovation company which is not under the same profit requirements as other departments but rather an innovation unit. When the innovation unit has developed a fully functioning innovation, it is rolled out within the parent company"*. Actor (9), a similar actor as Actor (10), describes how they work with innovation externally both through joint ventures, research and other projects *"We get our ideas from both internal and external sources and related to plastics it is quite a lot originating from research. We have currently a joint venture, a plastic recycling facility, and have been doing several projects with FMCG companies wanting to produce their product of recycled material"*. Actor (3), a large manufacturer, described how they were a part of several different collaboration regarding innovations *"We are a part of some innovative projects to influence and others to learn"*, and adds, *"regarding the plastic in our packaging, we work closely with a Brazilian supplier to replace the virgin material with renewable plastic"*. Actor (3) emphasize that some challenges need cooperation beyond the boundaries of the company *"A reflection is that open innovation has increased over the last couple of years and some questions need collaboration, that is the way forward."*

### 5.1.2 Collaboration among the actors

To get a better overview of the current market situation, today's collaborations within the identified actor chain have been studied. During the data collection, it was discovered that there are multiple collaborations among the actors within the recycled plastic industry to achieve a higher degree of a circular economy. The type of collaboration will be treated as the first aspect (A1), and the second aspect will be competitors within the actor chain (A2).

Starting with the first aspect (A1) type of collaboration. In the actor chain, collaborations existed primary with actors closest to them. For example, all producers, actor (3), actor (4), actor (5) and actor (6) describe their relationship with the waste collector as a long-term collaboration. Actor (6) explains *“We have ongoing contact with the waste collector to get their view on recycling and reuse, to be able to further develop our processes and products in a better way.”* Actor (5) further explains *“We have a contact person at the waste collector company who has continuous contact with us, with whom we have several meetings during the year and also continuous telephone reconciliations.”* Actor (8), a waste collector, explains their view of the collaboration with producers *“there are significant benefits from this collaboration to achieve our goals of recycling and reuse in the long term”*. Actor (5) further explains that this collaboration makes it possible to get a greater understanding of how to deal with recycling and reusability. Actor (5) further explains *“We also collaborate with the return system, i.e. the deposit system. We are currently in a research project where we are looking at how to develop the deposit system with other companies”*. Actor (4) is arguing, that the collaboration with the collector was damaged when discovering they were misled a couple of years ago *“The collector communicated that 80% of the packaging was recycled to us, but in fact, it was only 40% and the rest went to incineration”*. Actor (4) explains further *“We work hard to continuously come up with new more sustainable packaging. For example, we have to buy brand new machines when we develop new processes, which is extremely expensive. And it is very disappointing finding out that the material goes to incineration either way”*. Actor (4) is further explaining *“However, this collaboration has developed and is, as I said, much better today”*. Actor (8) describes the collaboration with producers as a transparent and strategic collaboration *“The collaborations with the producers/material companies are of natural characteristic; they order the collection function of us. We have developed a plastic guide to educate producers/manufacturers about how to design a recyclable packaging. We also offer contact persons for answering questions”*. Actor (12), a recycling actor, further explain *“We have*

*continuous meetings with both producers and the collector, where we are discussing the packaging manual, and helping them design recyclable packaging”.*

Other actors are arguing that they are currently involved in more comprehensive collaborations with all actors in the value chain, for example, actor (6) *“We have a collaboration with RISE that deals with on the go packaging. We are together with the entire chain trying to figure out a more sustainable solution for the on the go packaging”.*

Continuing on (A2) Competitors in the actor chain. During the interviews, all actors were asked about competitors within the identified actor chain. Actor (2), a plastic manufacturer, *“Almost none cooperation with competitors. In other companies within the Company’s group, cans and bottles are manufactured. So, in that perspective, we work with competitors to our sister companies.”* Actor (1) says *“We do not cooperate with the chain, but we have a long history of working with a circular economy mindset early on. One of the first companies in Europe that started recycling plastic from its customers.”*. A producer, actor (5), explains that they do not have collaborations with competitors, but they can collaborate indirectly with competitors. Actor (5) argue *“We actually do some, in the form of various research projects. Then we may choose producers that are not direct competitors. Let's say we should develop packaging for ketchup, then maybe we can collaborate with a company that delivers mayonnaise”.*

### 5.1.3 Value proposition

The parameter value proposition was derived after noticing that almost all actors were referring to sustainability, recycling or circularity as their main challenges.

