DATA SHARING FOR A CIRCULAR ECONOMY

A project for plastic's traceability in the automotive supply chain

Author

Lucia Tramutola

Master thesis

MSc. Strategic Product Design
Faculty of Industrial Design Engineering
Delft University of Technology

Graduation committee

Chair | Mr. Jacky Bourgeois
Faculty of Industrial Design - Design Engineering, Internet of Things

Mentor | Dr. Ella Jamsin
Faculty of Industrial Design - Design Engineering, Design for Sustainability

Coaches | Mesbah Sabur & Jordi de Vos
Circularise - founders

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Acknowledgements

I would like to take these very first lines to pay the due respect to all the people that helped me getting all the way to completing my master studies. As I like being objective, I will proceed to do so in a strict chronological order.

Hence, I have to start by thanking my parents, without whom I would, first of all, not exist. Other than for bringing me to life, however, I need to thank my parents for shaping me into the person I am today and for encouraging me to pursue my dreams, ambitions and desires, provided that I stayed in the boundaries set by the law while doing so. I will not further elaborate on the legality of all my actions, but overall, I guess you can both be proud of me.

Next, thank you Cecilia, for having been there my whole life. Not that you had a choice, of course, since you were there first. Anyway, you've always been, and always will be, the best sister I've ever head. I swear this has nothing to do with the fact that you are the only sister I have. Your pep talks kept me going through life and through my studies, while your infinite patience made sure I could turn to you whenever I had something to complain about.

Let's skip a few years and jump to high school. The quality of education I received during those five years still makes me beam at the thought of it, so I want to thank the wonderful professors I met there. You taught me all about hard work, collaboration and how fun learning can be.

In the same building, over the same span of time, I also met two more people I would like to thank. My best friends, my brothers, you were the ones to grow up with me and show me that changing opinions can be a sign of maturity and a running joke at the same time. I might, or might not, be talking about barbarian languages and lasagne for breakfast.

During my two years of bachelor in Turin and my last year in Erasmus in Stockholm I also had the privilege to be surrounded by great people. Shout out to all my friends there, who showed me the wonders of group work, photoshoots, diverse cultures, international dinners and reunions. You were the best companions I could ask for during such formative years.

Finally, I made it to my master! I would like to thank all the friends I made along these two years, for supporting me, helping me, guiding me and scolding me when necessary. You made my master so much more enriching than I can possibly express in words. Among all the wonderful people who were by my side for two years, I want to thank the amazing girls I have been having lunch with for almost the whole master and two amazing people who could only stay in Delft for one semester, but still taught me so much about long-distance friendships and long-term thinking.

Closing in on what's directly related to this project, I want to thank my supervising team, Ella, Jacky, Mesbah and Jordi, together with all the other people at Circularise, who guided me through the process and always had suggestions for improvements.
Last but not least, I owe it all to the two people in my "core graduation-support-system", who were both there for the highs and the lows of my journey.
The biggest and most heartfelt thank you then goes to my desk mate and future house mate, whose pep talks match my sister's in quality, but have a little more chili to them.
Dulcis in fundo, my last thank you goes to my better half. I hope you don't mind I put it down in words.

I hope you will all enjoy reading this graduation project, knowing you contributed to it so much.

Executive summary

The relevance of circular economy, in these days where the environmental impact and toll of humans' activities is undeniable, grows steadily. Circular economy, founded on three basic principles, advocates for all materials to be kept in use for as long as possible. This takes a concrete shape, for example, in the importance of recycling materials.
However, recycling materials can be a trickier business than one might think. Nowadays materials are so complex and specialized, that recycling them properly requires precise knowledge of their composition and content. In a way, then, it can be argued that the exchange of this knowledge, from material manufacturers to recyclers, is a core enabler of circular economy. As information exchanges happen mostly digital, data becomes then the key asset in this depicted scenario.

Data exchanges are as well not an easy feat. Looking only at a business to business market, several obstacles refrain companies from sharing data more liberally. For once, openly sharing data exposes companies to threats from competitors and losses in their negotiating power. Circularise, the start-up this project has been developed for, has come up with a technical solution for a data exchange system that relies on a distributed ledger. Thanks to their technological protocol, circularise can enable secure collaboration between material manufacturers and the rest of the supply chain, all the way to recyclers.

Despite the technological feasibility of the protocol, Circularise is struggling with finding clients. Currently the start-up has developed a value proposition that caters mainly towards material manufacturers and, as a consequence, material manufacturers are the only paying customer segment for them. In order for the protocol to have an effective impact and benefit on circular economy activities, expanding the client range is necessary for Circularise. This can be accomplished by expanding the start-up's business model portfolio, so to speak. This means running two different business models at the same time, one being the existing one, catering to material manufacturers, and another one ensuring that a new customer segment receives an offer worth paying for.

This is the opportunity this project is built around. In the course of this graduation project a digital platform has being design and is explained in this report, together with a new business model for Circularise to cater to automotive OEMs with a tailored offer.

Table of contents

Reading guide

Before getting to the report, here are a few lines on the graphic design choices made to assist the reader through the reading.

Text in plain black, as the one you are reading righ now is the standard font size and style. This includes most of the report's text.

However, some words here and there wil be in bold. Words and sentences in **bold** highlight **important content** or **summing up text**. Just like in the previous sentence.

Once a wise professor told me *"Do not forget to put all quotes in italics"*. I still remember, so in this report as well, quotes will be in italics.

Last, but not least, text in a red box, similar to the one you see contouring this page, highlights conclusions and key learnings.

Oh, and let's not forget that...

THIS IS A TEXTBOX
With its title

Texboxes contain information readers might not be familiar with. If that's your case, go ahead and read them, otherwise feel free to jump ahead.

Introduction

Circularise is a start-up, based in Den Haag, that has developed a protocol for **tracking materials along the supply chain**. Tracking materials all the way through the supply chain aims to ensure a proper **recycling** and **end of life treatment**, as the following chapter will explain in more detail. This project aims at helping Circularise in adapting the use of their smart protocol for materials tracking to plastics. A specific field of investigation was chosen together with Circularise: the automotive industry.

The automotive industry is an interesting one because the presence of **plastics in cars** has been regularly increasing in the past years. Nowadays in fact, plastics in cars make up to **12-15%** of the vehicle's weight (Hagn, 2015). This tendency is motivated by the advantages plastic materials bring when it comes to weight reduction (see Textbox 1).

Deliverables of the project, presented at the end of this report, are the design of a **new business model** for Circularise in the plastics for automotive field and a **digital platform**. The proposed business model will help Circularise in targeting the automotive companies with a tailored value proposition. Said value proposition is materialized in the aforementioned digital platform.

TEXTBOX 1
Lightweight design

Lightweight design is a common means of reducing a passenger car's fuel consumption.
In fact approximately one third of the engine's total fuel consumption directly depends on the vehicle's weight (Koffler, 2010).
Most promising strategies for weight reduction go through an enhanced use of composites materials, such as fiber-reinforced polymers (Das, 2001).
This might ultimately result in a higher percentage of plastics used in cars.

Report structure

This report is structured in six chapters, each with its own focus.

Chapter **1_** Explains the project's overall **process**. First, the different activities conducted in the analysis phase are introduced. Attention is given to how they feed into each other. An overview of the several tools used is then included. Lastly, the design iterations are presented as the way the new value proposition was designed.

Chapter **2_** Will explain **Circularise's context**, the technology they use and how their activities benefit circular economy. It will also present Circularise's current business model as it is being implemented in their only running project and explain the expansion plans that motivate this graduation project.

Chapter **3_** Verifies the **potential of the automotive industry** for Circularise, on the basis of three key assumptions underlying Circularise's business.

Chapter **4_** Gives a complete overview of the analysis phase conducted in order to identify a **key customer segment** as target for the business model.

Chapter **5_** Presents the final **deliverables**, starting with the new value proposition, materialized in the platform, and concluding with the explanation of the designed business model.

Chapter **6_ Conclusions** and personal reflection constitute the last portion of this report. The conclusions include some observations on feasibility, viability and desirability, together with project limitations and directions for further research. An implementation roadmap is as well featured in this last chapter.

Chapter 1
Process overview, method and tools, design iterations

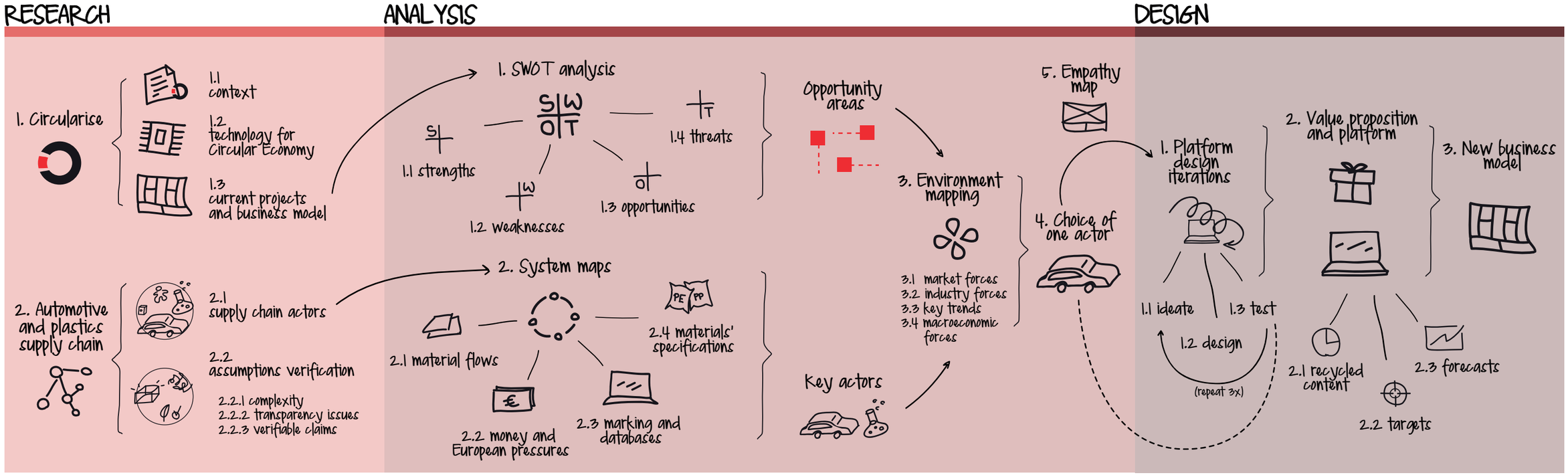
In this first chapter, the process followed during this graduation project is explained, together with the methods and tools used.

First, an illustration explains the process followed to achieve the end results, dividing the different activities in three phases: **research, analysis and design**. Detailed explanations on the research and analysis conducted are included in the third and fourth chapter.

After giving an overview of the process, that includes the method and tools used, said method and tools are better explained for those readers who are not already familiar with them. The overall method of this graduation project follows the one proposed in the *Business Model Generation*, a handbook published by Osterwalder in 2010. The tools explained are then the **business model canvas**, the **SWOT** matrix, the **environment mapping** and the **empathy map**.

Lastly, at the end of this chapter, another overview is featured which shows the **design iterations** conducted in order for the final design of the platform to take shape.

Process overview



The research phase revolved around two main focus points: Circularise and the automotive and plastics supply chain. Circularise's current situation was researched by interviewing the founders and reading revelant documentation provided by the company. The automotive and plastics supply chain, instead, was investigated via interviews and literature research.

The analysis phase also started with two parallel focus points. Circularise's current business model was analyzed in a SWOT matrix, while the supply chain actors were mapped around the lenses mentioned above (2.1 to 2.4). The SWOT analysis helped identify opportunity areas; the system maps showed the emergence of two key actors: plastic manufacturers and automotive companies. With these learnings in mind, an environment scanning was performed and as a result one key actor was identified: automotive companies. An empathy map was used to start ideating and designing.

Once a key actor was identified, a platform was iteratively designed to fit its needs. After three iteration a final design took shape, together with a value proposition. The new business model proposed was then built around such value proposition and platform, following the Business Model Generation method (Osterwalder., 2010). More details on the design iterations are included later in this chapter.

Method and tools

As mentioned in the chapter's introduction, the theoretical model that forms the backbone of this project's work on business model design is the book *Business Model Generation* published by Osterwalder in 2010. The book is divided into five different sections: Canvas, Patterns, Design, Strategy, Process. Altogether, these sections focus on separate aspects of business models.

In the course of this graduation project, both the overall business designing methodology and specific tools were leveraged upon. The singles tools are hereby presented, with reference to the book's chapters they can be found in.
The first chapter, Canvas, focuses on the building blocks necessary for a company to run their business. These blocks taken together compose the Business Model Canvas, the first tool explained below.

Business model canvas

The Business Model Canvas was central in this project, as it was used both as an analysis and a design tool (Fig. 1.1). The building blocks that compose it, in fact, act as lenses through which business models can be analysed as well as designed. The Business Model Canvas consists of nine blocks.

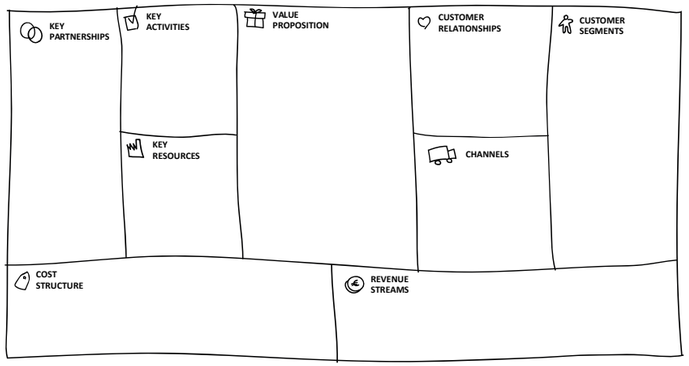


Fig. 1.1
Business model canvas

Following the book's order, the first for importance is the **Customer Segments**. Customer segments are the different groups of potential customers the business model tries to deliver value to. A business can target one or more customer segments, depending on their offer.

After the customer segments comes the **Value Proposition**. The value proposition embodies the services and products offering that a company develops to create value for a specific customer segment.

Channels are the ways a company can use to reach its customers to sell their offer, or to communicate with them. Channels have in fact five different phases: awareness, evaluation, purchase, delivery and after sales.

After channels, in order of importance, we find **Customer Relationships**. These cover a wide spectrum of options, from personal relationships to automated services and are basically the type of relationship a company want to maintain with its customer segments.

Finally, the last block in the right hand side of the canvas is **Revenue Streams**. In this block, all that pertains the company's entrances is included, as revenue streams are a description of where a company takes the money they need to operate from.

On the left hand side of the canvas we then have a counter-part to the customer segments: **Key Partnerships**. All external companies or entities that enable the business to deliver value to its customer segments fall under this category.

Key Resources and **Key Activities** are the blocks right next to key partnerships. In these two, the most important aspects required and the most important things a company must do to make a business model work, are featured.

Finally the last block in the canvas is **Cost Structure**. Here everything that pertains the costs a company must face in order to make its business model operative are included.

The main characteristic of canvas is that there is no fixed starting point for going through the different blocks, even though the book suggests a preferential order. Business models can be observed and designed starting from any field. In order to overcome this limitation during the project, the decision taken was to start from defining customer segments and value propositions first, as these emerged as the most interesting focal points from the SWOT analysis conducted on Circularise's current business model.

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The section titled Design gives a general overview of the design process, mostly targeted at those who do not possess a formal background education in design. As such, this chapter was the least useful for this project. However, in the very beginning of it, a tool is introduced, the Customer Empathy Map, that was used as a way to map costumer insights.

Empathy map

Empathy maps are an easy and effective way to look at the insights coming from both field and desk research. As can be seen from the picture (Figure 1.2) empathy maps are divided into six different areas: **think** and **feel**, **say** and **do**, **hear**, **see**, **pains** and **gains**. At the centre is the customer whom the fields refer to.

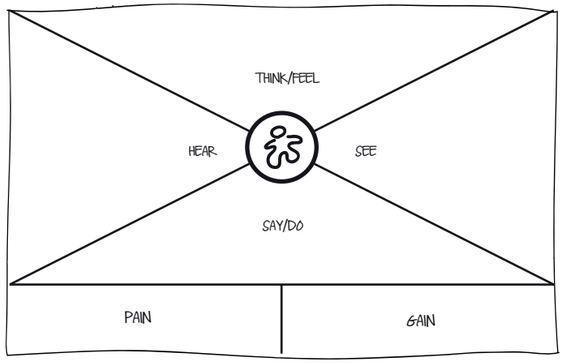

Fig. 1.2
Empathy map

These maps prove to be quite useful to get an overview of the system at hand. However, they have a main limitation which is that they are based on a B2C perspective, where the customer in the centre is usually a well-defined individual. In a B2B setting, such as the one this project takes place in, the customer is the whole company. To still be able to make use of this map, instead of considering the whole company, the perspective of one specific role can be adopted.

-

The second to last section, Strategy, introduces the importance of the SWOT Analysis and Environment Mapping to design effective business models. The content of this section was used as guideline for looking at trends and forces surrounding Circularise's current and prospected activities, in order to scope the new business model around them.

SWOT Analysis

The SWOT matrix (Figure 1.3), is a great tool for analysis. It is divided into four quadrants that look at **Strengths**, **Weaknesses**, **Opportunities** and **Threats** of the object to be analysed and evaluated (Ansoff, 1965).

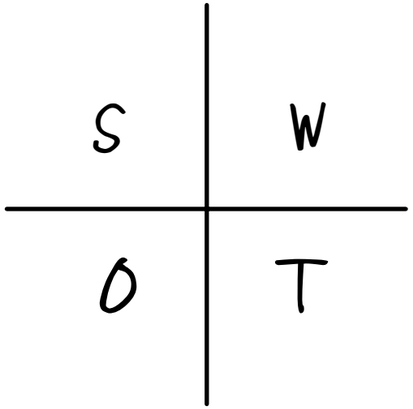

Fig. 1.3
SWOT matrix

This tool was used to evaluate the current business model Circularise has developed for the tracing of textiles. When applied to a business model, the SWOT analysis is conducted by looking at all the blocks separately, with the help of a checklist. In the checklist, several aspects are highlighted and graded on a scale from 0 to 5. Threats and opportunities and weaknesses and strengths are examined in parallel, as they are most often each other's opposites. For example, a company's customer segments can be very well defined, and this would be a strength, or not well defined, which instead constitutes a weakness.

Main limitation related to this tool is related to the fact that Circularise is still in the process of implementing their business model in the industry, hence assumptions had to be made in regards to some of the matrix's fields.

Environment mapping

The last tool hereby mentioned, environment mapping allows for keeping an overview of the bigger picture in which the business model finds its place. It focuses on four areas: **key trends**, **market forces**, **industry forces** and **macroeconomic forces** (Figure 1.4). Each of these areas needs to be investigated according to the points shown in the image below.

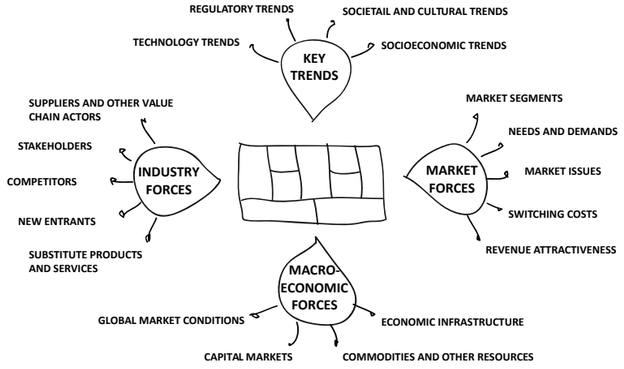

Fig. 1.4
Environment mapping

Main benefit of such tool is how well it complements the empathy maps, as those are fairly focused on the prospected customer, while this looks outside the immediate focus and helps uncovering further opportunities. Only risk that come with it is that such an overview can end up being dispersive and lack focus. As a way to counter that, special attention has been put into selecting the most relevant trends and forces in the industry of choice.