Actor (3) and actor (2), two plastic manufacturers, both highlight the importance of recycling, actor (3) argue *“Our current focus is Circular Economy, recycling and recyclability. These are the single largest areas in the upcoming years”*. Actor (2) describes their increased focus on sustainability due to high customer demand on recycled packaging *“A lot of our customers (producers) want recycled resources. There is a high demand for recycled material but lower supply, and the existing recycled material on the market doesn’t meet our requirements”*. Actor (12) explains *“In a circulating economy one of the most import factors is that the recycling is working.”*



Continuing to producers, actor (5), actor (4) and actor (6) agree on sustainability regarding the packaging has become central. Actor (5) explains how there has been a shift in focus toward sustainability in the area of packaging *“Right now, sustainability is the most important thing when it comes to packaging, especially the recycling part and/or being of renewable resources. In the past, it may have been application and price but no longer”*. Actor (6) highlights the importance of having a packaging which leaves as little climate footprint as possible and argues that there is a knowledge gap in the discussion of plastics *“All plastic ending up in nature is, of course, bad. Therefore, it requires that we ensure it doesn’t end up there. However, plastic is rather good at preserving fresh food and beneficial from a logistic perspective. The benefits are often difficult to communicate because people have already made up their minds”*. Actor (12) confirms and argues that the power from consumers’ forces producers to design packaging that is worse for the climate *“New packaging is emerging in the market, such as a mix of paper and plastic. This is because the consumer is told that plastic packaging is bad and ends up in the sea. Less than 1% of plastic packaging in Sweden ends up in nature. The consequence is that the packaging put on the market is not recyclable at all because it is a mix of material.”*

Actor (7) and actor (8), both waste collectors, are trying to increase the share of plastic material going to recycling and therefore decreasing the percentage going to energy recovery. The sorting and recovery actors, actor (9) and actor (10), are both arguing about the importance of creating a circularity connected to plastic. Actor (9) *“Plastic is right now a challenge and will still be one of the big questions onwards. Plastic is going to become the first Circular economy and therefore an incredible focus”*. Actor (10) argue that their main challenge is related to regulations enabling circularity *“Our biggest challenges are that the laws and regulations are still constructed to a linear economy. A transition must be made so that there are incitements, principals, and laws enabling Circular Economy”*. Other challenges are; products have to be designed for recycling; demand is ensured on the recycled product; adjusting their business model to a Circular Economy.

#### 5.1.4 Platform governance

Platform governance was something profoundly important for the actors taking part in the study and actor (3) explicitly points out the importance of clear governance structure when it comes to open innovation. The platform governance parameter has been further sub-categorized into

three aspects; (A1) Type of goals/challenges constructed on the platform, (A2) Creating value for all actors and (A3) Culture/environment.

Starting with the first aspect of Platform governance, (A1) What type of goals/challenges should be constructed on the platform, actor (1), a plastics manufacturer, emphasize the importance of working together and agreeing on concrete goals gaining the whole industry *“Sharing knowledge is good if it beneficial for all parties but only knowledge sharing is not enough. What is important with this kind of platform is that the different actors agree on common challenges that would benefit the whole industry”* and adds *“If the platform builds on a couple of actors sharing information, then you don’t send your experts”*. Actor (11) argue *“I think it is really interesting to be a part of something like this and I see the value of being apart. But I believe it is important to have an agenda if I want to be a part of a platform.”*

Actor (5), a producer, draws a parallel to the goals set by *The Swedish Food Retailers Federation*, of all plastic packaging being of renewable or recycled material by 2030 *“The main challenge for the platform is that it doesn’t evolve into a comprehensive forum for discussion. You have to go down into a certain depth, and I perceive the plastic packaging goals of The Swedish Food Retailers Federation 2030, is something that all actors agree upon because you do not want to be backward striving. However, no one knows how to accomplish it. It is a very ambitious and challenging goal, and it is right, but we do not know how to do it”*. Actor (5) adds *“When setting the goals of the platform, you have to look deeper and understand what the different companies need”*.

Actor (8), a waste collector, indirectly agrees with the others that the goals have to be of industry-wide characteristics *“If I am faced with a problem, Why don’t I go to a platform instead of solving it on my own?”* and adds *“If a producer of potato chips is sitting down figuring out how the packaging should look like, there is the node, we other actors are only sub-stakeholders”*.