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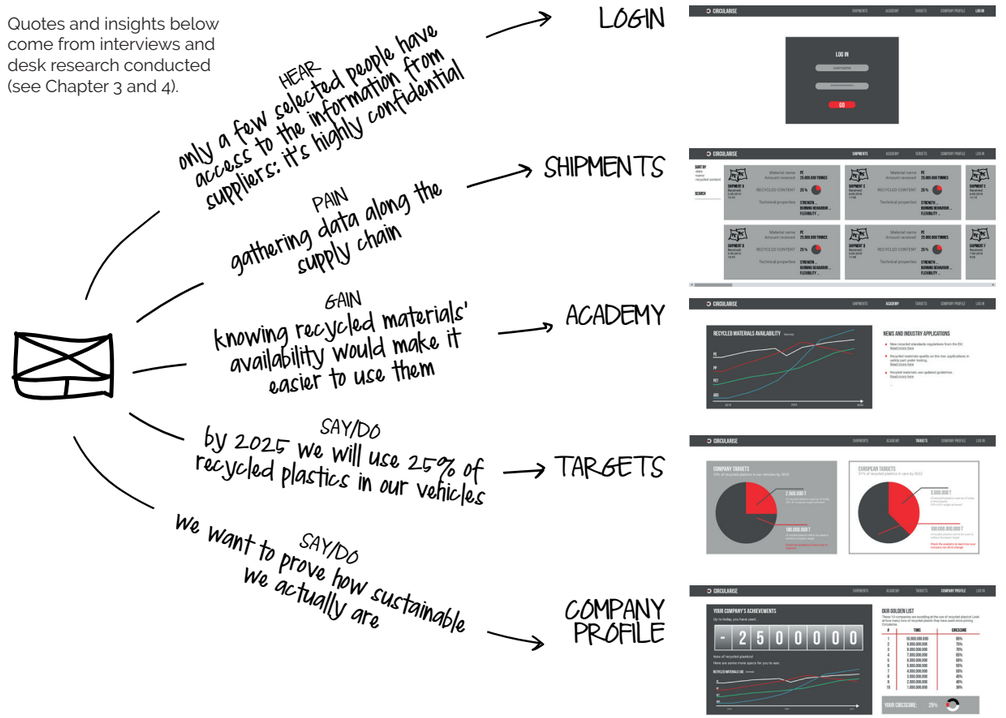
Not all chapters of the *Business Model Generation* have been mentioned in this short summary, but the whole book is an inspiring read and features several other tools and methods that can greatly contributed to projects such as this one.

Design iterations

The overview below shows how the three consecutive design iterations on screens for a platform contributed to give shape to the value proposition and final platform design.

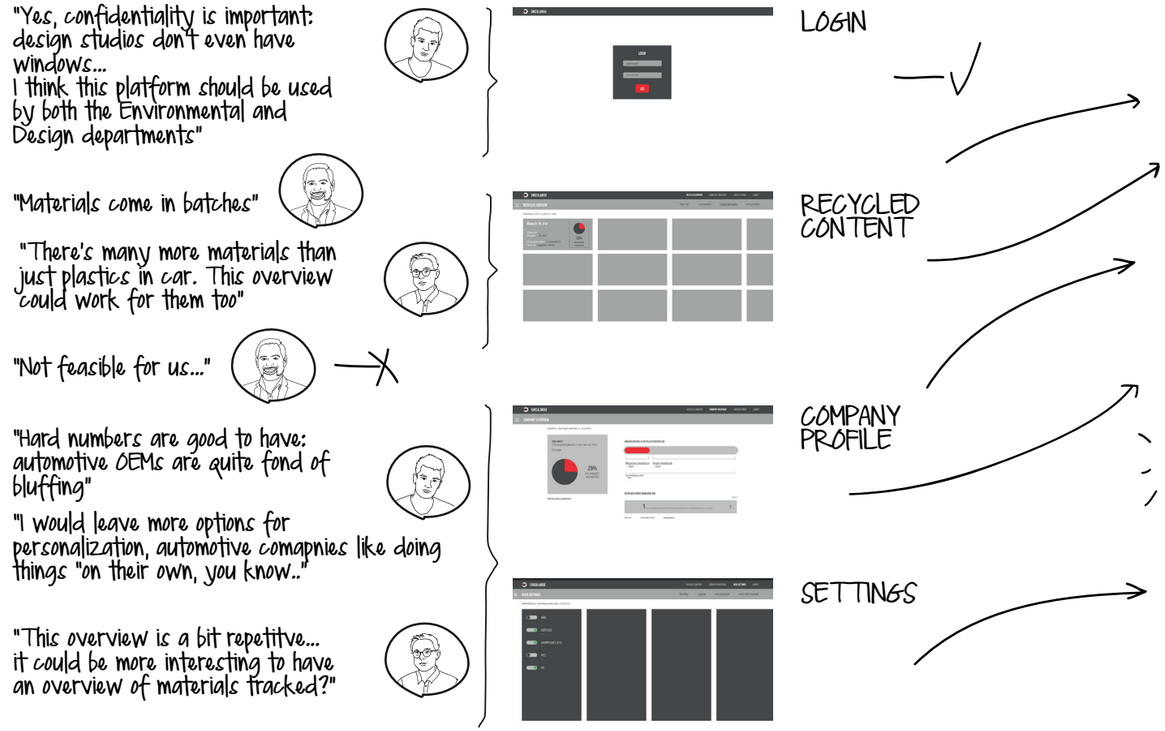
As a general description of the process, it might suffice to say that the empathy map was used as the basis for the ideation of the first iteration, while feedback from the automotive experts it was tested with fed into the following iterations. The most interesting insights and quotes from testing are included in the overview.

Quotes and insights below come from interviews and desk research conducted (see Chapter 3 and 4).



Automotive experts interviewed

Here on the side, the complete list of experts working in the automotive field, interviewed in order to gain feedback on the platform's iterations. Interviews were mostly conducted as informal conversations, or as semi-structured. The complete information on the iterations, as well as the interview guide used for semi-structured interviews, are to be found in Apeendix #6 and #7.



Advanced regulations and recycling - OEM

Interior Design Coordinator (former) - OEM

Mesbah Sabur - Circularise founder

Jordi de Vos - Circularise founder

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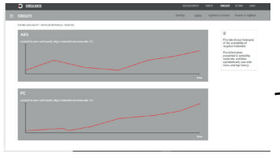

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TESTING 2 | **ITERATION 3: PRICING** | **TESTING 3**

Chapter 2
Circularise's context and expansion goals

Circularise was founded in 2016 by Mesbah Sabur and Jordi de Vos. The start-up plans to offers a business to business solution facilitating knowledge transfer between stakeholders. Such a solution consists of a decentralized information storage protocol and of a communication platform. Through these two, in short, Circularise allows actors in a value chain to exchange trustworthy information while remaining anonymous. Stakeholders are also enabled to easily fine-tune and update the amount of disclosed information, determine access rights and validate the information exchanged.

Context

Circularise's protocol is based on the application of several technologies and founded on supply chain management considerations. The technologies behind the protocol are blockchain and zero-knowledge proofs (see Textbox 2). These all contribute to ensure that proofs of a material's provenance are communicated along the supply chain without confidential information being revealed. The intention of the start-up is to in fact facilitate a so called "**flexible transparency**".

TEXTBOX 2
The technologies behind flexible transparency: blockchain and zero-knowledge proofs

Blockchain is a publicly verifiable open ledger that allows for decentralizing ownership of personal – or corporate – data (Zyskind, 2015). Essentially, blockchains are a distributed database of all transactions or digital events that have been executed and shared among participating parties. Each transaction in the public ledger is verified by consensus of a majority of the participants in the system. Furthermore, once entered on the chain, information can never be erased. A popular example of blockchain use is Bitcoin, a peer-to-peer digital currency (Crosby, 2016).

Zero-knowledge proofs (ZKP), instead, are a method by which a person can prove to another person that they know a certain piece of information, without disclosing said information. In this systems, the first person goes under the name of prover and the second under the name of verifier (Goldreich, 1994). Common use cases of ZKP are in the field of cryptography for e-voting and once again e-cash, or digital currency (Chaabouni, 2012).

This type of transparency is particularly helpful when **complex supply chains** are involved. In complex supply chains the number of stakeholders is high, as high is the competitive drive among them. Obvious consequence of this is the extreme **confidentiality** of information exchanged between suppliers and clients. Moreover, in complex value systems the information exchanged is fragmented and there is a lack of traceability standards that cover the whole chain, from manufacturing to end of life.

In this kind of contexts, Circularise's solutions provides a good answer to the need for privacy. In Circularise's words, in complex value chains: "*While full transparency is not the solution because it is too much information, full privacy is not the solution either. The problem is, just like some people could become criminals when they are sure they can get away with it, so could supply chain actors. Big companies are no exception. Providing a system where all stakeholders can be held accountable for their actions, audit results can be published and shared, and information can be exchanged in a flexible way, is key.*" (Pasotti, 2018).

Basically, Circularise's protocol is there for companies to **formulate verifiable claims** about their products, and for end consumers to **access proofs** of these claims. In order to do so, the start-up is in the process of developing a platform for clients, smart tagging systems fit for different materials and components and an application for consumers and recyclers, where the information recorded on the smart tag can be accessed.

In the image below (Figure 2.1) is a schematic overview of the main touchpoints the start-up plans to develop. The platform would be facing the business clients, brand owners and the supply chain actors, while the product passport, materialized in an application, would face recyclers and end users and provide them with product information.

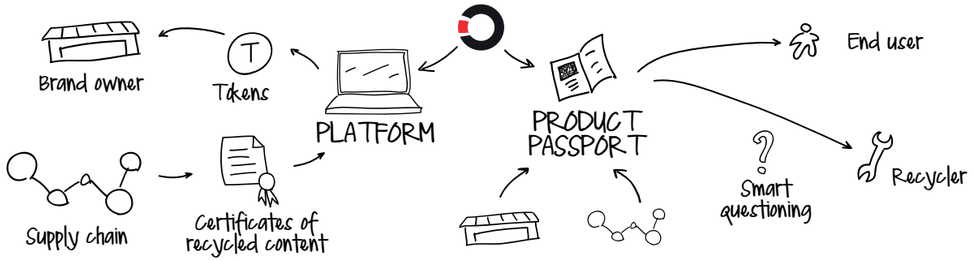


Fig. 2.1
Circularise's interfaces and touchpoints

Technology for a circular economy

The end goal of Circularise's protocol is to leverage on technology to promote the shift to a circular economy by increasing the use of recycled materials. This paragraph focuses on briefly explaining circular economy and how Circularise's protocol can drive a positive impact towards it.

Circular economy revolves around three principles (Ellen MacArthur Foundation, 2019):

1) Design out waste and pollution
The design phase is responsible for around 80% of the environmental impacts caused by a product or a service. The first principle of circular economy targets this issue, by encouraging a better use of materials and technologies and by considering the creation of waste a design flaw.

2) Keep products and materials in use
Keeping products and materials in use for longer can be done via several different activities such as recycling, repairing, reusing and remanufacturing. These are the so-called "loops" of circular economy and according to the second principle they can be closed by recirculating products, components or materials.

3) Regenerate natural systems
The third and last principle of circular economy states that we should not only try to not ruin our ecosystem, but also do all that is in our power to improve it. For example, returning useful nutrients to the soil enhances this important natural resource.

Circularise's protocol, as it is used now, revolves mostly around the second principle. The uniqueness of the technology Circularise developed, in fact, is that it allows for faster, more direct, safer and decentralized information exchanges around data such as the recycled content of materials. It does so by using blockchain and zero-knowledge proofs, to allow stakeholders to communicate without compromising on privacy or losing competitive advantage.

For example, material manufacturers can upload certificates of recycled content onto the platform and brand owners can **see information related to the recycled content without having direct access to the certification**, which may contain all sorts of confidential information, such as the chemical composition of the material and so forth.

Without such technology, the only way to get information about recycled material content is auditing all actors in the supply chain and requiring recycled content certifications. Both are however long and expensive processes that result in the recycled materials being more costly than virgin ones.

For as long as recycled materials stay more expensive than virgin materials, unfortunately, wider market adoption of them is challenging. Price reduction is still in fact the market's dominant logic and consumers' acceptance of higher prices for recycled materials is low. Circularise's technology allows to cut on these costs by tracing the material directly and hence eliminating the necessity of auditing all the actors in the supply chain. This **lowers the cost of recycled materials** and aids their wider adoption.

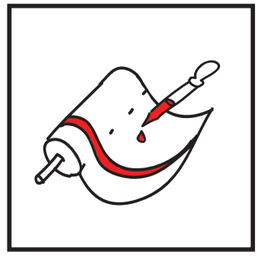
Increasing the adoption of recycled materials has a positive effect on the environment and resource efficiency and therefore constitutes an important step towards building a circular economy.

Current projects and business model

At its beginning, Circularise's focus was tracking electronic equipment and ensuring a safe disposal of dangerous substances and recovery of valuable metals. To best do so, they approached several manufactures of electronic around Europe and started implementing their protocol bottom up. However, some steps still have to be taken for this project to scale, which is why no further details on it are mentioned in this report.

Soon after that, they realized that the supply chain of **textile industries and fabrics** was just as complex as the one for electronic equipment. Naturally so, they then decided to expand to this sector and implemented a new system for chemically tracing and tracking fabrics.
As of today, this system is being put to work with **Inditex** and one of their suppliers, **Summit Company**, as illustrated in the following pages.

1.

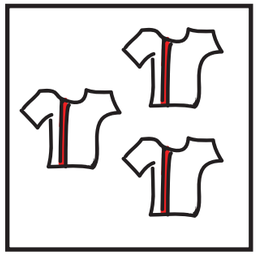


Chemical tracer inserted in Summit Company's textiles

The **chemical tracer** produced by **Tailorlux** (see Fig. 2.2) is inserted in the textiles of Summit Company during the production process and mixes uniformly with the textiles' fibers.

Fig. 2.2
Tailorlux's chemical tracers

2.



Supply chain manufactures products

Circularise's pilot involves one of Summit Company's main clients: Inditex.

Inditex is a multinational fashion company that own several clothing brands like ZARA and Pull&Bear among others.

Through supply chain processes Summit Company's textiles get manufactured into products, in this example t-shirts.

3.

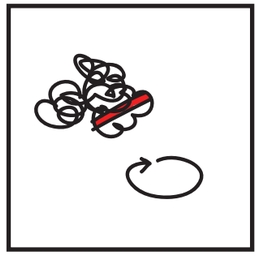
Product gets purchased at Inditex store, used and discarded

End users purchase the marked products through the existing retail channels.

As the tracer is not visible or othewise perceivable, the use phase does not go through any changes and the t-shirt gets used and worn normally.

After use, the product gets discarded.

4.



Textiles recycling process

After being discarded, the t-shirt goes through recycling processes that bring it back to the state of textile fibers.

This process, as well, does not affect the chemical tracer, that in fact remains present in the fibers.

From these fibers, new textiles are produced and their recycled content is certified.

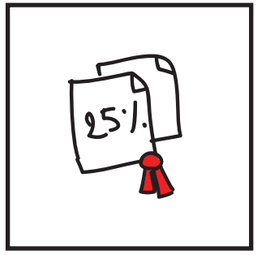
5.

3rd party auditor checks on recycled content

A third party company is in charge of auditing the amount of recycled content in the newly made textile.

They do so by **scanning the tracer** from Tailorlux, directly on the texile, with the appropriate scanning technology.

6.



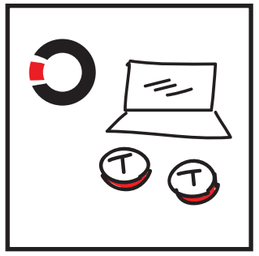
Certification of the amount of recycled material

The third party then releases an **analog certificate** of the recycled content for the specific batch of textile audited.

These auditing processes and certifications are quite pricey, as mentioned before.

Furthemore, the certificates contain information on the composition of the textile that is highly confidential and has to be kept secret.

7.

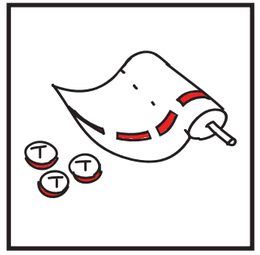


Circularise turns certificate into digital tokens

The analogue certificate is valid for the whole batch of material, but it can only be used once with one client. Material batches, however, are sold to multiple clients.

This is where technology comes in help. On Circularise's blockchain, **every certificate becomes a set of tokens** (one token per kg of material certified). These tokens are the digital currency of the start-up's platform.

8.



Tokens travel with textile in the value chain

The tokens can then be **transferred**, via the platform, to multiple clients, once these purchase the certified textiles.

The clients, such as Inditex, have then a proof of the recycled content in the textiles they buy, without confidential information about the materials' composition being revealed. Summit company can sell their textiles to other clients without the need for multiple certificates.

For this specific project, Circularise has established and is running a pilot test. However, the start-up has developed a business model as well, that will become effective as soon as the pilot is proved successful.
In order to showcase said business model in a clear way, a Business Model Canvas is featured below with clarifications on its content, block by block (Fig. 2.3). The order in which the blocks are explained follows that of Osterwalder's work on the subject (Osterwalder, 2010).

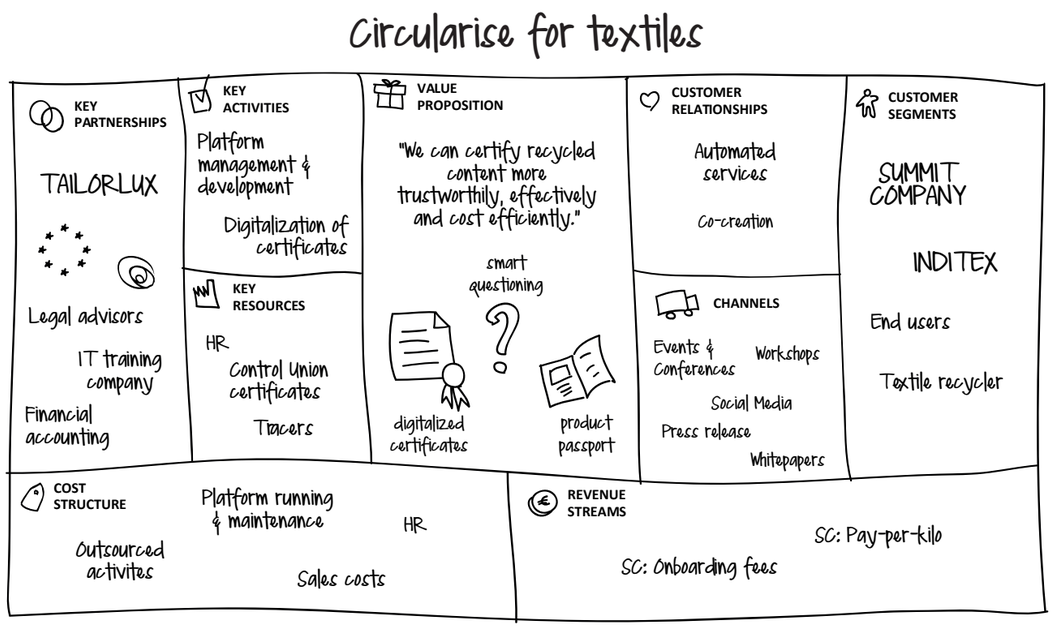


Fig. 2.3
Circularise's current business model

Customer segments

The main customer segments, as visible above, are four: **textile manufacturers** (in the pilot's case, Summit Company), **brand owners** (such as fashion brands, in the pilot it's Inditex brands), **end users** (the people that purchase textile products), and **textile recyclers**.

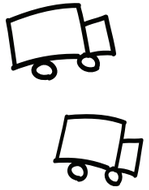
Value proposition

For these customer segments, Circularise's value proposition consists of easing the process of finding out and proving the amount of recycled content present in the textiles. As it emerged in a conversation with the founders, they describe their value proposition as "we can certify recycled content more trustworthily, effectively and cost efficiently".
This value proposition takes shape in three distinct offerings: the **digitalization of certificates of recycled content**, an automated system of **smart questioning** to understand the product content and composition and a **product passport** to convey information about products. These three offerings deliver different value to the different customer segments (see Table 2.1).