Moving over to the second aspect of Platform governance, (A2) Creating value for all actors, a plastics manufacturer, actor (2), argues that one of the main challenges is to get people realizing there is a value of the platform and taking time contributing. Actor (9) explains they are a part of a similar platform, but it seems to be more effort put in than value coming out *“We are a part of a forum, similar to yours, where projects are created out of relevant topics. We*

*take part in it as much as possible, but it requires much time. It takes time from my day-to-day work*". Actor (12) highlights that there is a value of communicating with other actors. Still, there always is a conflict of interests that might not be visible at first *"There are challenges in all kinds of forums since each actor has their interests"*.

Furthermore, actor (2) argues there must be fair value situations for all actors engaging in the platform *"It has to be a win-win situation for everyone, so there aren't some people running their own show that only favors them"*. Actor (5) agrees that this is highly important *"It must be clear that being on the platform creates value for all participants"*. Actor (8) adding that one of the most critical factors of a platform is an actual payoff for the individual actor and platform governance in achieving that *"One important factor is a concrete payoff. What are the benefits in three years from now? When it comes to speculative goals; sub-goals, requirements, and expectations should be put up"*.

Finally, the last aspect of Platform governance (A3) Culture/environment. The environment is highly important when establishing a collaborative innovation platform. Actor (5) describes it as *"I believe another factor that is important for a successful platform is to establish an open environment which invites collaboration among the actors"*. Another producer, actor (3) adds *"When working with open innovation communication is key"*. Actor (2), a plastics manufacturer, argues that the people joining the platform and their attitude are critical *"People have to go in with an open heart and be open for collaboration"*.

### 5.1.5 Composition

What kind of actors and competencies, that should be present on the platform, are represented in the composition parameter. The composition parameter has been further divided into two sub-aspects; (A1) Competence and (A2) Scope of actors.

Actor (2) argues that there is of high importance to get the right competence into the platform and especially people from the business side of the industry, *"I have taken part in standardizing committees, and if there is a low representation from industry and high representation from various interest organizations, then the standard will be set in a manner that is not practically implementable"*.

Continuing on (A2) scope of actors, there is important to have actors from the whole chain. Actor (2) explains from experience *“Neither of the actors from the chain knows the conditions for the other entirely. Therefore, it takes a long time. We had a supplier of recycled material, granulates, that supplier didn't understand why we couldn't have such significant variation in the quality of the plastic. Perhaps that variation in quality would have been acceptable if you were producing a garbage bin, but if you have an intake hole of 8/10 of 1 mm then you cannot have grains of grit mixed in the plastic. This type of question becomes “aha-experiences”, there is much expertise in the whole chain and therefore need of multifunctional teams”*.

Actor (5) explains that there is a need for an actor-chain perspective for particular challenges since there is a rapid technological change in each actor's area of business/operation *“Some questions cannot be solved individually. A lot is happening on the technical side of the packaging, but also the sorting and recycling part. Therefore, a chain-perspective is somehow required to solve it”*. Actor (5) adds that these questions require a broad coalition and doesn't see any issues of collaborating with competitors in the traditional view *“I think it requires a broad agreement. Several manufacturers and several packaging suppliers etc. Large established along the entire chain”*. Actor (6) agrees *“I certainly believe in collaboration over the actor chain”* but also imply that these are not friction-free *“However, these kinds of collaborations require time and effort, it largely depends on the design of the collaboration”*.

#### 5.1.6 Platform PR

The parameter of platform PR was derived after noticing that there existed a need from the participants of relating and comparing the concept of a collaborative innovation platform to something that existed today. At first, we were often met with the reply *“There already exist several of these platforms”*, even if this comparison was not 100% accurate. In addition to this, there are a lot of forums and organizations working with sustainability issues. Therefore, there is a need to articulate the difference and value of being a part of a collaborative innovation platform.

Actor (3), actor (4), actor (6), actor (8), actor (9) and actor (10) implied either that they had been a part of, or that there already exist, this kind of platform. Actor (4) was slightly negative to the concept *“My personal thought is that it wouldn't lead to anything. I believe it's better to work directly with researchers since they possess deeper knowledge”*. Actor (10) argues that

this is how it is done today and refer to the producer responsibility *“This is how it’s done today on the plastic packaging market. Since there is a producer responsibility for plastic packaging, there is no value for us to be on such a platform”*. Actor (3), actor (6), actor (8) and actor (9) believe there already exist these kinds of platforms but see however the potential, actor (3) *“I believe these kinds of platforms for waste flows already exist. However, we are very keen on being part of them”*, Actor (6) *“It would be beneficial to have collaboration along the chain of actors, but it sounds kind of similar to a potential RISE project where all actors are present”*, Actor (8) *“There are so many initiatives of various kind, a couple are coming from RISE. But yes, we want to be a part of something like that but only in one not in 30 different”*, and Actor (9) *“Återvinningsindustrierna have this kind of forum, we are trying to be a part of it as much as possible, but it takes a lot of time”*.