	DIGITALIZED CERTIFICATES	PRODUCT PASSPORT	SMART QUESTIONING
Textile manufacturer	Prove recycled content	Communicate products with brand owners	-
Brand owner (OEM)	1. Reduce auditing costs to prove recycled content 2. Make verifiable claims about recycled content	Communicate their products with end users	Communicate their products with recyclers
End user	See proof of brand owner's claims validity	Know the product they are buying	-
Textile recycler	-	-	Know product to recycle

Table 2.1
Circularise's current value proposition

All of the information above, according to the start-up, should be accessible via a digital platform or application (see Figure 1). Such solution, that gives access to different pieces of information to different customer segments, can be categorized as a multi-sided platform. Multi-sided platforms are those platforms where two distinct, but interdependent customer groups' demands are coordinated. For example, payment platforms need both cardholders and merchants to be successful (Hagiu, 2015).
Multi-sided platforms have therefore a peculiar trait: their value grows proportionately with their number of users (Osterwalder, 2010).

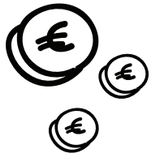


Channels

The channels through which Circularise plans to get in touch with new clients and get them on board are **conferences** and **events**, or **activities** and **workshops**. These two channels are mostly targeting textile manufacturers and recyclers and brand owners. Direct sales, which means having an internal sales team that gets in touch with prospected clients, are also included as a possibility, together with social media campaigns, again targeting these customer segments. When it comes to end users, instead, Circularise intends to leverage on press releases, open access publications and social media.

Customer relationships

If we only observe the pilot, co-creation activities have been part of the way Circularise develops their service, but in an optic of scaling up to industry size, the offer they provide falls under the category of **automated services**. Automated services, as defined by Osterwalder, "can recognize individual customers and their characteristics, and offer information related to orders or transactions." (Osterwalder, 2010).



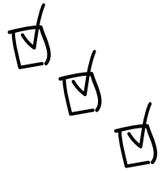
Revenue streams

When looking at the revenue streams, it's clear how Circularise positions its offer – the multi-sided platform described under the value propositions – as a freemium model. Freemium models are those models where the same, or a complementary offer, is available for certain customer segments free of costs. A good example of this is Spotify: paying users access music without

advertisements, while non-paying users can access the music too, but then listen to ads as well. Out of the four customer segments identified in Circularise's business model, in fact, only one counts as paying customers. These are textile manufacturers. Revenues take the shape of on-boarding fees, to start off the tracking system, and a **pay per usage fee**. Specifically, the pay per use accounts for kilos of certified-to-be-recycled material, as explained in the illustration of Circularise's activities.

Key partners

In order for Circularise to be able to run their business, a few external parties are needed. In the Business Model Canvas, they fall under the block of "Key Partners". First among these partners is **Tailorlux**, a German company who developed the chemical tracer used to track recycled content. This chemical tracer works specifically with fabrics, as it can be inserted in the thread during production phase and does not modify the characteristics of the fabrics produced. Other relevant partners are legal advisors, financial accountants and third parties in charge of technology validation. The endorsement from the European Union and foundations like Ellen MacArthur's are also relevant for the start-up. Last but not least, an IT company is necessary for training prospected employees and outsourcing some of the platform related activities.



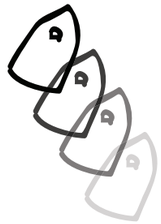
Key activities

Key activities for Circularise to operate revolve mainly around the platform. Hence, in this building block of the canvas, **platform development** and **management** find a central stage, together with the **digitalization of certificates** of recycled content.

Key resources

In the Business model canvas language, these represent a key resource for Circularise. These **certificates of recycled content** are issued by an external auditor, Control Union, on the basis of the Global Recycled Standard (see Textbox 3). Other key resource is the chemical tracer itself, developed by

Tailorlux as mentioned above. Crucial key resource for the start-up are, however, **human resources**. Specifically, Circularise needs developers and blockchain expert to smoothly run operations. Finally, in order to scale the protocol to match industry numbers, **IT** and technological developments are necessary.



Cost structure

Looking at the last block in this Business Model Canvas, it is possible to observe how costs originate from **outsourced activities**, **human resources**, **platform** running and maintenance and **sales**. In more detail, the outsourced activities are the ones regarding legal, financial and IT services. Human resources related costs are Circularise's employees' salaries. Sales costs come mostly in the shape of travel expenses. Costs related to the platform are, for examples, updates, hosting of the website and such.

TEXTBOX 3
Control Union and the Global Recycled Standard

Peterson Control Union is a family owned enterprise, established in the Netherlands in the 1920. They specialize in independent, international cargo surveying and super-intending. They provide their clients with quality reports and a vast range of certifications (Peterson and Control Union, 2018). Among these certification, in 2008 they developed the GRS. The GRS is a standard that sets requirements for third-party certification of recycled content, chain of custody, social and environmental practices and chemical restrictions. Since 2011, ownership of this standard has been passed on to another entity, Textile Exchange (Control Union, 2019).

Key learnings from this business model

1. Opportunities for increasing profitability seem to be present, as only one out of four customer segments is paying for Circularise's services.

2. The business model as it is targets the textile value chain specifically, as the type of chemical tracing used works for fabrics. Different industries where diverse materials are used, such as the automotive, might need different solutions.

Circularise's plans and their assumptions

For Circularise to be impactful, further expansion to tracking other materials is nevertheless necessary. The new material that caught Circularise's attention is plastics and the first step of this graduation project is to verify whether the automotive market could be a valuable field to start with when it comes to plastics traceability.

Initial assumptions to be verified via a preliminary research phase are the following, upon which Circularise's protocol is based:

1) The supply chain of the automotive industry is a complex and fragmented system, where **communication between stakeholders is indirect**.

2) The stakeholders **fear full transparency**, as confidentiality of information is in most cases the reason behind their profit margins.

3) At least one actor in the supply chain cares about **making verifiable claims** related to environmental performances.

When these assumptions are met, Circularise's protocol makes business sense for that market and the start-up's selling and on-boarding process become much easier.
In supply chains that are simpler, where communication between stakeholders is direct, transparency is not feared and actors have no interest in sustainability claims, the protocol brings comparatively less advantages than it does in systems where these conditions are not met.

Chapter 3
Assumptions verification

An important initial phase of this graduation project has been the verification of the assumptions listed in the previous chapter. Such verification allows Circularise to understand whether the automotive industry is indeed a promising one where to implement their protocol for plastics traceability.

As a quick summary of the research goal and sub-goals, see the overview below (Figure 3.1).

Verification of assumptions was conducted via literature research and qualitative interviews. Here follows an overview of the activities conducted in both types of research. Conclusions on each single assumption are to be found at the end of this chapter.

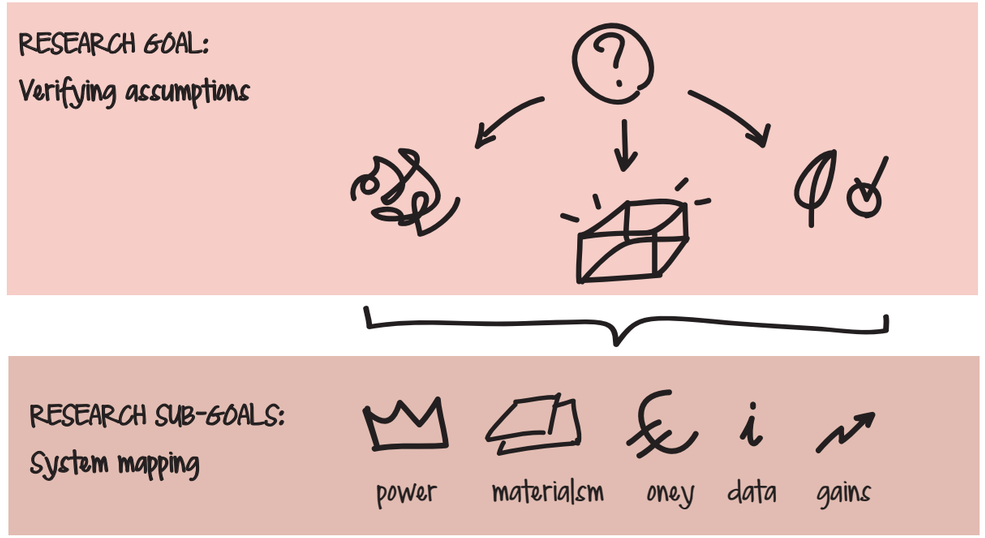


Fig. 3.1
Research goals and sub-goals

Overview of literature research activities

The literature research verted on four main topics: the amount of **plastics in cars**, the **legislative pressures** from governments and the EU, **users profiling** and **green supply chain management** case studies. These four topics were chosen as a starting point, early in the process, as they would grant a holistic overview of the automotive market, with a focus on plastics, actors involved and existing pressures and motives for increasing sustainability and circularity.

Literature research was conducted by use of an initial set of generic keywords, such as “automotive”, “plastics” and “sustainability”. This first query allowed for recent literature reviews to be found. From these, cross-referenced papers came to the surface. Attention to finding case studies was also given, for they offer an effective way of seeing greening initiatives’ development over time and its influence on actors’ roles, responsibilities and behaviours.

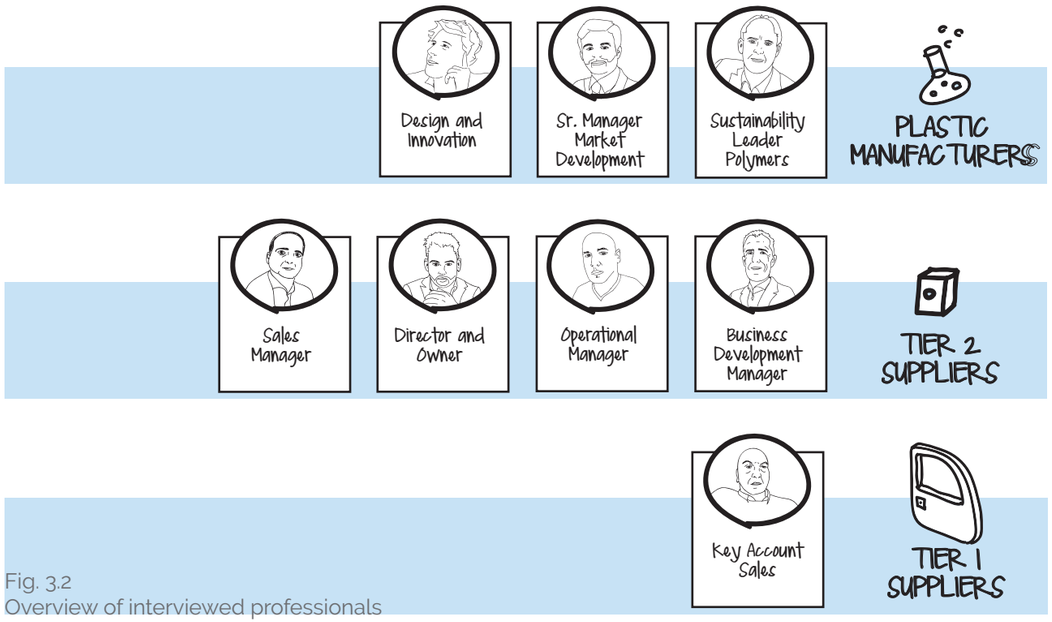
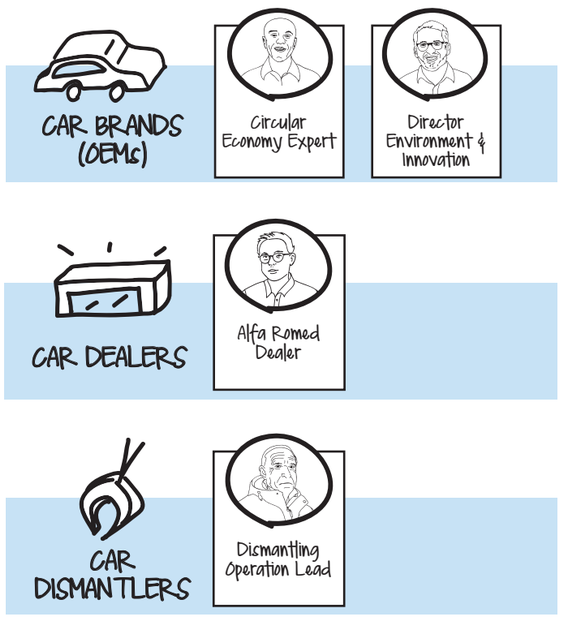


Fig. 3.2
Overview of interviewed professionals

Insights from literature were considered valuable when contributing to paint a clear picture of the automotive industry and of its efforts to implement sustainability. Quantitative information about plastics and cars (percentages, numbers and plastics typologies) was also considered interesting to frame the size of the issue at hand. To keep an handy overview of topics and connections between papers, a mind map was drawn and can be found in Appendix #1.

Overview of interviews conducted

In an effort to further deepen the knowledge of the automotive supply chain, qualitative interviews were conducted with eleven different professionals from the various stakeholders that work in the plastics and automotive value chain.



As it is visible from the overview on the side (Figure 3.2), the professionals that have been interviewed mostly work in **Sales**, **Research & Development**, or **Corporate Social Responsibility** teams. This focus was intentionally made, after a quick first literature research, as it emerged from several sources that these departments are the ones that mostly communicate with the other actors in the chain. (Orsato, 2007; Zhu, 2007)

Semi-structured interviews were then conducted with the selected participants over phone, video call or in person. The structure of the interviews was based on the research sub-goals, therefore interviews were split into three to five parts, examining relations between the different actors in the value chain, claims about sustainability,

internal and external pressure of environmental regulations.

For the different interviews, a separate interview guide was redacted, depending on the kind of company the interviewee worked for. This was deemed necessary in order to gain specific insights into, for example, collaboration practices between clients and suppliers. For a more detailed look at the interview guides, see Appendix #2.

The value chain of plastics and automotive

Before diving into the actual verification of assumptions, a quick overview of the automotive and plastics value chain is here presented. Each actor's role – thirteen are the ones identified – is explained in the cards below and a few lines after the cards give a short summary of how materials and components travel along the chain (Fig. 3.3).

At the beginning we find plastic manufacturers, the material producers. These are generally chemical industries of varying sizes. Next come the suppliers, divided into Tier 1 and Tier 2. Tier 2 suppliers buy materials from the plastic manufacturers, produce plastic components and sell these components to Tier 1 suppliers. Tier 1 suppliers assemble components coming from Tier 2 suppliers and sell them to car brands (or OEM, original equipment manufacturers). The car brands then distribute these to car dealers, that sell them. Finally, once the vehicles reach their end of life, they end up at a car dismantler.

Without further ado, let's now jump into verifying the three key assumptions.

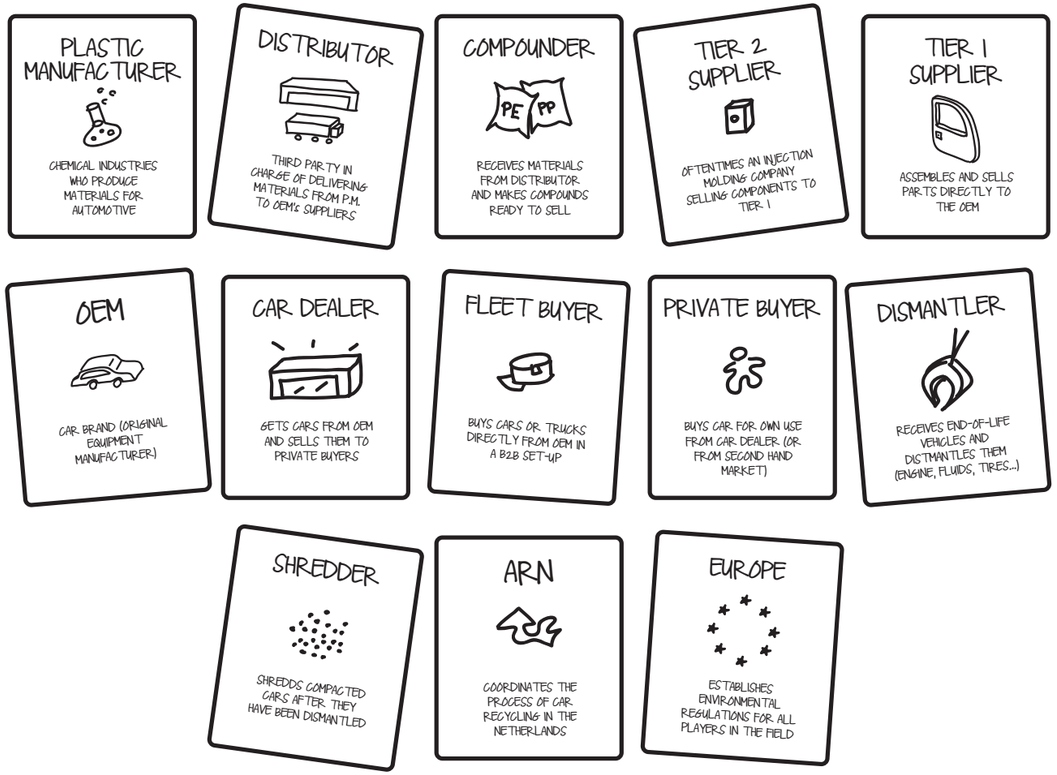


Fig. 3.3
Actors in the automotive and plastics supply chain

Assumption 1 _The supply chain of the automotive industry is a complex and fragmented system, where communication between stakeholders is indirect

Insights that prove it from literature

Doran and Hwang give a comprehensive overview of how a standard supply chain looks like and compares it to a modular supply chain (Doran et al. 2007). In both cases, **communication** between the different actors is **indirect** and fragmented. In a standard supply chain, communication happens between client and supplier, from the automotive brand to their direct suppliers and from these suppliers to sub-contractors and so on. In a modular supply chain, instead, communication happens between automotive companies and direct suppliers and between direct suppliers and a network of all sub-contractors.

Communication between stakeholders appears indeed to be mediated and fragmented. The same can be said about material labels. Vieberink in fact gives an overview of the several marking and labelling standards existing in the automotive industry (Vieberink, 2018). The **lack** and importance **of a clear and standardized labelling** is also stressed from Duval and MacLean, when talking about the role of product information for the goal of recycling plastics (Duval et al. 2007). In an earlier paper, Van Hoek also underlines how end of life identification of parts is to be enabled with a shared material coding system, that is, however, still missing (Van Hoek 2001).

Insights that prove it from interviews

From the words of the actors interviewed, it clearly emerges as well how mediated communication is in the automotive supply chain. According to one of the companies contacted, suppliers like themselves, who don't sell their products to automotive companies directly, but to **intermediaries**, have little to no involvement in the design phase. These companies, that go under the definition of Tier 2 companies, work for car brands only indirectly. In their own words:

"We are second tier, so we deliver to the first tier supplier not directly to the to the OEM [automotive company], so it's the model."(Sales manager, Tier 2 supplier)

Tier 1 companies, instead, often engage in co-design activities with the car brands. As one of the interviewees mentioned, in fact:

"Sulla base di quelle che sono le richieste del cliente si sviluppa quelle che sono attività che molte volte sono proprio di co-design, quindi si sviluppa direttamente in collaborazione con il cliente il design e la soluzione tecnica più idonea." (Responsible for sales, Tier 1 supplier)
[on the basis of the client's requests, activities that are oftentimes real co-designing are developed, so directly in collaboration with the client we develop the design and the technical solution that is most fitting]

Plastic manufacturers are also involved in the design and material specification processes and they talk directly with the OEMs as well. Specifically, they focus on the design department.

"What we focus on is early specification, on one hand that means helping designers and innovators selecting the right materials for their products. And on the other hand it's connecting with the OEMs and basically make sure that what they have in mind that they can actually deliver this." (Design and Innovation, plastics manufacturer)

The communication and collaboration between these three stakeholders is mediated and interrupted, but at least it still happens, even with occasional co-design activities. The communication between plastic manufacturers and their **distributors** is instead close to non-existent. The same interviewee quoted above mentioned in fact that, for commodity plastics, which are the most used ones in the automotive sector, sales happen via distributors. These parties' sole interest is selling the materials to their clients, with little regard to guarantees on its origin.