Actor (2) and (5) both see the value of being part of a collaborative innovation platform and actor (5) argues that it doesn’t exist today *“If such a platform would exist, I believe most certainly it would be of interest”*. Actor (1) is very positive to the concept *“There is no unmitigated platform today. The owners of Svensk Plaståtervinning are representants from both producers and plastic manufacturers. There is a lot of competence there. However, there are no joint projects instead, everyone works on their own”*. Actor (1) sees RISE as a potential participant on the platform and has a slightly negative viewpoint on RISE’s projects *“The platform could be done together with RISE or Naturvårdsverket since they got a lot of money. But there is not anyone who has pulled together these kinds of projects before. However, RISE and the universities are good at launching projects and investigating new things but also things that have been investigated two times before. But these projects are very slow, and rarely it results in anything practical, most often in theories and the statement”*.

Even though 50% of the interviewed actors’ first reaction was that there already existed these kinds of platforms the majority were optimistic to the concept when described in further detail.

## 6. Discussion

### 6.1 The actors view of a collaborative innovation platform

In several of the interviews, the actors pointed out that it exists platforms like this in the market. However, the various actors are explaining the platform, but their arguments do not fully reflect our picture of a collaboration innovative platform. Some respondents are arguing that these kinds of collaborations already exist covering some parts of the actor chain, for example, some producer believes that it is enough collaborating with a waste collector, which helps them design a recyclable packaging. Others say that the collaborations with *RISE*, *Återvinningsindustrierna* and *Norrskén* are similar concepts to the platform. For example, there is a comprehensive collaboration, covering several of the identified actors, for “on the go” packaging. Other actors say that they would rather focus on collaborating with researchers since they have in-depth knowledge in specific fields, which corresponds to Tekic and Willoughby’s (2017) findings on using researchers for co-creation purposes. The concept of collaborative innovation platforms might be new to some of the actors and, therefore, there is a potential risk of misunderstanding. As seen in the analysis, half of the respondents’ first reaction is that these platforms already exist, even if this is not the case. The actors, may, therefore, not considerate a collaborative innovation platform of being a way for developing innovations and creating standards. It would be easier for the actors to grasp the concept of collaborative innovation platforms if there existed more practical cases of platforms. Collaborative innovation platforms, or intermediaries, can be valuable assets for the innovation process, especially concerning challenges demanding collective action (Agogué et al., 2013). By using external competence as a complement to internal, broader expertise can be acquired, which is the fundamentals behind open innovation (Chesbrough et al., 2006).

The interviewed actors argue that if they were going to participate on the platform, each actor must see the concrete payoff to be a part and contribute on the platform in the early stage of the innovation process. This corresponds to Kohn Rådberg et al. (2017) studies on science parks, which emphasize the problematic of actors wanting to measure the performance and value of participating according to traditional quantitative measures. Yström et al. (2018) believe that it is crucial not going to “solution thinking” in an early stage of the innovation process because it can prevent important ideas. Yström et al. (2018) think that in an initial phase when you meet the other people, it is vital that you are explorative and share their “crazy

ideas” to exchange opinions with each other. Setting a concrete goal for the platform might be a risk of going to solution thinking too early. However, to make a viable platform on the plastic recycling industry, the platform mustn’t get associated with being another forum for discussion. Thus, in the creation of the platform, concrete goals are essential. However, there is a risk of missing out alternative solutions created during the exploratory phase.

The interviewees also believe that the “right” actors should be present on the platform. For example, one actor cannot contribute with all knowledge; instead, all actors need to contribute. The actors believe that the actors, who are invited, are wisely chosen. Otherwise there is a risk that not all actors can contribute with their ideas and thoughts.