"Distributors make sure that it [the product] comes wherever you want it. But the downside of this is that it doesn't matter if the Sabic material, Basf, Bayer, or local Chinese manufacturers, so you can say very little about the origin of your feedstock." (Design and Innovation, plastics manufacturer)

As a way to address this issue and in an effort to ensure traceability and recyclability of automotive parts, several systems exist already. Such systems can be **databases, catalogues or tracking and labelling standards**. The ones mentioned by most of the experts consulted so

far, are the IMDS (International Materials Database System), the RM (Raw Material) catalogue and the MAT (Materials), UL (United Laboratories) and ISO (International Organization for Standardization) labels. Below, an overview of the existing standards and the stakeholders that use them (Table 3.1).

Among these, the **IMDS** is the most interesting one. The IMDS was a joint initiative of several automotive companies, such as Porsche, Audi, BMW, Ford, Volvo and others that dates back to the year 2000.

Main aim of creating such a database was for automotive companies to have a way of *"collecting information about materials, but both in terms of what type of substances and also in terms of the amounts of certain substances" (Director Environment and Innovation, car manufacturing company).*

For as comprehensive as it is, however, the IMDS is used by Tier 1 and Tier 2 suppliers and OEMs, while the rest of the supply chain, both downstream and upstream, cannot access it. Once again, this goes to show how fragmented the communication is between the different actors who operate in the automotive industry.

RM	✓		✓			
MAT			✓	✓		
UL			✓	✓	✓	
ISO	✓		✓	✓	✓	✓
IMDS			✓	✓	✓	

Table 3.1
Existing automotive tracking and marking standards **DIGITAL database** /ANALOG label

Key learnings from verification of assumption 1

1. Communication between stakeholders in the automotive industry is indirect.

2. Circularise's services can help by effectively bridging the traceability gap between material producers and car brands.

3. Materials' traceability will benefit the system's circularity too, as it will provide benefits for the car recyclers, who would have access to more information.

Assumption 2_The stakeholders fear full transparency, as confidentiality of information is in most cases the reason behind their profit margins

Insights that prove it from literature

A number of articles found stress how, for suppliers to the automotive industry, the pressure on innovation is getting higher and higher (Sedgwick, 2013). With the whole industry being disrupted by the move to electricity, autonomous cars and new players in the transportation field, suppliers are even more pressured into adapting to their customers' requests.
This is especially true in those cases where the automotive companies are building up green supply chain management practices (Zhu, 2007). In these circumstances, suppliers of all sizes can only rely on the **undisclosedness of their investments in R&D** to keep their competitive edge and maintain customer relationships.

Insights that prove it from interviews

The market competitiveness, however, becomes more clear in the words of the experts interviewed. Both plastic manufacturers and tier 2 suppliers, who don't work exclusively for the automotive market and have a less close relationship with the OEMs, **fear** the complete **transparency** of their processes and materials composition. To quote the exact words:

"Like I say it's a trade secret how you make a product, the margin between the feedstock the end material basically makes your profit margin. The margin are so flimsy, this is why they are called commodity materials, that it's a really big risk if somebody finds out your formula."
(Design and Innovation, plastics manufacturer)

An extra reason for tier 2 suppliers to fear competition and treasure confidentiality is that

"In the automotive, it's very easy for companies to change you for another supplier." (Business Development Manager, Tier 2 supplier).

Even the IMDS confirms this assumption, as the access to information there is extremely

restricted:

"There are a few selected people due to confidentiality. Well, when it comes to exactly the specific component, the supplier, but a specific supplier, so the detailed information can only be accessed by people who are allowed to have that access. Not everyone can have access." (Director Environment and Innovation, car brand).

Key learnings from verification of assumption 2

1. Circularise's protocol maintains the confidentiality and secrecy of data exchanged. This is most desirable in the automotive industry, as it meets the existing restrictiveness to information access.

2. Sensitive data is not to be exchanged among competing companies.

3. Access to information databases such as the IMDS is restricted to specific individuals in each company.

Assumption 3_ At least one actor in the supply chain cares about making verifiable claims related to environmental performances

Insights that prove it from literature

In the same paper mentioned above, Van Hoek presents two case studies where automotive companies took a leading role for designing closed-loop systems of plastic recycling (Van Hoek, 2001). Underlying motivations behind these activities can easily fit into Reinhardt's frame of state-of-the-art **greening approaches** (Reinhardt, 2000). This is the case of Smart, that tried redefining the market by showcasing initiative for improving their cars plastics' recyclability. Zhu talks about practices, in a context of green supply chain management, that automotive companies engage in as an effort to increase sustainability consideration between suppliers (Zhu, 2007). One of these is the so-called "*green purchasing*" and relies very much on the fact that car brands possess all necessary validation that suppliers comply with their green standards.

Most of these internal reasons for caring about the environment are externalized with public **campaigns** and turned into **marketing messages**. As is the case of Smart, mentioned above, many more car brands have interest in facing consumers with such goals. Volvo, for example, has recently stated it wants to incorporate 25% of recycled plastics in their cars by 2025 (Doyle, 2018; Fig.3.4, 3.5). A while back, instead, Renault, with its ICARRE 95 project, was aiming at designing vehicles that are recyclable up to 95% (Ellen Mac Arthur Foundation, 2017). Last addition to this list, Land Rover started marketing a new line of Range Rovers partially made of recycled plastics (Williams, 2018; Fig.3.6).

Fig. 3.4
Volvo XC60 with recycled plastics content

Fig. 3.5
Interiors of Volvo XC60

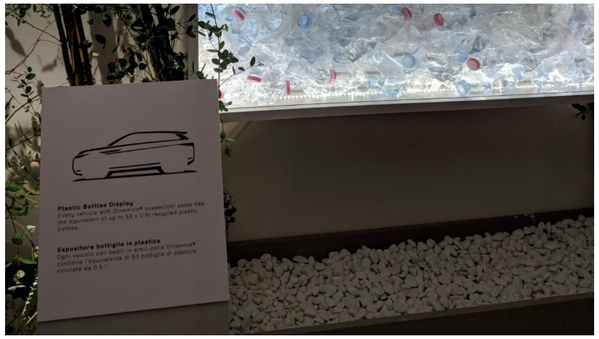


Fig. 3.6
Land Rover stand at the Milan Fuorisalone, 2019

Insights that prove it from interviews

Very much like the literature reviews showed, interest in plastics recycling and related marketing campaigns are mostly to be found among car manufacturers. The interviewees working for automotive companies indeed expressed **interest in proving their environmental claims** to consumers, or in having the **possibility to measure** the results of their sustainability efforts in a more standardized and verifiable way.

"Manca una metodologia comune per riuscire a quantificare quante plastiche riciclate poi vanno nell'auto." (Circular Economy Expert, car brand)
[There lacks a common methodology that allows to quantify how much recycled plastic ends up in the car]

Automotive brands have different reasons for wanting this information. In one case, out of the two automotive brands interviewed, the driving motivation is meeting the objectives set by the **European campaign for Pledging Plastics** (European Commission, 2018). When asked why this traceability was important to his company, the interviewee in fact stated that:

"Perché c'è una pressione dell'Unione Europea. Se lei cerca un'iniziativa, che è stata lanciata dalla commissione europea lo scorso anno che si chiama "Plastics Pledging Campaign" è un'iniziativa, ovviamente volontaria, che chiedeva a vari settori industriali di dimostrare quanto erano bravi a mettere sui propri prodotti plastica riciclata." (Circular economy expert, car brand).
[it's because of a pressure from the European Union. If you look up an initiative, launched by the EU last year that's called "Plastics Pledging Campaign", it's an initiative, joined on a voluntary basis, that asked to different industry sectors to prove how well they could use recycled plastics on their products.]

The second automotive company interviewed has instead internal goals for bringing "fossil free trucks" to the market.

Plastic manufacturers, even if not as enthusiastic about proofs and traceability, have however mentioned that the communication around plastics and sustainability has changed from claims regarding CO2 emissions, to **claims concerning recyclability**.

"Quindi gli stili di comunicazione si stanno modificando, passando da quello che era un claim standard "Questo prodotto contribuisce alla riduzione del

CO2 del 20% rispetto al passato" ad un messaggio che dice "Questo prodotto è facilmente riciclabile o 100% riciclabile", o "Questo prodotto è fatto con il 5-10% di plastica riciclata"." (Senior Manager Market Development, plastics manufacturer)
[Well, communication styles are changing, going from a standard claim like "This product contributes to CO2 emissions reduction 20% more than in the past" to a message that says "this product is easy to recycle, or 100% recyclable", or "this product is made of recycled plastics up to 10-15%"]

Given the importance of market and marketing trends, this shift in the communication focus is not to be underestimated.

Key learnings from verification of assumption 3

1. Communication of compliance to sustainability standards is commonplace in the automotive market.

2. The focus of said communication is shifting from the CO2 content to the recycled percentage content. This is an opportunity for Circularise, as it fits into their existing processes and service offerings.

3. Pressures on automotive OEMs come from the European Union as well as from internal company targets and are the reasons why automotive OEMs care about sustainability claims.

Market relevance

Having verified all three assumptions helped form a basis for this project's relevance. This proves in fact that **the automotive industry is a promising one for Circularise** to cater to.

The next phase of this project, the analysis, looks into the automotive and plastics industry as a whole, in an effort to identify which stakeholders, in the industry, are more relevant.

Chapter 4
Analysis

All information retrieved during the research phase fed into the analysis phase. As illustrated in Chapter 1 (see pp. 22,23), the analysis phase made use of several tools with the aim to identify a key actor to serve as the customer segment that the new business model should target.

At the beginning of this phase, two different analyses were conducted in parallel: a **SWOT** (see p.27) analysis of Circularise's current business model around textiles and a **systemic mapping** of the automotive and plastics value chain. These two analysis gave two distinct outputs. From the SWOT matrix, in fact, **key opportunity areas** were identified by combining strengths, weaknesses, threats and opportunities emerged from Circularise's current business model. From the system maps, instead, **two key actors** emerged that have most influence on the value chain.

However, these two outputs did not give sufficient insight into which actor to target. A last tool was then used, the **environment mapping** (see p. 28), before the decision could be taken.

Once the key actor had been choses, the last tool presented in Chapter 1, the empathy map (see p. 26), was used as a way to reorganize all insights emerged on said actor from both field and desk research. The map then served as a starting point for the design phase, whose results are showcased in the following chapter.

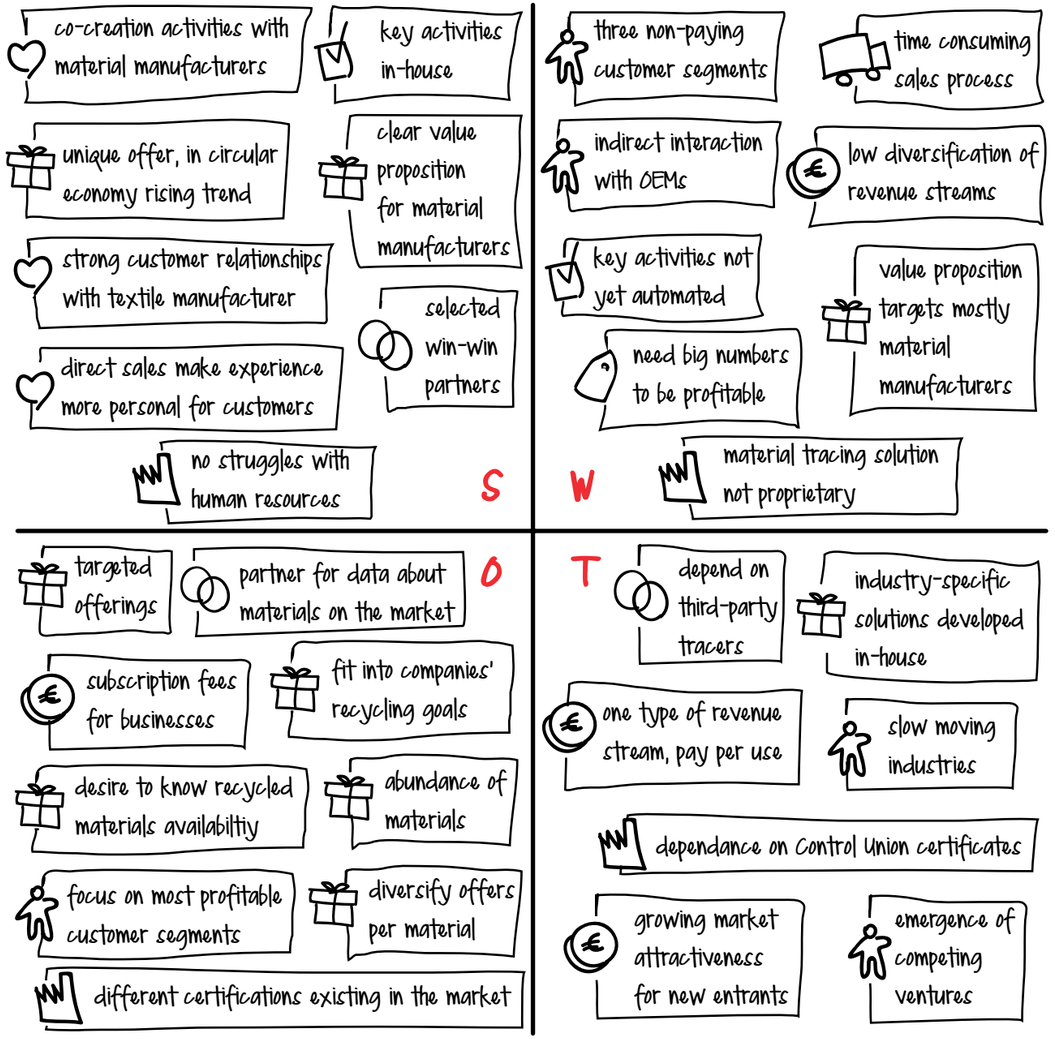
This chapter will then explain the different analyses conducted and how insights gained from each of these motivated the project's focus decisions.

SWOT analysis of Circularise's business model for textiles

In the following page, the SWOT analysis conducted over Circularise's current business model, the one for textiles featured in Chapter 2 (see p.42) is showcased.

The intention behind this analysis was identifying **opportunity areas at the intersections of the strengths, weaknesses, threats and opportunities**. Such opportunity areas, obtained from the textile industry context, could then be translated into the new context of plastics and automotive that this project revolves around, as the two industries share the basic similarities that allow for Circularise's operations (see Chapter 3).

The evaluation of Circularise's textiles business model was conducted on each block, taken individually, on the basis of a checklist that can be found in the *Business Model Generation* (Osterwalder, 2010).



The assessment of the building blocks was first conducted for strengths and weaknesses, then for threats and lastly for opportunities.

Strengths and weaknesses

According to Osterwalder's checklist, value propositions are strong when they are well aligned with customer needs, have network effects, are built upon synergies between products and services and, last but not least, the customers are satisfied. In Circularise's business model for textiles, the **value proposition** is really clear towards **material manufacturers** and it is well connected to the textiles industry's rising attention to sustainability issues. On the other hand, the value proposition does not target the other customer segments – end users, Inditex and textile recyclers – with the same effectiveness, because the offer was actively co-created only with material manufacturers.

Looking then at costs and revenues assessment, then, the most important criteria are revenue margins, costs and revenues predictability and differentiation. Circularise suffers from a really **low diversification of revenue streams**, as the business model relies almost entirely on a pay-per-use revenue coming from material manufacturers. The start-up's costs, instead, even if easily predictable, promise to offer good margins only if a wide portion of the textiles industry would embrace Circularise's solution.

Key resources, key activities and partnerships are evaluated on the basis of how difficult they are to replicate and how efficient and of quality they are. In the case of the business model we are analysing here, Circularise strengths rely on the fact that the key activities are kept in-house, hence they're more difficult to replicate, and the key human resources are not an issue for the start-up to attract, as they claim themselves, leveraging on the partnership they have with the Delft University of Technology. The partnership with Tailorlux is also a strength for Circularise, as the two companies enable each other's businesses in a win-win solution: Tailorlux tracers rely on Circularise's protocol and vice versa. Weaknesses however incur when considering that key activities, namely the digitalization of recycled content certificates, are not yet automated in the start-up's processes. The tracing solution not being proprietary is also a potential weakness for Circularise, as it opens the door for competitors to replicate it, or collaborate with Tailorlux directly.

Regarding customer segments, relationships and channels, the start-up has a good customer segmentation, but direct relationships only with the material manufacturers, Summit Company.

Co-creation activities and **direct sales** contribute to tightening this relationships, making it one of Circularise's strengths. On the opposite side of the matrix, however, the indirect interaction with OEMs (Inditex), the presence of three non-paying customer segments (Inditex, end users and textile recyclers) and the lengthiness of direct sales processes all constitute weaknesses for the start-up.

Threats

Threats to value propositions mostly come in the shape of substitute products, or cheaper alternatives from competitors. In Circularise's case, current risks are low, but industry-specific solutions could be developed by **in-house ventures**, increasingly common in all industries, as evident from a quick desk research (Brigl, 2017).

For revenues and costs, instead, according to Osterwalder's findings, threats come in the shape of an excessive dependence from one type of revenue stream and emergence of competitors and in the shape of unpredictable cost risings. The latter is not an issue for Circularise, but the dependence on one type of revenue stream, the **pay-per-use,** is undeniable. Another point of attention that could become a threat for the start-up's revenues is the attractiveness of the market they're working for. Sustainable business models are lately on the rise and might end up reducing Circularise's market share and revenues (Bonini, 2011).

Threats related to resources, activities and partnerships are disruption in the supply of resources, worsening quality of activities and the eventuality of partners collaborating with competitors. Circularise's activities don't seem to be subject to any threat in the short and long term, but the same cannot be said of resources and partnerships. Tailorlux is in fact free to collaborate with the start-up's future competitors, as their material marking solution can be easily used by other parties than Circularise. Lastly, as far as resources are concerned, the certificates of recycled content provided by the Control Union might become, for Circularise, more difficult to digitalize. Control Union, in fact, loses potential entrances due to the start-up's activities: where earlier companies would need to request several certificates for a same material batch, with Circularise's protocol this number is reduced to one certificate. Control Union might, as a consequence, take actions against Circularise.

Regarding the last three blocks of the canvas – customer segments, channels and customer relationships – the most common threats are market saturation, the emergence of competitors, irrelevance of channels and deterioration of customer relationships. The only threats that

Circularise is likely to be facing here are related to the customer segments. In a slow moving industry, such as the fashion one (and the automotive as well), the start-up might in fact not face market saturation quickly, but on the contrary it might take Circularise an extremely long time to get a reasonable share of said market. Competitors, as mentioned above as well, are likely to emerge as well.

Opportunities

Identifying opportunities for the value proposition means looking at possibilities for products servitization, product service integration, satisfying more customer needs and considering complements or extensions to the current offer. For Circularise, this could suggest the creation of **more targeted offers**, specifically aimed at a company, instead of industry, and the opportunity to help the companies they work with in reaching internal – or European – **targets** for the use of recycled materials. The abundance of materials that can be traced suggests opportunities for expanding such range, unsurprisingly so, as this is the very opportunity that stands behind this project as a whole. A wide-spread uncertainty around the availability of recycled materials could also be a way for Circularise as it would satisfy a different customer need (Biddle, 2019). As complements or extensions to the current offers, Circularise could, for example, diversify their offer depending on the material they are tracking.

Opportunities around revenue streams are usually creation of different revenue streams, or replacement of one-time transactions with recurring payments. Given that Circularise is already using a recurring payment mechanism –their pay-per-use system – creation of different revenue streams seems more interesting. One way to achieve this could be by introducing **subscription fees**, that are anyway becoming increasingly common in the B2B scenario (Sopeltseva, 2019).

As far as key resources are concerned, opportunities revolve around better exploitation or sourcing. The start-up is for now leveraging only on one type of sustainability related certifications, the certificate for recycled content. However, many **more certifications** exist that Circularise could exploit. Key partnerships opportunities come in the shape of exploiting partners' channels, enhance the collaboration practices and chances of outsourcing. For Circularise, enhancing collaborations could be a promising route to take as a way to gain more data about recycled materials on the market.

Lastly, opportunities revolving around customer segments can imply a finer segmentation of

the market, or expanding the range of targeted customer segments. Benefiting from growing markets can also be considered an opportunity related to customer segments. For Circularise, this suggests the option to focus their business model around the **most profitable customer segments**, for example, in the textile industry, fashion brands and companies like Inditex, Nike, H&M and other (Amed, 2019).

Summing up

Taken as a whole, the SWOT analysis shows the presence of blocks, in Circularise's business model for textiles, that are slightly weaker or open to more threats. These are the customer segments, weakened by the presence of many different client groups that bring no revenues to the company. The indirectness of the interaction between Circularise and some of their B2B customers – OEMs – can also be taken as a point of improvement for the start-up.

The SWOT analysis also helps in distinguishing which blocks of the business model canvas are least problematic, or stronger. These are mainly the key activities, customer relationships and cost structure. Activities, resources and costs are in fact the areas of Circularise's business model that are already optimized to their best and as such do not show many weaknesses and don't let the start-up exposed to many threats.

Opportunity areas

After each block of the business model was analysed, strengths, weaknesses, threats and opportunities were examined altogether and matched when compatible. This gave rise to a few so called "*opportunity areas*", listed below.

The detail of which strengths, weaknesses, threats and opportunities match together is included in the appendix (see Appendix #4).

1. Development of industry specific solutions instead of material specific

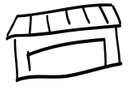
This opportunity area is interesting because in any industry, be it the fashion one or else, the range of materials used differ greatly. While still increasing the number of materials they can track, Circularise could profit from the knowledge gained on these industries by offering solutions targeted to other pain-points around materials sourcing or information transfer.

2. New offering to aid companies' target monitoring activities

As touched upon above, targeting other pain-points in the industry could be interesting. From further research it emerged that companies have internal targets around the use of recycled materials (Doyle, 2018). In addition to that, targets are often imposed by governmental bodies (European Commission, 2018). Circularise could expand their offering to aid companies with target-monitoring activities.

3. Diversify certification range per industry

Given the wide amount of materials that compose products on the market, it is evident how certifications also span wider than just focusing on recycled content. Digitalized certificates of CO_2 content, human rights compliance, responsible sourcing and even guarantees on refurbished parts could be added to the offer.



4. Development of offers targeting OEMs instead of materials manufacturers

This opportunity is one that Circularise is already very conscious of, but does not leverage enough, as priority goes to the development of material tracing systems and to the pilots currently running. However, offers targeting specifically OEMs could prove to be a profitable way to expand their business and generate new revenue streams.

5. New revenue streams from new offerings

As far as revenue stream are concerned, developing new offers could also be addressed at material manufacturers, or any other actor in the different value chains. For example, Circularise for now does not work with Tier 1 or Tier 2 suppliers, who could instead prove interesting to target directly in a near future.

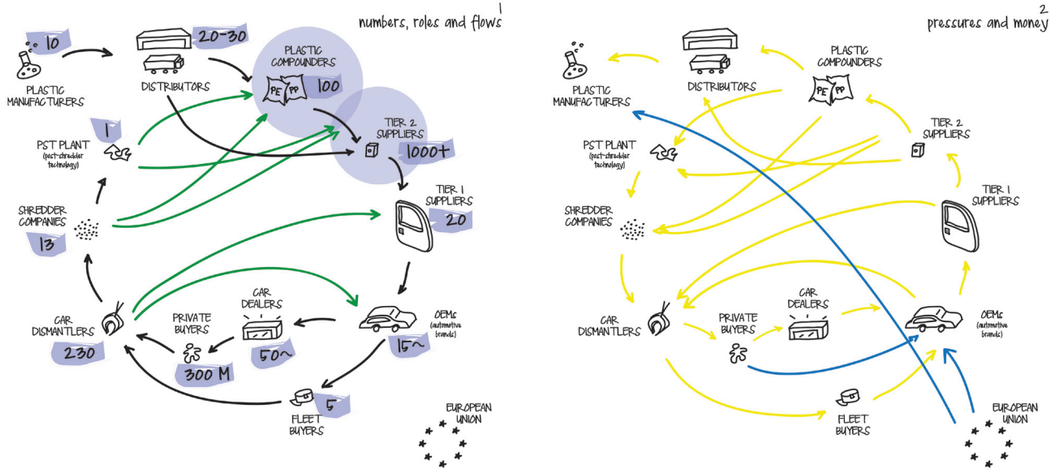
These opportunity areas could all be part of the final design, but a further selection of them would help the design solution to be more focused.
As a consequence, once these opportunity areas had been drawn, by only looking at Circularise's current situation in the textile industry, the time came to look back at the automotive and plastics industry and identify key players there. Such key players, or player, would be in fact the best choice of customer segments to target in the new business model for plastics and automotive.

System maps

The same desk and literature research conducted to verify the three crucial assumptions (see Chapter 3) also allowed a comprehensive mapping of the automotive industry as a whole. This chapter presents the results of such activity, in the shape of four visual maps.

The first shows the **flow of virgin and recycled materials** between the different stakeholders and gives some approximate numbers of actors in the chain.

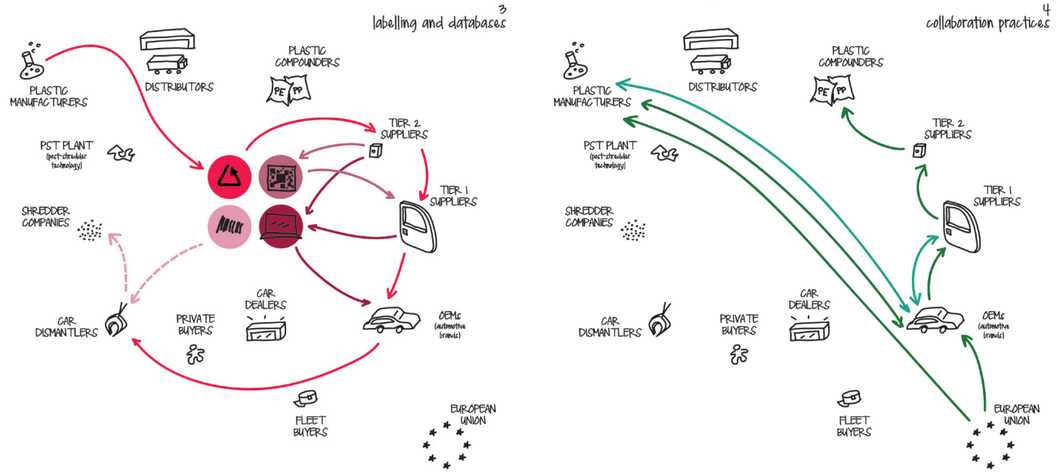
The second features monetary exchanges and **pressures for adoption of environmental measures**.



The third highlights the existing **tracing** systems and **databases** existing in the automotive industry.

The fourth and last focuses on **collaboration practices** between stakeholders.

Each map highlights and explains which actor, out of the thirteen present in the industry (see p.55) is more influential, or relevant. Conclusions of the four maps will then clarify which actors are most promising as customer segments for Circularise's new business model.



Map 1: Numbers, roles and flows

The first map gives a first overview of the supply chain for plastics in automotive. Stakeholders are mentioned and an approximation of their numbers is given, with references to the European and Dutch context.

Materials flows are outlined in different colours, for virgin and recycled streams.
An interesting finding that emerged from the research is also illustrated on the top right bubbles. Several companies, in fact, operate both as plastic compounders and as Tier 2 suppliers, creating an overlapping between different competences.

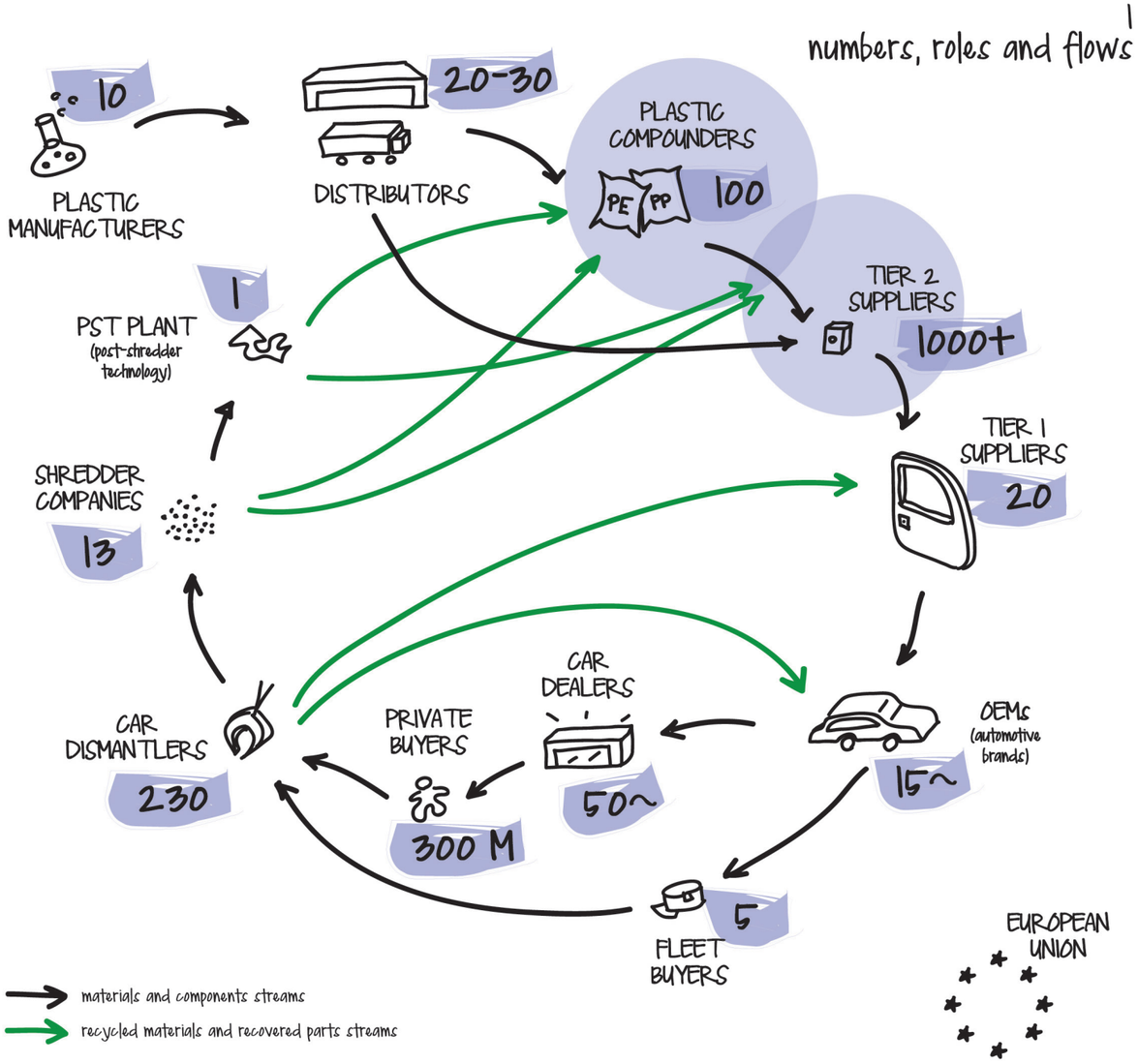
Most relevant aspect that can be observed from this map is how recycled materials streams – the green arrows – are not inputted in the system by plastic manufactures. This is due to the fact that the recycled materials' market is not as established and scaled as the virgin materials one, the profitability is much lower and the request as well. Plastic manufacturing companies, that are mostly chemical industry giants, such as DuPont, Monsanto and Mitsubishi, do not then have the flexibility and agility to incorporate materials recycling in their offer:

"We are not that entrepreneurial on a small scale [of recycled materials ED]. On a huge scale, yes, on a small scale, no." (Design and Innovation, Plastic Manufacturer).

This is potentially interesting for Circularise, as their protocol for tracing materials along the value chain, if applied to plastics, could make **sorting and recycling easier and more effective at a bigger scale** too. This would provide the start-up with a potential new client, as plastic manufacturers could then incorporate recycled materials in their offer.

Key stakeholders in this map

Plastic manufacturers



Map 2: Pressures and money

This second map focuses on the flows of money and on existing pressures, in the market, for stakeholders to implement sustainability measures.

The most interesting insight that is visible by looking at the **money flows**, that derive from contracts between stakeholders, is that the supply chain is, indeed, very fragmented. Automotive brands, in fact, have no direct client relationship – graphically shown by the arrows – with any other than their tier 1 suppliers. Money and contracts are important in a supply chain because they imply **influence**:

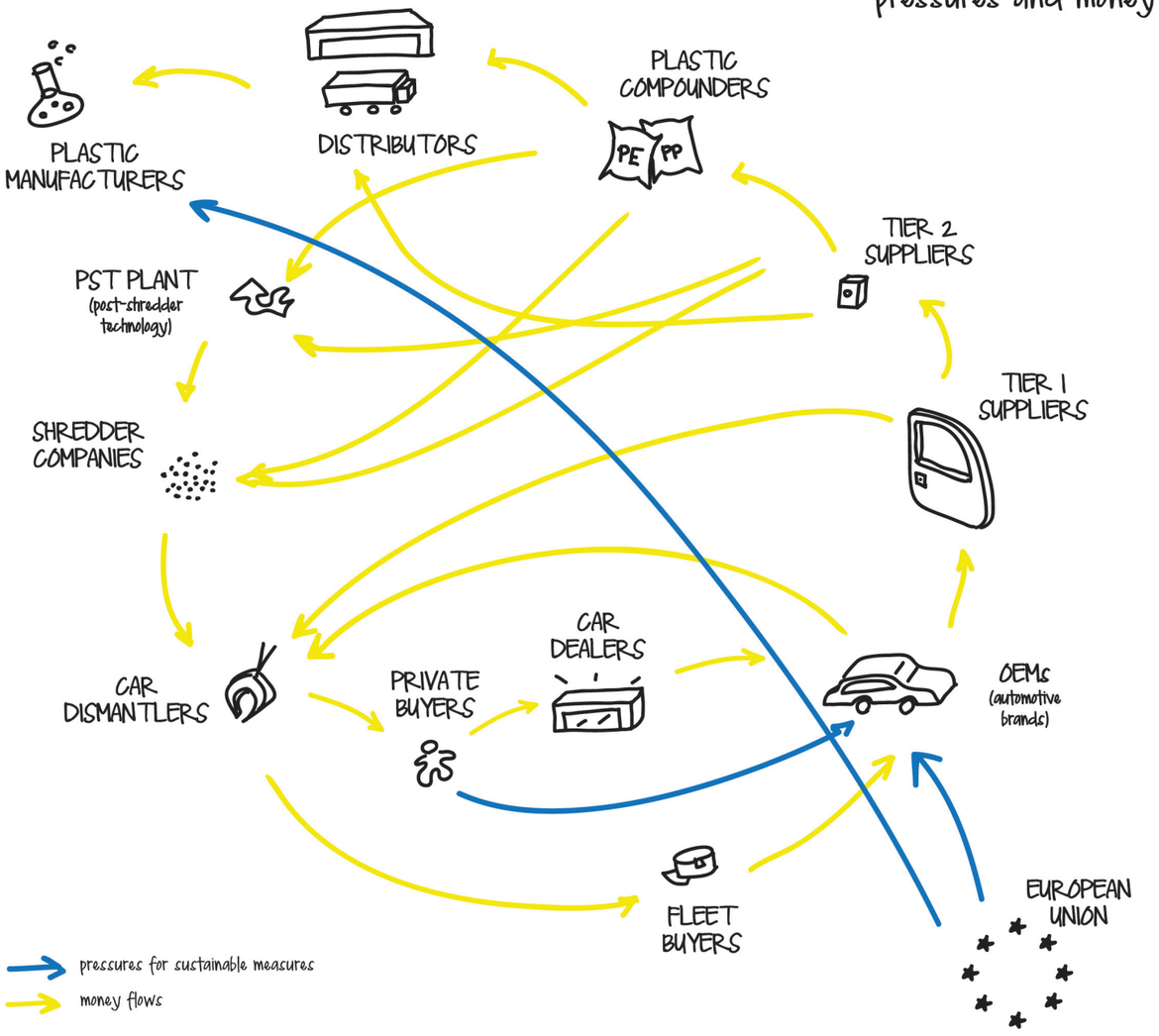
"We have quite some influence on our Tier 1 suppliers, but Tier 2… no." (Director Environment and Innovation, OEM).

The tier 1 suppliers only act as clients for their tier 2 suppliers and so forth. However, automotive brands are also, when it comes to the production of vehicles, the party that starts the whole chain. Contractual requirements ripple down from them to Tier 1 and from Tier 1 to Tier 2 and so forth. If Circularise were to target their new business model towards automotive companies, these could make sure that the start-up's protocol was adopted by all downstream actors necessary.

When it comes to pressures for **sustainable action**, it's important to notice how OEMs feel it coming from both buyers and the European Union, and plastic manufacturers mostly from the European Union. Such pressures make the two stakeholders the most interested parties to work towards circularity and sustainability.

Key stakeholders in this map

Plastic manufacturers and OEMs



Map 3: Labelling and databases

The third map shows how the existing labelling standards and databases connect the various actors and travel along the supply chain. For more details on the labels and databases mentioned, see Chapter 3 p.58. It is interesting to note here that there is **no traceability between plastic manufacturers and distributors**.

"Commodity plastics, once they're at the distributor, they disappear." (Design and Innovation, Plastic Manufacturer).

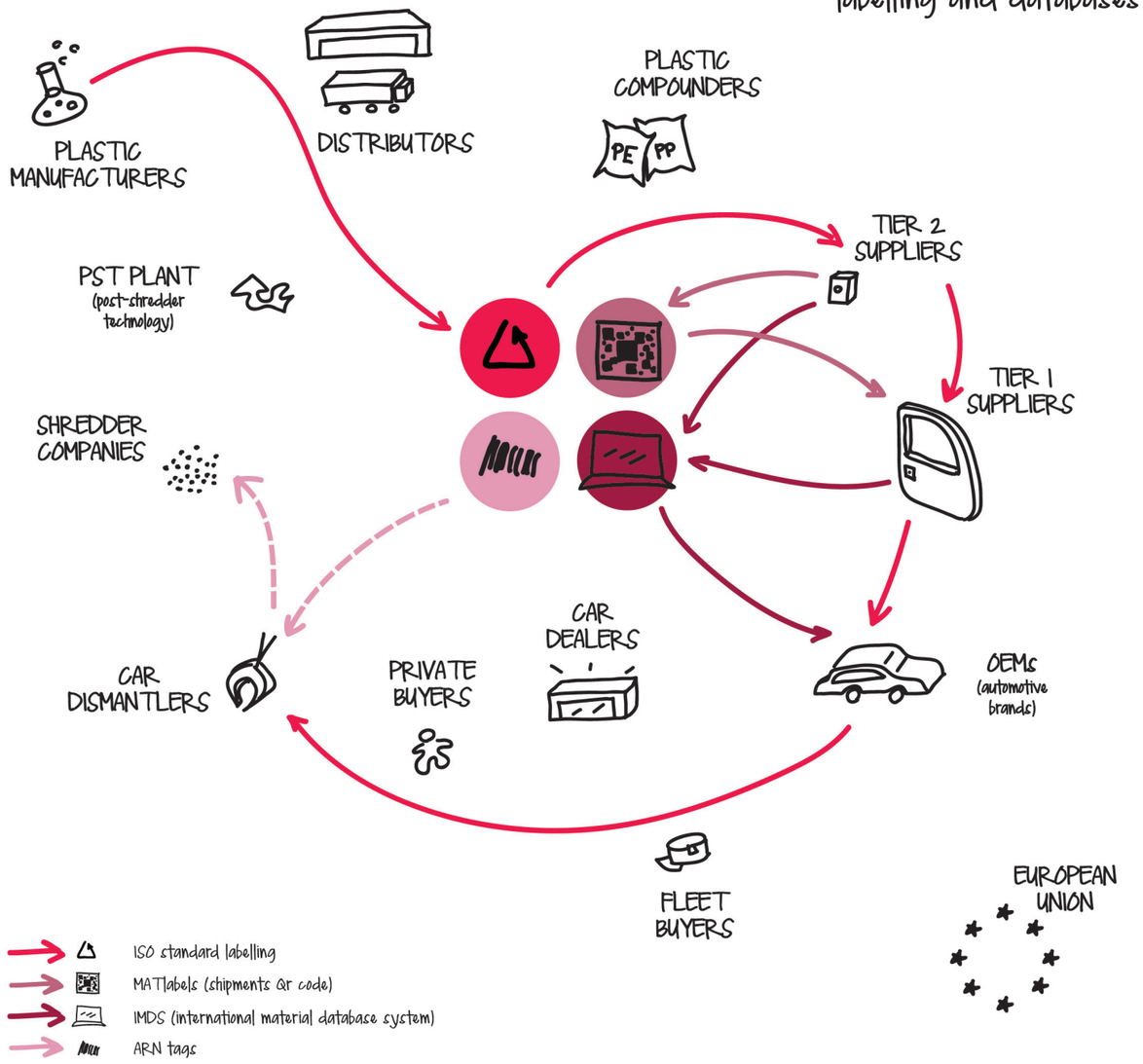
This is a pretty interesting gap for Circularise to fill, as without such tracking OEMs cannot make fully verifiable claims about the materials they use.
Furthermore, there is, in the automotive market, a desire to possess verifiable information, as the IMDS shows (see p.58). Referring to what was mentioned in the previous chapter, in fact, the IMDS is a quite comprehensive database of materials, founded and used by most automotive companies in the world. However, plastic manufacturers do not have access to it and material information is filled in by tier 2 suppliers, skipping several actors in the chain.