## 6.2 The foundations for a collaborative innovation platform

### 6.2.1 Industry conditions

As Herzog (2008) points out, an industry that suffers from industry convergence forces companies to look beyond the boundaries of the company to stay competitive. The recycled plastic industry is suffering from industry convergence due to converging value propositions. Throughout the conducted interviews, with actors representing the whole chain of the Swedish plastic recycling industry, sustainability goals were brought up as one of their main challenges, especially toward the issue of plastic. Bogers et al. (2018) refer to factors such as the Sustainable Development Goals potentially driving the development of open innovation. Higher requirements regarding sustainability force the actors to adapt their businesses. The requirements come from both regulations and increased awareness among the society. Therefore, the value proposition converges around sustainability. To achieve sustainability, more extensive collaboration among the actors would be beneficial, which speaks for using an intermediary (Agogu  et al., 2013).

Furthermore, Agogu  et al. (2013) argue that intermediaries are beneficial for problems requiring extensive knowledge and several actors. Agogu  et al. (2013) explicitly mentioning that difficulties, with high societal demand, often require extensive collaboration among several actors and argue for creating a platform to both establish and manage the collaboration. The issue of plastic packaging pollution has during recent years boiled up to a global problem. *The European Commission* has established several sustainability goals related to the design and recycling of plastic packaging. Furthermore, the Swedish interbranch organization *The Swedish*

*Food Retailers Federation*, has set even stricter sustainability goals. The increased awareness in society regarding the unsustainable handling of plastic is palpable and make up one of the most current and critical challenges for the companies within the industry. This study indicates there exist an interest for a collaborative innovation platform. Additional research should be carried out to investigate if this is true for most industries affected by sustainability goals.

The plastic recycling industry is relatively new. Most of the identified actors have been active for a long time, but recycling has not been their primary focus. According to Yström et al. (2018), there are benefits of using collaborative innovation, especially on new markets, since established markets often suffer from established players wanting to develop projects individually. The result of the study regarding how the actors resonate around innovation is of a mixed character. The majority still rely mainly on innovating in-house; however, they still exploit knowledge generated outside the boundaries of the company. There are diverse opinions on whether open innovation is a necessity for the future or just something that consumes time. However, the study showed that recently, more and more actors are actively looking for external collaboration related to the innovation process through research, external projects, knowledge exchange, start-ups, and joint ventures. As stated by Lee et al. (2010), open innovation concerning the R&D process is more common among larger actors; which also this study indicates where larger firms are exploiting external knowledge in the form of collaborations with suppliers and participating in forums. However, other established players prefer keeping the innovation in-house, one actor had even developed their innovation unit within the parent company.

Nowadays, the actors primary have collaboration with the actors closest to them in the actor chain. Some actors also point out that they have collaborations extending even further. The collaborations make it possible to increase the know-how and streamlining process among the different actors. Previous studies are showing that cross border collaboration can bring different kinds of skills in different areas (Oxley & Sampson, 2004; Granstrand et al., 1997; Das & Teng 2000). Yström et al. (2018) argue that if the different actors are used to collaborate, it is easier for collaborative innovation to work when showing the benefits of it. If there is a habit of collaborating, there is also an ability to be more open to new ideas (Yström et al., 2018).



### 6.2.2 Guidelines for platform

Previous studies on collaborative innovation platforms have a tendency focusing on the managerial challenges and importance of platform governance (Kohn Rådberg et al., 2017; Ollila et al., 2011). Platform governance, also in this study, showed to be highly relevant among the interviewed actors. Setting the goals of the platform seemed to be essential for the actors positive to the platform; agreeing on common, industry-wide, challenges generating value for all participants on the platform. Actor (1), actor (5) and actor (8) are all arguing for a relative high-level concreteness regarding the goals to avoid the platform turning into a forum for discussion.

There is confirmation with Ollila et al. (2011) studies on collaborative innovation platforms, for example, the goals of the platform should not be too similar to the company's own goals. Agreeing on common goals is also crucial for achieving collaborative innovation (Fayard, & Metiu, 2014). To what extent the innovations coming from the platform will generate value for all participants cannot be predetermined, as Bogers et al. (2018) argue, there is uncertainty connected to innovation policy and the impact of innovations can differ for different organizations.

Another important factor related to platform governance is creating an inviting open environment on the platform. Supporting open culture is also confirmed by Ollila et al. (2011) to hinder actors behaving opportunistically, which was one of the main managerial challenges they identified.

When attracting competence to the platform, getting people from the industry and the experts from the different companies is essential. Actor (1) argues that if it is only a place for sharing knowledge, the companies will not send their experts. The individual actors possess great expertise, and rapid technological development takes place in their operations. However, between the actors, there exist significant knowledge gaps, which affect the overall recyclability of plastics. Some challenges, therefore, need collaboration beyond the boundaries of the individual companies. For example, the design of the packaging is most utter important for the material to have the prerequisites of being able to become a new recycled product. If the design is inadequate for the technical capabilities of the sorting facility, it will end up at the energy recovery actor. Or if the input material to the recycling actor has a high variation in

quality, then it becomes impossible for a plastic manufacturer to manufacture specific plastic components. Parallels can be drawn to Agogu   et al. (2013) findings on when intermediaries can be beneficial; Implementing a circular mindset on the plastic industry implies a new way of looking at a problem and require several actors to find a solution.

### 6.2.3 Challenges

Apart from attracting the right actors, goal construction, developing and maintaining a favorable environment; there are additional challenges to make a successful collaborative innovation platform.

The main challenge will be communicating and marketing the collaborative innovation platform. About 50% of the participants' first response when pitching the concept was similar to "These platforms already exist". However, 75% of the actors were still emphasizing the importance of collaborating with the whole actor chain concerning particular challenges, and a majority were favorable to the concept after explaining it in further detail. As mentioned before, the study shows that actors want goals that create value for all the participants on the platform. If the platform fails to communicate the benefit of being on the platform, how it differs from existing forums and the goals of the platform, it will not reach its full potential. Companies will behave opportunistically, down prioritize the platform and refrain from sending their most competent people.

Furthermore, during the interview process, it was discovered that a prior lack of transparency had affected the collaboration between actors within the plastic recycling industry. The collector had lied about the percentage that was recycled. Both Fawcett et al. (2012) and Ystr  m et al. (2018) argue that the past and shared history affect a relationship. It is emphasized by Ystr  m et al. (2018) to achieve collaborative innovation, it is crucial to go through the co-directing, co-developing and co-deploying phase. During the data collection, this study slightly touched upon the co-directing and the co-developing phase of their model. To further develop this study into a practical collaborative innovation platform, the model introduced by Ystr  m et al. (2018), could be a useful tool.

## 6.3 Contribution

The study also contributes to the literature with a couple of critical parameters that the actors' value for a potential platform. Some parameters are mentioned by prior studies, while some are new. Ollila et al. (2011) argue the importance of communicating the goals of the platform and that the goals mustn't be too similar to the goals of the individual actors. This study also showed the importance of setting goals. However, a high level of concreteness and creating value for all participating actors were the most vital aspects. The value of creating an open environment is mentioned by both this study and several prior studies (Ollila et al., 2011; Yström et al., 2018; Dyckmans & Rooney, 2015). The actors on the platform should be wisely chosen. However, it is subjective who the "right" actors are and depend on the goals of the platform. Further research has to be done in order to increase generalizability. The value of being a part of the platform should be communicated clearly. If this only applies to the plastic recycling industry, since it is already flooded with discussion forums, or if it applies for most collaborative innovation platforms is hard to predict from this study.

Additionally, the study gives a first indication that a collaborative innovation platform seems applicable in the plastic recycling industry. The plastic recycling industry is characterized by knowledge-gaps, common challenges, and converging value propositions among the different actors. These aspects emphasize the applicability for a collaborative innovation platform (Agogué et al., 2013; Herzog, 2008). There also seems to exist an interest for the platform since a majority were favorable to the concept when described in detail.

## 7. Conclusion

Open innovation has been a hot topic in both academia and business ever since Chesbrough introduced the concept at the beginning of this century. The concept has evolved in different directions, and one sidetrack is the concept of intermediaries and collaborative innovation platforms. The purpose of this master thesis was to investigate different parameters that are critical when establishing a collaborative innovation platform in the plastic recycling industry. To answer the research question, the dynamics of the industry were studied, and interviews conducted with representatives from the entire value chain.

The first step was to map the relevant actors within the selected industry and then pursue interviews from representatives from all relevant actors. This study contributes to an understanding of whether a collaborative innovation platform would be suitable within the field, by analyzing the perspectives from different actors. Additionally, the interviews covered the actors' current view on innovation, existing collaborations and main challenges.

Based on prior research and the dynamics of the industry, a collaborative innovation platform seems applicable to the plastic recycling industry. The increased awareness regarding the unsustainable handling of plastic waste has put pressure on all actors within the plastic recycling industry. Their value proposition seems to have converged towards sustainability, recycling, and circularity. Creating a circularity for plastics require extensive collaboration among a broad set of actors. A converging industry and a desire for increased cooperation support the argument of using a collaborative innovation platform.