Additionally, *"sull'IMDS si lascia una certa libertà quindi non sei costretto a mettere così una ricettazione precisa" [there is a certain freedom on the IMDS, so you don't really have to insert such a precise recipe] (Key account Sales, Tier 1 supplier).*

This **dilutes** the **directness** of the information flow from material manufacturers to automotive OEMs, as well as its **accuracy**. OEMs are in fact at the receiving end of the IMDS information flow, and they are, as the database's promoters, the most interested in its detailing and accuracy, which they use to make claims and communicate specifics about their vehicles. Circularise's protocol could then make it easier for automotive OEMs to have better and more direct information on the materials that constitute the vehicles sold.

Key stakeholders in this map

OEMs



Map 4: Collaboration practices

This last map shown here on the right highlights which stakeholders collaborate more with each other during their respective product development phases.

Materials are in fact often designed together between OEMs, first tier suppliers and manufacturers.

"We don't have a say in the materials, OEMs decide with plastic manufacturers and the Tier 1 suppliers." (Sales manager, Tier 2 supplier)

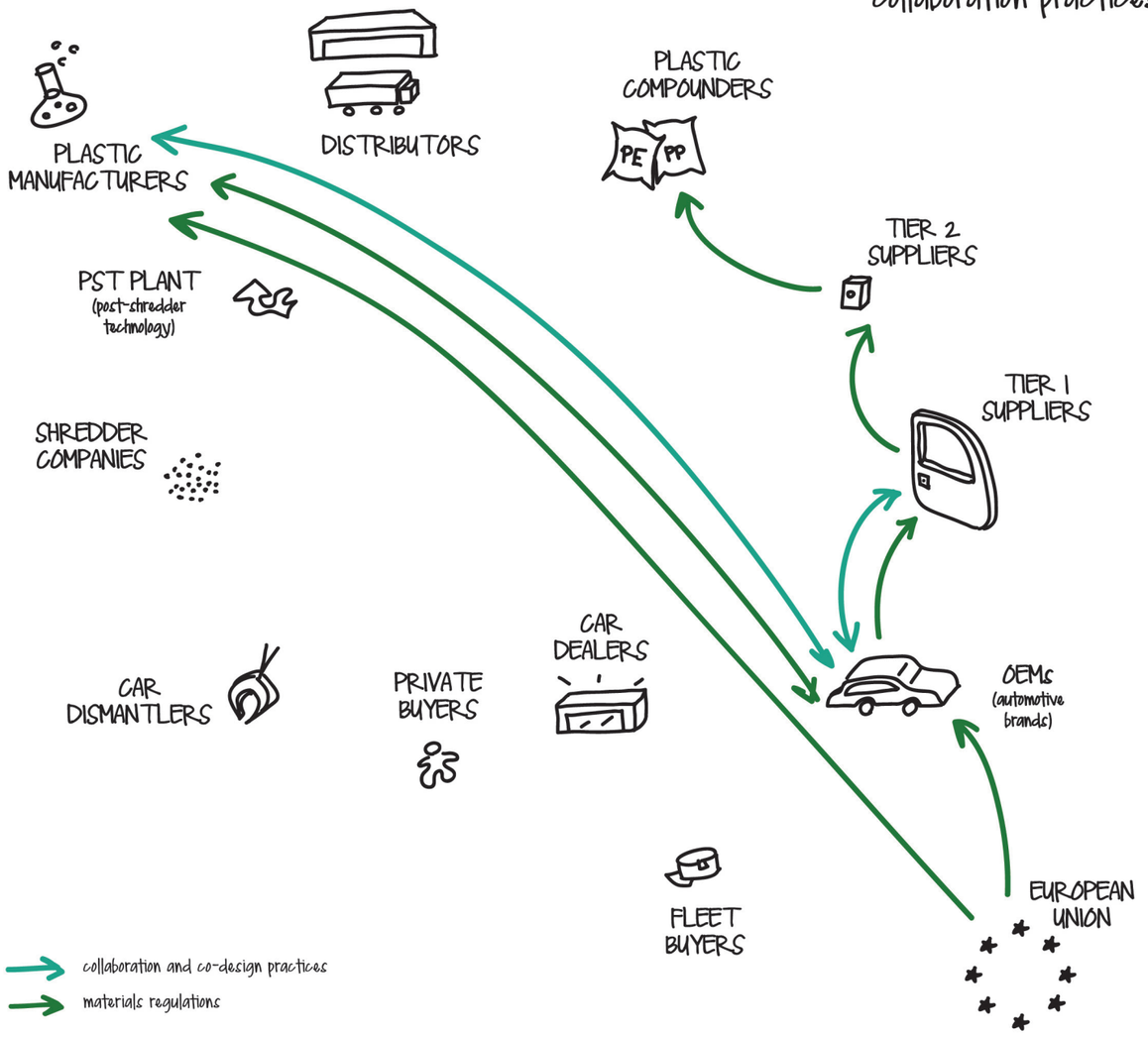
OEMs and plastic manufacturers collaborate as well by **aligning their roadmaps** for materials use, so as to facilitate the dynamic between offers and demands. This synergy between material manufacturers and OEMs could be interesting for Circularise to leverage on, since, already in the textiles sector, their protocol allows for more direct information exchange between these two players (Summit Company, the textile manufacturer, and Inditex, textile OEM).

Regulations on materials that can be safely used in the market come from the European Union in the form of specifications. These affect both **OEMs and plastic manufacturers directly**, and the rest of the stakeholders indirectly.

"The European Union acts at the beginning – so us – and at the end of the value chain – so OEMs." (Sustainability Leader Polymers, Plastic Manufacturer)

Key stakeholders in this map

Plastic manufactures and OEMs



The key players in the field

The analysis conducted via the system maps showed the emergence of two key players in the value chain under examination. These are automotive OEMs and material manufacturers.

Automotive OEMs in fact are a key player when looking at money flows and the influence they carry with them, pressures for environmental measures, the importance of labelling and databases and collaboration practices with the rest of the industry.

Plastic manufacturers, instead, show their relevance for Circularise when looking at material flows, pressures for sustainable measure and collaboration practices.

The new business model that is to be designed for Circularise could target both these actors. However, according to Osterwalder's method, designing a business model around one specific customer segment makes sure the offer is more focus and well defined (Osterwalder, 2010). The next step in this graduation project was then deciding on one of the two key actors, by looking back at the opportunity areas identified and by using another tool, the environment mapping described in Chapter 1 (see p.28).

Environment mapping

In order to remain coherent with Circularise's current market, only the European automotive industry has been examined. The complete environment mapping is included in the appendix (see Appendix #5), divided in the four key areas of market forces, industry forces, key trends and macroeconomic forces. In this paragraph only those insights that contributed to the choice of one key actor to target as customer segment are mentioned.

The analysis on **market forces** brought into attention the difference between needs and demands of plastic manufacturers and automotive OEMs. The latter, in fact need to have a

complete overview of the materials present in their vehicles to fulfil the requirements of end of life producer's responsibility regulations (Kumar, 2004). This results in a strong demand for information from the suppliers that takes shape in the IMDS system. Plastic manufactures have no such necessity, as they do not deliver finished consumer products to a B2C market.

Looking at **industry forces**, instead showed a lack of competitors for Circularise, other than automotive OEMs' traditional way of monitoring suppliers via third parties or internal audits. Plastic manufacturers, on the other hand, are developing their own recycling techniques that, once scaled to market size, could make Circularise's protocol – that aims at better waste sorting to increase quality of recycled materials – irrelevant.

Key trends shine once again the spotlight on automotive OEMs, as regulations on recycled content are being pushed onto automotive companies and suppliers by the European Union and national governments alike. On a socioeconomic level, new conglomerates are taking shape: on Monday the 27th of May, FCA proposed a 50-50 merger to the Renault group (Gapper, 2019). This action will result in creating a huge OEM player, with a strong base in the European market. The perspective of a client the size of FCA and Renault combined seems potentially interesting for Circularise as well.

Last but not least, the analysis of **macroeconomic forces** shows that material manufacturers are increasingly shifting towards incorporating sustainable measures into their products and plastic manufacturers make no exception, as the growing research on bio-plastics shows (European Bioplastics, 2019). These factors would make them more susceptible to Circularise's offer.

Choice of one actor

Taken as a whole, however, the environment mapping reveals that potential in the automotive and plastics value chain can mostly be found in targeting automotive OEMs. The pressure put on them from governmental institutions towards being sustainable, coupled with that exerted by buyers, the emergence of new conglomerates and growing buying power that comes with these seem to both push and allow them to invest more in sustainability-related offerings. The needs and demands for materials information in the automotive market also fit very well with Circularise's key activity of certificates digitalization. Finally, the lack of competitors already in the market leaves the door open for Circularise.

A last consideration needs to be made regarding the opportunity areas earlier identified. Choosing automotive OEMs as the targeted customer segments fits in fact perfectly with the fourth opportunity area, that showed how developing offers targeting OEMs directly could be advantageous. Other opportunity areas that fit with targeting automotive OEMs are the first and second. Developing industry specific solutions could work well with automotive brands as it would help Circularise in offering more tailored solutions, specific to the automotive industry, rather than to the material, plastics. Lastly, it already emerged from desk and field research that automotive OEMs have internal goals for the use of recycled materials. Circularise could easily use their protocol to help companies in automating and optimizing target monitoring activities.

Due to all these different considerations, **automotive OEMs** were then the chosen customer segment around which the new business model for Circularise was built during the design phase of this project.

According to Osterwalder's method, the most natural order in the design of a business model, once the customer segments have been identified, is to create a value proposition that meets the customer needs. To that avail, one last tool from the Business Model Generation proved then to be useful in order to design a relevant value proposition to target this customer segment. Said tool is the empathy map, whose use is showed and explained below.

Empathy map

The empathy map, described in Chapter 1 (see p.26), is an easy way to collect all insights coming from both desk and literature research and turn them into an actionable starting point for designing solutions. developed for a B2C context, empathy maps can also be translated to B2B, by relating the insights gained through research to a specific user. In this case an Innovation and Environment manager was chosen as focus. The complete empathy map is shown in the figure below (Figure 4.1).
The map was used as a **basis to generate ideas** for the new value proposition. While that is explained, together with the rest of the business model, in the following chapter, here below is a short explanation of how the empathy map started the design iterations already mentioned in Chapter 1 (see pp. 30-32).

The different fields of the empathy map, as can be seen from above, were filled with insights from the research and gave way to the first version of the platform. Relevant insights were used to define user needs, such as for example confidentiality, and design platform screens that would address them (for example, for the confidentiality need, a login screen was designed).

Fig. 4.1
Empathy map for automotive OEMs

Chapter 5
The new platform and business model

In this last chapter the final deliverables of the project are presented. First, the **value proposition** designed is explained. Then the design solution, in the shape of a **digital platform** for automotive OEMs, is showcased and justified. From there, the new proposed **business model** is built and explained block by block. The final considerations, at the end of this chapter, revolve then around the **costs and pricing** of the design solution.

The value proposition

The value proposition designed was built after three design iterations. The design iterations – the overview of which is featured in Chapter 1 – were conducted by prototyping potential screens for a digital platform that would embody the final value proposition. Each prototype was then tested with experts from automotive OEMs and Circularise founders, to receive feedback on the proposed offering. Three iterations conducted in this way resulted in a coherent and desirable value proposition, that could leverage Circularise's technology to offer automotive OEMs tailored information on their use of recycled materials.
The value proposition designed is then the following, parted in three sections.

For automotive OEMs, Circularise will provide an overview of their effective use of recycled materials that fits into the companies' current ways to look at their vehicles.

Furthermore, it will aid them in reaching their internal targets and the ones imposed by regulations around the use of recycled materials, by providing them with a way to visualize their progress.

Finally, Circularise will support the automotive OEMs' efforts to use recycled materials by giving them knowledge about their availability on the market.

All three parts of the value proposition will be enabled by the uniqueness of Circularise's technological protocol. The overview of effective use of recycled materials will in fact be possible thanks to Circularise's **partnership with material manufacturers** and their material **tracers**. The information collected in this way will also make it possible, for the start-up, to provide automotive OEMs with an overview of their progress in reaching internal targets that relies on precise data instead of estimates. Last, but not least, Circularise's partnership with **recyclers** will allow the start-up to gather data on the materials available on the market and securely provide them to automotive OEMs, boosting the recycled materials use right from the design phase.

This value proposition was then again, just like during the design iterations, embodied in a digital platform where automotive OEMs can access the data Circularise will provide. The next section shows the different screens of the platform.

The platform

Interactive version: https://projects.invisionapp.com/prototype/cjwdul07o006f3z01x4yfy1i2/play

First screen is the **login** page. A user profile is required, inside the company, for reasons of accountability and to ensure confidentiality of the information featured in the next screens (Figure 5.1).

Further and more elaborate considerations on the kind of professionals the platform caters to will be included in the next section, when mentioning the customer segments of the proposed business model. For now, it might suffice to say that the intended users are managers in the Sustainability, Recycling, Regulations and Purchase departments.

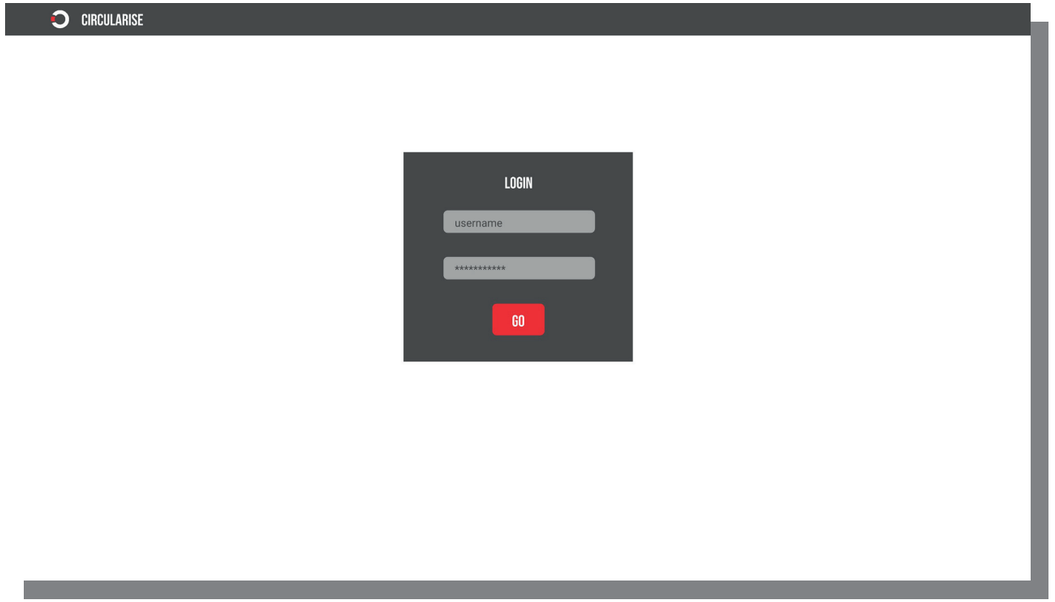


Fig. 5.1
Platform's login screen

The screen **Recycled Content** shows the envisioned design solution sprouted from the opportunity area of providing automotive OEMs with an industry specific offer (Figure 5.2). The recycled content of materials is in fact showcased in a way that, from the design iterations (see Appendix #6) emerged to be most coherent with the industry standards. Vehicle lines are the higher level categorization. Each vehicle line keeps the separation between Interiors, Exteriors and Under the Hood. Material batches have been integrated for each of these three segments.

Future design iterations could surely investigate in even more detail the relevance of more information on the recycled materials properties, or other characteristics. However, for the purpose of this design solution, relevance was given mainly to how information on recycled content should be displayed.

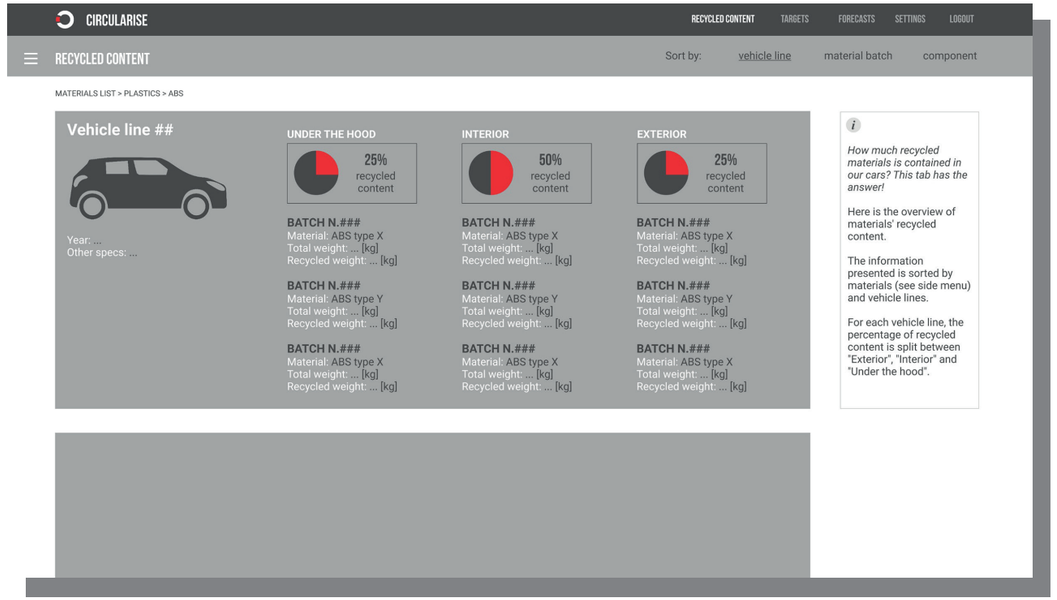


Fig. 5.2
Platform's recycled content screen

The screen **Targets** helps automotive companies in maintaining an eye on the goal and in monitoring their progress. Internal targets are accompanied by European and national targets (Figure 5.3). The two bars below offer a quick visual overview of the conversion from virgin to recycled feedstock and of the total amount of recycled material used. The choice was made to allow for looking at the second dataset on a yearly and quarterly basis.

For future design iterations, in fact, this might prove to be interesting data for the automotive OEMs, as they could observe the kind of fluctuations the Advanced Regulations and Global Recycling manager was mentioning while giving feedback on the second design iteration (for all design iterations, see Appendix #6).

As a side note, the targets examples in Figure 5.3 are fictitious.

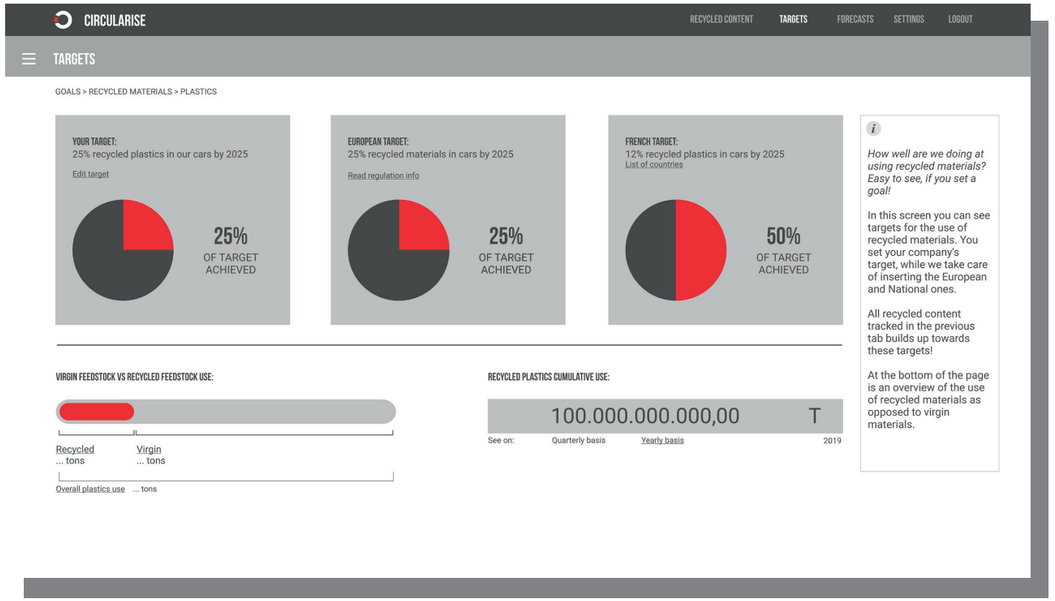


Fig. 5.3
Platform's targets screen

Lastly, the final screen that embodies the value proposition is **forecasts** (Figure 5.4). This data helps automotive OEMs in choosing to use recycled material. Particularly, the material procurement department could benefit from direct access, while departments that try to drive sustainability and recycling throughout the company could use these forecasts to campaign for the use of recycled materials.

The forecasts on availability of recycled materials can be obtained by knowing, for every year, the amount of cars that end up at car wreck yards and the recycling rate of the materials they are made of. The data the platform already shows in the first tab Recycled Content, could also, in a later stage, feed into these calculations. Evidently, for Circularise to gain this kind of data, some degree of cooperation with car recycler seems necessary.

The next paragraph will dive deeper into what is requested for the proposed platform to be feasible and viable.

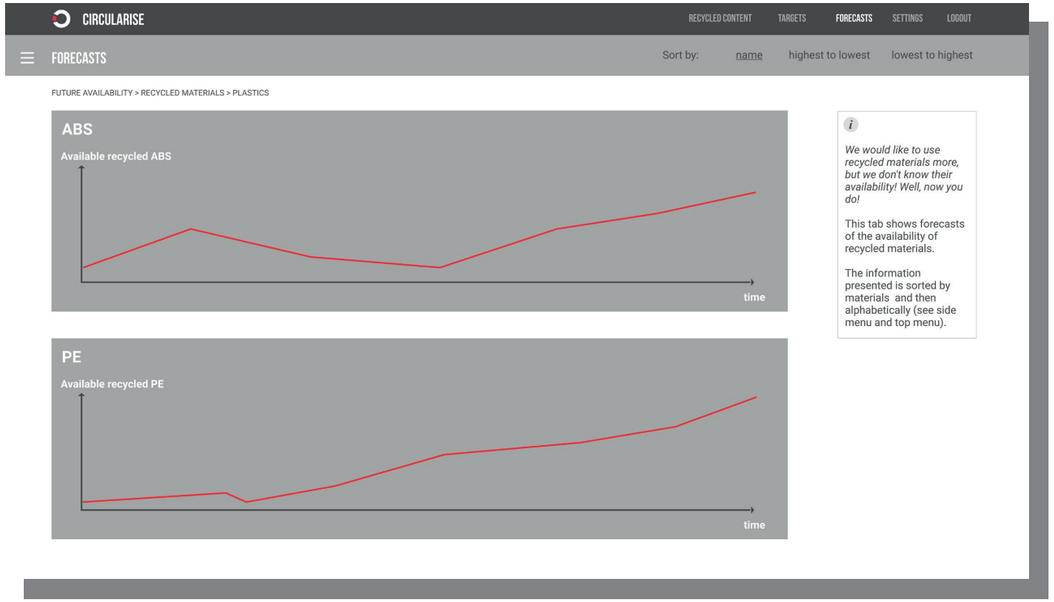


Fig. 5.4
Platform's forecasts screen

The new business model

This paragraph will argument the business model designed around the value proposition shown above. The Business Model Canvas (Osterwalder 2010) will again be used as a guide and each block will be explained individually. More extensive considerations in terms of costs and pricing will be featured afterwards, with a best and worst case scenario analysis, to ensure the financial viability of the design solution (Figure 5.5).
As a final introductory remark on the business model below, **key assumptions** need to be clarified.

1. The **tracing technology** that will allow to track plastics along their life cycle is assumed to be, in its nature, **comparable to the one used for fabrics**. As a consequence, no collaboration from intermediate actors on the supply chain is required. Communication of recycled content will, so to say, flow directly from the plastic manufacturer to the automotive OEM.

2. Circularise's **business model towards material manufactures and recyclers** is assumed to remain **unchanged**. As a consequence, material manufacturers will still be billed according to usage of the system, so per kilo of material certified to enclose recycled content. Correlated assumption is that the costs Circularise's current business model already considers (see cost structure p.16) will be covered by the revenue streams originated by that same business model.

3. Last, but not least, the proposed business model is **not assumed to be implementable in the short term**. A critical mass of plastics will, in fact, need to be traceable before Circularise starts to target the automotive OEMs customer segment. Most reasonably, an upcoming pilot project that will take place with Domo and Covestro, two plastic manufacturers, could already include an automotive OEM, but a few years will be needed before the whole solution could be scaled to market size.

4. All considerations and calculations are based on the **European market** alone and Europe is considered as one single market region.

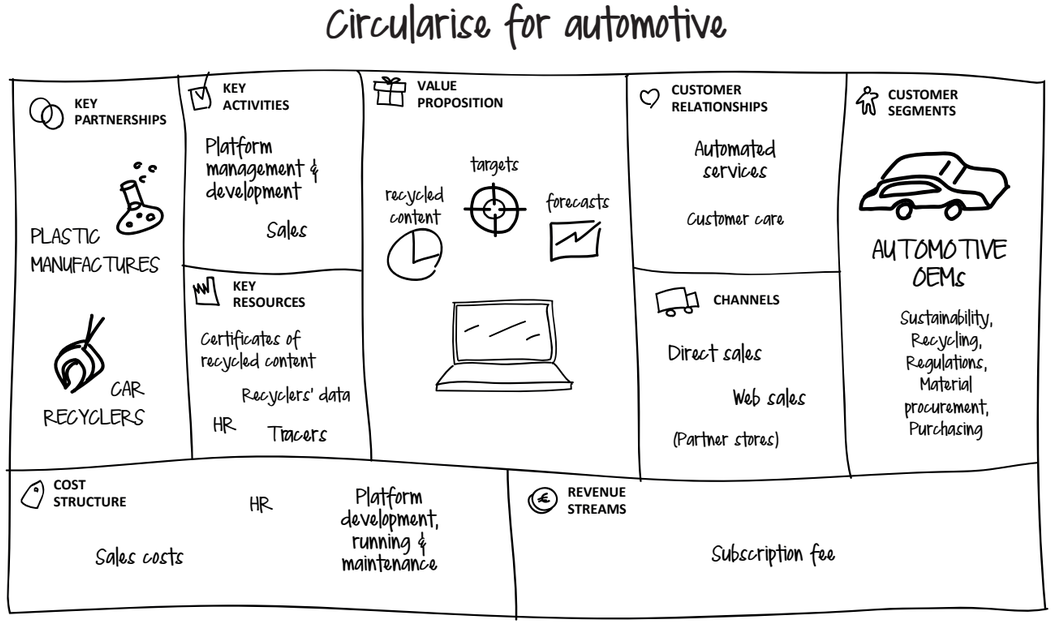
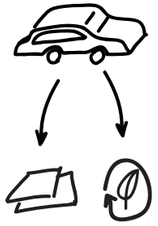


Fig. 5.5
The new business model for Circularise in the automotive industry

Customer segments



Automotive OEMs are the customer segment this business model revolves around. The departments targeted in the value proposition are those that take care of **Regulations, Sustainability and Recycling** initiatives as well as the **Materials Procurement or Purchasing** department. Depending on the company, the first department can be a single entity, or four separate departments, as it emerged from a quick LinkedIn search. Managers can be then appointed by country, or region, depending on the size of the business.

Such differences are important to consider for estimating the **number of users** the platform could have. In the European market, 15 separate automotive groups operate (Bekker, 2019). In the best case scenario, each group has four departments that can be targeted and each department has at least two managers who could become users of the platform. That would result in a total of 15x4x2=**120** potential users. In the worst case scenario, instead, each group has only two targetable departments, each with only one manager. That would make consist in a total of 15x2=**30** potential customers.

Channels

In order to identify the best channels for Circularise to reach the abovementioned customer segment, two types of considerations have been made. The first one regards the existing typologies of channels, as described in the *Business Model Generation* (Osterwalder 2010). The second one regards established patterns in the automotive B2B market.

The table on the next page (Table 5.1) shows the different types of channels existing and evaluates their potential along the five phase of the sales process: awareness, evaluation, purchase, delivery and after sales (Osterwalder 2010). Evaluation is defined on a scale from 0 (no fit) to 2 (fit). The numbers have been assigned following the reasoning explained afterwards.

		PHASES	TYPES				
			awareness	evaluation	purchase	delivery	after sales
own	direct	sales force	2	2	1	1	1
		web sales	1	1	2	2	2
	indirect	own stores					
partner		partner stores			0		
		wholesaler					

Table 5.1
Channel types and phases

Own stores and wholesaler have no fit as channels in the proposed business model. Own stores would require an additional investment and would not be relevant for Circularise's activities for anything else than sales. Wholesalers are of little to no relevance in the context of digitally based, proprietary solutions. The platform should have its own domain and not be available for customers through general indirect channels.

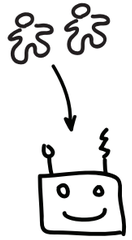
The best fitting solution for selling the platform to automotive OEMs, however, is through direct sales, namely sales force and web sales. A **sales team of at least two people** per geographic area could allow Circularise to reach its customers more quickly and build better personal relationships in the awareness and evaluation phases. After these stages, online channels would prove to be more effective and cost efficient for the purchase, delivery and after sales.

Established patterns in the industry confirm how business to business

transactions are mostly driven by direct sales. Data to prove this pattern can be seen in the third design iteration (see Appendix #6). Several of the software presented in that table has in fact a direct sales option for large size enterprises. Furthermore, the interviews conducted during the initial research phase, showed how relevant the role of the sales department is in maintaining and growing the customer base. One of the Sales managers interviewed gave an overview of how sales towards their automotive customers proceed:

"When I look for new customers the first approach is by telephone, and then there's visits at their site to talk about our possibilities". (Sales manager, Tier 2 supplier)

Circularise's channels, then, for this business model should expand to include a small sales team, able to reach out to customers in Europe directly.



Customer relationships

Direct interaction of the **sales team** with the prospected customers, should be focused in the initial stages of on-boarding the platform and eventually on after sales customer care. For the rest, once scaled to market size, the platform's services should fall under the category of "**automated services**". Automated services are those services that "*... can recognize individual customers and their characteristics, and other information related to orders or transactions*" (Osterwalder 2010).

Revenue streams

The revenues originating from the platform should complement the revenue streams from material manufacturers. As such, instead of a pay-per-use system, that could still apply to plastic manufacturers, as it does for textile manufacturers (see p.44), automotive OEMs should pay a **subscription fee**, as is common for digital services in general. Billing would be annually and each user profile would count as a single subscription. Considerations on the prices of the platform will conclude the description of the business model and can be hence found below. Customer care services could be priced separately,

or be included in the total subscription price. Again, considerations on this will follow afterwards.

Key partnerships

Two key partners are required for this business model to be feasible. **Plastic manufacturers** should partner with Circularise and co-develop a plastic tracing solution that will allow the material to be tracked directly, as explained in the introductory assumptions to these paragraphs. **Recyclers** should partner with Circularise to allow for data on materials' availability to be communicated in the Forecasts tab of the platform.
Both these parties will gain advantages from the collaboration. Data from the European Union, in fact, shows how the availability of recycled plastics in the market is not equalled by the demand of it (European Commission, 2019). Reassuring automotive OEMs of the recycled material's availability will contribute to the demand meeting the offer and will positively impact the market.

Key activities

Key activities for Circularise in this business model revolve around the **platform development and maintenance**. In the initial stages, **sales** will also count as a key activity.

Key resources

Key resources, as visible in the illustrated canvas, will be the **plastic tracing technology**, **data** from recyclers and **certificates** of recycled material content. Human resources as well will be crucial for the start-up.

Cost structure

Costs incurred will then depend on the **platform** development and management, necessary **human resources** and again on **sales**. While the first

two types of costs are quite self-explanatory, it might be useful to specify that sales costs usually comprise travel expense to visit clients, or admission fees to events and conferences. Costs from a support team will also play a role, especially in the first years of the platform's launch. Both sales and support team, according to Circularise's expertise could consist of two full time employees each.

Cost price analysis

To establish a pricing for the platform different considerations were made.

First a comparison was made between the platform's offer and existing software and digital platforms used in automotive. These proved to be not a good enough comparison, given the peculiarity of Circularise's technology and the designed platform's offer.
As a consequence, an investigation was made into what the investment would be for Circularise to develop and run the designed platform. This allowed to calculate the desired ROI (return on investment) of the project. This number formed the basis of a pricing proposal, defined on two scenarios – best and worst case – where market share and profit are also included.

The pricing obtained by the ROI and best/worst case scenario calculations was then compared against the costs of supply chain auditing. Supply chain auditing is the current way companies obtain information about the use of recycled materials by their suppliers. This comparison allowed to understand the value that the designed platform brings to its users in terms of cost savings. Conclusions are then drawn on this project's viability.

Comparison with existing software and digital platforms

Existing software and platforms were classified on the basis of their functionalities, listed below:

1. **design/create**: the software or platform incorporates computer aided design functionalities;
2. **communicate**: the software/platform allows users to communicate with each other;
3. **data**: the software/platform allows users to access and visualize data;
4. **sharing**: the software/platforms allows for content created with it to be shared with other users;
5. **industry tailored**: the software/platform is tailored to the automotive industry specifically;
6. **decentralized/secure**: access to data is allowed by a safe, decentralized database.

The prices indicated in the table featured in the following page are – where not otherwise specified – per user and per month, billed yearly (see Table 5.2).

Software/ Platform	Characteristics						Price options		
	1	2	3	4	5	6	1	2	3
Tableau			✓				62 € *Full offer*	31 € *Explore only*	10 € *View only*
Slack		✓		✓			6,25 € *Standard*	11,75 € *Plus*	Direct sales *Grid*
Office	✓	✓		✓			8,80 € *Business*	10,50 € *Premium*	4,20 € *Essentials*
Cisco WebEx		✓					17,30 € (per host, per month) *Plus*	25,65 € (per host, per month) *Business*	Direct sales - *Enterprise*
Adobe CC	✓			✓			59,99 € (per license, per month) *All apps*	24,99 € (per license, per month) *Single app*	-
Autodesk 3Ds Max	✓						256,20 € (per license, per month)	2.049,60 € (per license, per year)	5.532,70 € (per license, per three years)
Circularise			✓		✓	✓	-	-	-

Table 5.2
Software comparisons

This table shows well enough how existing software and digital platforms in the automotive industry do not easily compare to the offer that Circularise brings to the automotive industry. The uniqueness of the designed platform is in fact related to both content – specifically tailored for the automotive industry – and underlying technology – that relies on a decentralized database, allowing for secure storing of confidential information.

However, this uniqueness makes it difficult to establish pricing by a mere comparison with other software and platforms used in the automotive industry. As a consequence, pricing considerations were expanded by looking at the costs Circularise would have to cover for the development of the platform.

Initial investment for Circularise

The initial investment for Circularise to develop and run the platform was estimated together with the start-up's founders. Included in this calculations are also sales related costs and all those costs previously specified in the business model's cost structure paragraph (Table 5.3). The costs of second and third year are also included in order to take into account the difference between one-off and recurring costs.

TYPE OF EXPENSE		Y1	Y2	Y3
Platform	Development	500.000 €	-	-
	Maintenance	50.000 €	50.000 €	50.000 €
	Service costs	50.000 €	50.000 €	50.000 €
	Updates	200.000 €	200.000 €	200.000 €
	Hosting	12.000 €	12.000 €	12.000 €
Support team (2 ppl)	Support team salaries	200.000 €	200.000 €	200.000 €
	Travel and other expenses	100.000 €	100.000 €	100.000 €
Sales team (2 ppl)	Sales team salaries	200.000 €	200.000 €	200.000 €
	Travel and other expenses	100.000 €	100.000 €	100.000 €
TOTAL		**1.412.000 €**	**912.000 €**	**912.000 €**

Table 5.3
Initial investment for Circularise

The total initial investment of 1.412.000 € in Y1 and the yearly costs of 912.000 € for the second and third year – necessary to build and run the designed platform – are a starting point to establish a pricing system for said platform. The average costs considered for the pricing calculations below are obtained by dividing the one-off costs – the development costs – over three years. The average cost is then 1.078.667 € a year.

Pricing for best and worst case scenario

The pricing for best and worst case scenario was calculated with the **aim of covering the initial investment costs and granting the start-up a profit margin of 10% within three years**. Three years are assumed as the payback period for this project. The payback period represents the time necessary in a project to cover the initial investment and become profitable. The profit margin, instead, is the is equal to profit divided by revenues. A margin of 10% is considered an average margin according to the Corporate Finance Institute and will be therefore assumed to be fitting in this case as well (Corporate Finance Institute, 2019).

In both best and worst case scenario – to simplify calculations – Circularise's market share is as well assumed to remain unchanged and amount to 50%. Only variable between best and worst case scenario is then the amount of potential users, whose numbers refer to considerations previously made in the paragraph on customer segments. The proposed pricing calculation is then showed in the two tables below, first without profit considerations and then with.

The yearly price per user, before profit considerations, is obtained by dividing the average costs for Circularise – calculated in the paragraph above – by the number of registered users on the platform. Monthly price per user is instead obtained by dividing the yearly price by 12.

Base assumptions	15 OEMs groups in Europe Circularise's market share: 50%		
Best case scenario	- 4 separate departments - 2 managers per department - 120 potential users - 60 registered users - 4 users per OEM	Yearly price per user Monthly price per user Yearly price per OEM Monthly price per OEM	17.977,78 € **1.498,15 €** 71.911,11 € 5.992,59 €
Worst case scenario	- 2 separate departments - 1 manager per department - 30 potential users - 15 registered users - 1 user per OEM	Yearly price per user Monthly price per user Yearly price per OEM Monthly price per OEM	71.911,11 € **5.992,59 €** 71.911,11 € 5.992,59 €

Table 5.4
Pricing calculations before profit considerations

As visible from the table above, the monthly price per user, before profit considerations, is then 1.498,15 € in the best case scenario and 5.992,59 € in the worst case scenario. The next table shows the pricing including profits. The pricing with the desired profit margin is calculated by inverting the formula for the profit margin itself. Profit margin formula is as follows:

*Profit margin (%) = [(total revenues – total costs) / total revenues]*100*

Using the reverse formula, desired revenues to meet a 10% margin amount to 1.198.518,52 € yearly.
In the table below, the results of the subsequent calculation and the final pricing that would allow Circularise to meet the goal of a 10% margin in the first year (Table 5.5).