Due to the increased awareness around sustainability endless number of forums and interbranch organizations have popped up. It is a struggle knowing which to join and quantify the value of attending. Companies refer to abstract discussions and low level of concreteness. However, as far as our knowledge goes, there is no unmitigated collaborative innovation platform today representing the whole chain of actors within the plastic recycling industry. The study shows that there is an interest for a collaborative innovation platform. Since the actors are currently being overwhelmed by sustainability forums, goal construction is of great importance. It should be set, to the greatest extent possible, in a manner that creates value for all participants on the platform and with a relatively high level of concreteness.

The study contributes with parameters critical for establishing a collaborative innovation platform; communicating the benefits of being a part of the platform (platform PR), choosing the participants wisely (composition) and setting goals with a high level of concreteness (platform governance). Additionally, this thesis addresses an industry not yet covered within the field of a collaborative innovation platform. Finally, the study concludes that there exists interest, and there are several factors speaking for a collaborative innovation platform in the plastic recycling industry.

Lastly, there is limited generalizability regarding the findings of the case study, since it is based on twelve interviews. There is a lack of prior research supporting the importance of the parameters “composition” and “platform PR” in the field of collaborative innovation platforms. Also, it is subjective which the “right” actors might be and depend heavily on the goals of the platform. If it is crucial communicating the value of being a part of the platform, for collaborative innovation platforms in general or mostly for the plastic recycling industry is hard to predict based on this study.

## 8. Limitation and future research

This master thesis is a case study about critical parameters if establishing a collaborative innovation platform in the plastic recycling industry. During the study, it was found that there is an interest and a collaborative innovation platform seems applicable in the plastic recycling industry. Furthermore, research about how to practically establish a platform has not been covered in this thesis. A set of actors was identified that enables the recycling of plastic packaging, called the actor chain. Companies constituting these actors were then interviewed. The thesis builds on theory on open innovation, collaborative innovation, and collaborative innovation platform. However, it would have been exciting and advantageous to analyze other collaborative innovation platforms on a practical level, to increase the understanding of the management process and organizational culture.

Furthermore, the study doesn't go into further depth concerning how the platform can be developed on a practical level. Therefore, it would be interesting to analyze how to establish a platform and, for example, see how workshops, forums, and meetings would be set up. Also, it would be relevant to analyze the ownership structure of the platform. It would be interesting widening the scope of the study and look into a broader range of plastic products, not only packaging. This study has focused on the Swedish market, and it would be interesting to investigate how companies on a global level are tackling the issue of recyclability and their view of a potential collaborative innovation platform.

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# Appendix

## Appendix A is showing the interview guide for the different actors

### General questions

- What is your current position?
- For how long have you had that position?
- What are your biggest challenges?
  - And why?

### Collaboration

- What kind of collaborations do you have with the actors in the identified chain?
  - How would you describe the nature of these collaborations?
  - What kind of factors are you valuing in these collaborations?
- Do you have collaborations with competitors?
  - Can you give an example?
    - What are the main reasons for these collaborations?
    - Have they developed during the process?
    - How would you describe the nature of these collaborations?
    - How was the collaboration initiated?
      - What is the purpose of the collaboration (Project? knowledge sharing?)

### Innovation

- How do you work with innovation nowadays?
  - How do you develop your ideas?
  - How does the process work, from idea into products or services?
  - What kind of factors are you valuing when doing innovation?
- Do you work with open innovation?
  - Give examples
- Are there any competitors in the identified chain?
  - If competition:

- Do you think it is beneficial to collaborate, despite the competition?
- If, no competition:
  - Do you believe there are areas where collaboration would be beneficial?

#### Collaborative innovation & Collaborative Innovation platform

- If it would exist a collaborative innovation platform where different actors within the recycling industry are working together to find solutions, for example for plastic food packaging. Would you be interested to be a part of that?
- What do you think are important to think about when developing a Collaborative Innovation Platform?
- What are your expectations?
  - The advantages and disadvantages to be a part of the platform?
- What kind of actors would you think are interesting to have on this platform?
- To what degree can you collaborate at the platform?
- Can you see some other potential challenges, within the industry, where it would be beneficial to collaborate through a collaborative innovation platform?

#### First question again

- What are your biggest challenges?