Base assumptions	15 OEMs groups in Europe Circularise's market share: 50% Profit margin: 10%		
Best case scenario	- 4 separate departments - 2 managers per department - 120 potential users - 60 registered users - 4 users per OEM	Yearly price per user Monthly price per user Yearly price per OEM Monthly price per OEM	19.975,31 € **1.664,61 €** 79.901,23 € 6.658,44 €
Worst case scenario	- 2 separate departments - 1 manager per department - 30 potential users - 15 registered users - 1 user per OEM	Yearly price per user Monthly price per user Yearly price per OEM Monthly price per OEM	79.901,23 € **6.658,44 €** 79.901,23 € 6.658,44 €

Table 5.5
Pricing calculations including profit considerations

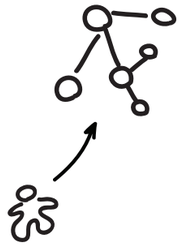
Once the profit margin is considered, the final proposed pricing for the platform becomes **1.664,61 € or 6.658,44 € a month per user, in the best and worst case scenario respectively.** As these numbers are, per se, quite high considerations need to take place around their viability in the automotive industry. In the next paragraph then, a comparison is drawn between the proposed pricing of the platform and the current expenses OEMs incur into when conducting auditing of their supply chain.

Comparison with supply chain auditing

Finding the exact expenses OEMs incur during supply chain auditing operations is, however, difficult. Such numbers are not made public and are challenging to retrieve by means of a simple desk research.

As a consequence, in this paragraph, three different scenarios are drawn to approximate the expenses of supply chain auditing activities. The first scenario draws an hypothesis for costs related to internal supply chain auditing practices. The second focuses on third-party supply chain auditing. The third and last, instead, draws a comparison between third-party supply chain auditing and sales forecasting reports, in order to pinpoint the order of magnitude for expenses that automotive OEMs incur into to obtain information they value.

1. Full time manager devoted to supply chain auditing



In the interview conducted with the former Interior Design Coordinator, it emerged that the **salary of a manager** in an automotive company can amount to circa **200 €** an hour. Out of the automotive OEMs interviewed over the course of this research, one stated that they have one manager per area who is in charge of auditing the suppliers to verify the presence of recycled content in their materials.

With the due limitations, given by the reliance on the word of two people only, this can be taken as a starting point to draw a first comparison between the yearly subscription fee of the platform and the salary of such a manger. The manager would in fact earn around 400.000 € a year, on the basis of a 40 hours workweek and 52 weeks a year.

Both worst and best case scenario, show that the proposed platform would result in cost savings, providing automotive companies with the data they seek for 19.975,31 €, or 79.901,23 € per user yearly.

2. Estimated price of auditing companies reports

Supply chain auditing can be performed by third parties as well. Traditional consultancies such as McKinsey and KPMG among others offer in fact this as one of their core and most profitable services (KPMG, 2019).
Estimations on the cost of a single auditing report cannot easily be achieved by desk research, but surveys have been published that state the average costs of audits. For private companies in fact, in 2013, the average audit hours required were 2.927, at an estimated average cost of **179 US$ per hour**, which amounts to approximately 160 € (Bramwell, 2014). This would result in a yearly expense of 468.320 €.

Once again, the yearly costs of the platform are, in both worse and best case scenario, significantly lower.

3. Comparisons with sales forecasting reports

After looking at the costs for a full-time supply chain auditing manager and at costs for third party auditing, a third and last comparable expense that automotive OEMs incur into are sales forecasting reports. Sales forecasting reports are generally outsourced to consultancies, such as the ones mentioned in the paragraph above.

During the testing of the third design iteration, the Product Development and Strategy Intern mentioned that sales forecasting reports can cost anywhere **from 50.000 to 100.000 € each**. In automotive OEMs sales forecasting is the most important activity for production planning of each vehicle line (Vahabi, 2016).

To draw a comparison as realistic as possible, the aforementioned cost of 50.000 €– assuming the lowest option as truest – has been multiplied by the number of vehicle lines produced by one automotive brand, FIAT, in 2019 (FIAT, 2019). The amount of vehicle lines sold by FIAT In 2019 amounts to eight: Tipo, 500, Panda, 124, Punto, Qubo, Doblo and Fullback.

In the case where only one sales forecasting report is needed per vehicle line, the total costs of these reports would be 400.000 € per year. Once again the proposed pricing of the platform appears to not be topping the monetary range of B2B offers.

Conclusions on proposed business model pricing viability

The previous paragraphs have tried to contextualize the platform's pricing in the automotive industry landscape. Overall, exact price estimates for the costs automotive OEMs incur into are difficult to achieve without direct industry connections and access to the exact financial data, but the three comparisons presented all try to show that the proposed pricing is far from being unrealistic.

These considerations help in enforcing the viability of the proposed business model. Automotive OEMs in fact would not be charged amounts that are hugely dissimilar or superior to those they already pay for the same (comparison 1 and 2) or for similar (comparison 3) information.

The role of technology and circular economy in the final design

The proposed business model designed and explained throughout this chapter will help Circularise in attracting a new customer segment with an offer tailored to their needs. Circularise's protocol, in fact, will grant automotive OEMs the possibility to access exactly the information they want, without having to trust any intermediate actor in the value chain. Claims on recycled content of the vehicles they sell will be directly verifiable and proved by the protocol and no confidential data will be released, causing harm to the competitiveness of all companies in the value chain. Circular economy will also be positively impacted by the implementation of this business model, as recycled materials could be included in vehicles considerations starting from the design phase.

The following two sections tie these aspects together and stress the relevance of the new business model designed for Circularise.

Technological feasibility

With the technologies that Circularise's protocol is based on (see p.35), showing the necessary information will not be an issue. In fact, without the distributed ledger that Circularise relies on, such a comprehensive overview – as is the one showed in the first tab of the platform – would not be possible.

Circularise's protocol, differently from the databases that automotive OEMs currently use, will be able to guarantee a **precise overview of the data** inserted in the system. Such data, as mentioned before, will be provided by third-party certifications, just as is the case in the textiles industry, that Circularise will digitalize.

Digitalized certificates, however, won't be visible, for the automotive companies, in a purely transactional manner, as it is in the textiles industry (see pp. 40-41). The **total amounts** of recycled materials certified and used will in fact be **compiled** and showed in the visualization proposed for the first and second tab of the platform. This compiling is easily enabled by the digitalization of certificates. This allows indeed for processing all data points of the certificates (such as the material's chemical composition, properties, weight, recycled content) and separates it in single information blocks that can be combined between the multitude of different suppliers working with automotive OEMs.

Combining all data together will be beneficial for automotive OEMs, as it will allow them to get a quicker overview of the information they need.

Positive impact for circular economy

The data Circularise will be able to provide to automotive OEMs will allow these to act accordingly to the circular economy principles. Forecasts on the availability of recycled materials could be of use right from the design phase and form a base for **material procurement decisions**. This fits within the first and second principles of circular economy (see p.37).

Increasing the use of recycled materials starting from the design phase will in fact contribute to the overall **reduction on the vehicle's impact** on the environment. Furthermore, using recycled plastics will make sure that the **material's life is extended** and kept in the loop for longer, with significant reductions on the impacts that producing virgin raw materials has.

Finally, one last consideration on the impact towards circular economy of this business model ties back to the way the automotive and plastics industry works. As illustrated in the system maps, in fact, automotive OEMs sit at the top of the production value chain. Specifications and requests coming from them ripple downstream to the other actors in the chain. As a consequence, an increase in use of recycled materials will affect the operations of the vast multitude of OEMs suppliers, driving more attention to sustainability in all sort of different companies.

In conclusion, with the proposed business model, Circularise, once able to expand their activities to tracking plastics, will be able to target the most relevant actor in the automotive sector all the while gaining a new paying customer and increasing the impact on circular economy.

Chapter 6
Conclusions and personal reflections

This last chapter will evaluate feasibility, viability and desirability of the design results. It will also highlight project's limitations and point out issues and directions of exploration that could use further research.

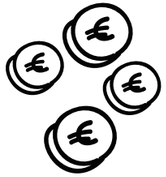
A roadmap is featured here as well, to highlight key milestones and intermediate steps for Circularise to implement the proposed business model. The roadmap, divided in three horizons is accompanied by a more detailed overview of the first horizon, in an effort to help Circularise with more concrete steps and planning.

Personal reflections will conclude this report and tell the project's story from a more subjective point of view. Key learnings from this graduation experience will be touched upon as well.

Feasible, viable and desirable

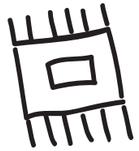
Throughout this project, considerations about feasibility, desirability and viability were used as guides for the design. In fact the value proposition and business model that are this project's outcomes would not make sense if not filtered through these three lenses. The following paragraphs will explain how each of these elements came into play and how the final design is strengthened by them.

Desirability is mostly related to the user's point of view, as it embodies user's preferences and desires. During the course of the design iterations, desirability was the main focus for the platform's evaluation. Each interviewed expert contributed in fact to shape the final design, offering their point of view on content and features of both the platform and value proposition. This way of designing made therefore sure that the end user's point of view was well integrated and accounted for in the final design.



Viability considerations relate to more material and monetary concerns. Considerations on those aspects were quite a fundamental part of designing the new business model. For it to be viable, in fact, the new business model would have to prove profitable and suitable for the start-up, while also offering a cost-saving – and not cost-aggravating – option to automotive OEMs. Chapter 5 already extensively dug into the monetary aspect, so that will not be repeated here. It will instead suffice to say that the calculations and comparisons made seem to prove both profits for Circularise as well as

benefits for the automotive OEMs



Feasibility considerations, lastly, help in evaluating what can be easily and conveniently done. In this project's scenario, that mainly revolves around the technology and protocol Circularise possesses and how it enables safe and confidential collaboration between a whole network of stakeholders. The start-up's reliance on blockchain and zero-knowledge proofs in fact enables them to offer the designed value proposition by safely sharing all necessary data without disclosing confidential information. This uniqueness, coupled with Circularise's established system in textiles, guarantees the feasibility of the proposed business model.

However, for as much as the proposed design takes into account desirability, viability and feasibility, some limitations were encountered through the project which give rise to directions for further research. Both these points are explained in the two sections below.

Project limitations

The main limitations of this project were centred around two points: stakeholders interaction and relying on assumptions.

Interacting with **stakeholders** not directly involved in the project took a lot of time and effort. To get in touch with the necessary people, in fact, LinkedIn recruiting activities were undertaken and in order to successfully book the time for an interview, two to five interactions were needed. This constituted a limitation for the project, as the number of stakeholders that could be reached was limited, especially when looking at experts working in automotive OEMs.

Stakeholders interaction, furthermore, was planned to happen in two different moments during this project, once at the very beginning, during the research phase, and once during the design phase. The original project intention was to co-design a solution with all relevant stakeholders in a series of co-creation sessions (see Appendix #8). This also proved to be challenging, as confidentiality and secrecy are of primary importance for the companies involved in this project, and being simultaneously present in a co-creation session was perceived to be too much of a risk.

In order to bridge these two stakeholders-related difficulties – finding enough people and

co-creating the design solution – several strategies were of use. First of all, a reliance on the existing university network with automotive companies, for example those involved in graduation projects and in mandatory courses. Secondly, a reliance on my own personal network of friends and colleagues working in the automotive sector and in automotive OEMs. These two different networks made it possible to find enough experts to be interviewed. Lastly, flexibility towards the initial planning allowed for changes in the original strategy. Since co-designing proved in fact to not be feasible, **design iterations** were planned as a replacement that could still allow for stakeholders' feedback without requiring more than an interview from the single automotive OEMs.

The second type of limitation for this project is related to the **assumptions** that needed to be made as a basis for the new business model. These assumptions, listed in Chapter 5 (see p. 100), mostly revolve around Circularise's current activities and how the newly designed business model should fit into them. Out of the four assumptions present in the abovementioned page, the first one is crucial for this project to be implementable. A tracing technology similar to the one in place for textiles – so in essence a physical, chemical **tracer** – would in fact allow Circularise to enable direct communication between plastic manufacturers and automotive OEMs. The lack of such a tracer, however, would imply the necessity of a collaboration between all actors in the supply chain, making the designed platform too similar to the systems, like the IMDS, that are already in place in the automotive industry.

Completely overcoming this limitation could be achieved by prolonging the project's length. Domo and Covestro, the two plastic manufacturers Circularise is hoping to partner with, in fact, seem to be **interested in the development** of such tracer for plastic materials as well. No substantial proof or claim can be drawn for informal conversations such as these ones, but manufacturers being interested in developing a technological solution to guarantee the direct tracing of their materials would facilitate Circularise's adoption of the business model proposed here, as it would resolve one of its key underlying assumptions.

Directions for further research

All of the above being said, two main points of further research emerge in tight connection with the project's limitations.

The first research direction could in fact address stakeholders interactions, to better understand how the platform should look like and which other functionalities it might include.

More **interviews and design iterations**, in fact, could deepen Circularise's knowledge of their current and potential clients, both automotive and textile OEMs. Further research on automotive OEMs would be beneficial for this project directly, while more research on textile and fashion OEMs could allow Circularise to expand their business model portfolio to include an offer able to turn this customer segments into a paying client as well.

A second direction for research should instead aim at finding, or developing, a **plastic tracing technology**. Such technology could even be a physical tracer, inserted in the plastic's formula directly. If this was to be the case, however, attention should be put on making sure the tracer's formulation causes little to no issue with the necessary quality standards and chemical, or physical properties and requirements of the material. The existence or the development of such a tracer would make it possible for Circularise to implement the designed business model.

A roadmap for Circularise

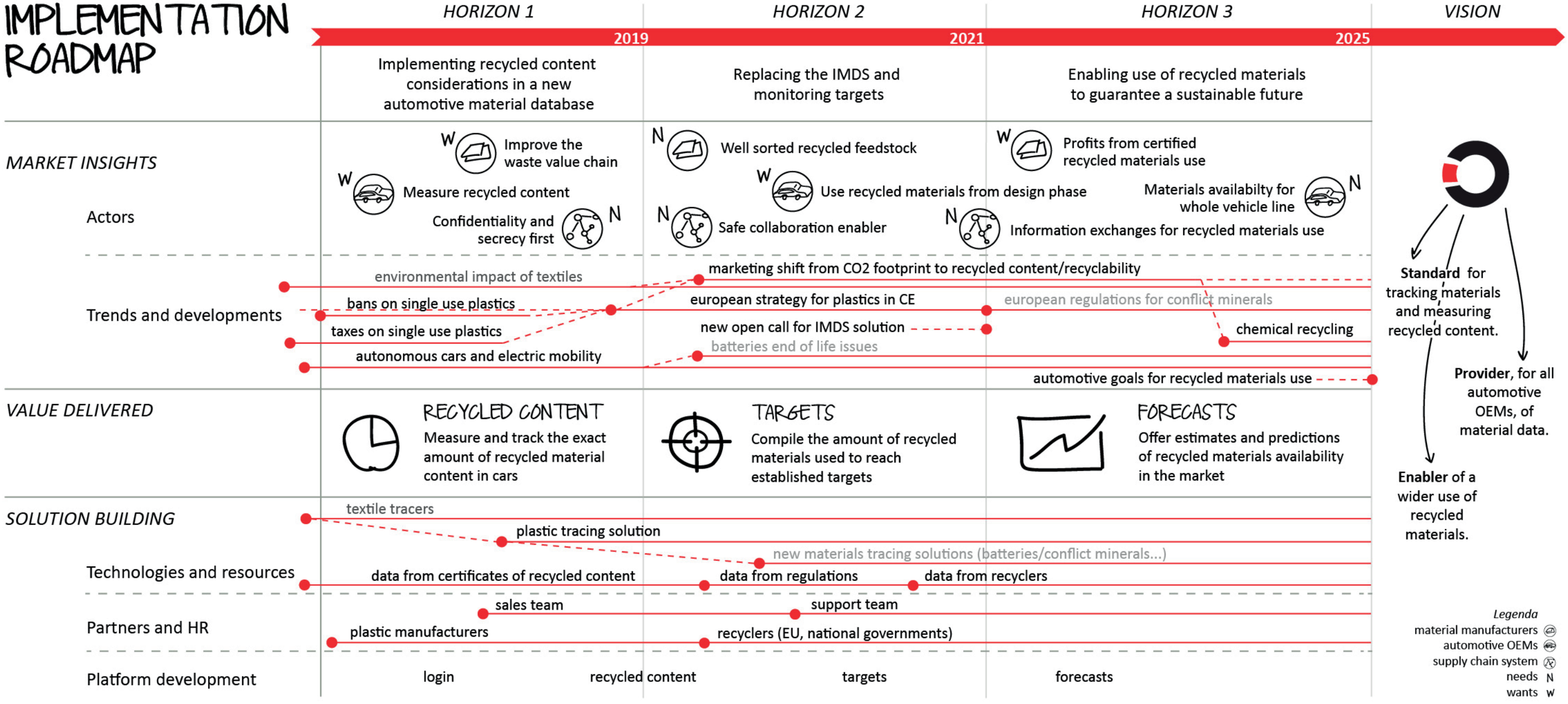
Looking back at the method followed all along this project, the one proposed by Osterwalder, one last step is necessary for a business model to come to life: an implementation plan. This is what this section will focus on, as an implementation roadmap for Circularise will be here presented and explained.

The roadmap featured in the next pages is intended as a tool for Circularise to **align activities and communicate a clear company vision**, both internally and externally. As a consequence, at the end of the roadmap a vision is proposed for Circularise to reach.

The three horizons of the roadmap have a specific time frame assigned to them. The first horizon, for example, lasts six months, from now until the end of 2019. This short term focus was chosen as a way to better fit into Circularise's current planning strategy. As of now, in fact, the start-up operates in an agile way and is opportunity driven: six months is the furthest stretch of time they plan in detail. The second horizon, instead, spans all the way to 2021, the year in which new European regulations on conflict minerals will come into play and could be potentially integrated in the company's offering. Finally, the third and last horizon reaches the end of 2025, terminal year for the European Strategy for Plastics in a Circular Economy (European Commission, 2018) and also for Volvo's internal goals in terms of recycled materials use (Doyle, 2018).

The roadmap, other than the separation in horizons, is also partitioned in three different layers. These are **market insights, value delivered and solution building**. Market insight are findings from the research and analysis phases of this project that contributed to shape the value proposition and new business model; they are divided under two headings, actors and trends and developments. The layer titled value delivered explains the value Circularise will bring to automotive OEMs and in which shape; this layer is directly related to the screens of the designed platform. The last layer, at the bottom of the page, focuses on the necessary pieces to build the proposed design solution and business model; it is then divided in three sub-layers, namely technology and resources, partners and HR and platform development.
A detailed explanation of the three horizons can be found after the roadmap.

IMPLEMENTATION ROADMAP



Horizon 1

The goal of the first horizon is to implement **recycled content considerations** in a new automotive material database.

The insights that open up the door for such opportunity are related to automotive OEMs and material manufacturers, a category that includes both the textile manufacturers Circularise is already working with and the plastic manufacturers the start-up is trying to sign a contract with. Main actor needs, found through the field research and interviews conducted, are in fact a desire to improve the waste value chain on the material's manufacturers side that corresponds to automotive OEM's desire to measure recycled content in their vehicles. These two converging aspirations happen in a supply chain environment that still values confidentiality and secrecy above everything.

Trends and developments featured in the map also contribute to paint a favourable scenario for Circularise. Source for the items included in this layer was the environment mapping, consultable in full in Appendix #5. The focus is hence more on plastics-related trends and developments than textiles, also because Circularise is already working with the textiles and fashion industry.

All the information included in the market insights helped shaping the first part of the value proposition that is repeated in the roadmap and materialized in the first platform's screen. The last and final layer, solution building, takes the requirements of the designed business model in terms of key partnerships, resources and activities and plots them on the roadmap's timeline. In the first horizon, in fact, the partnership with plastic manufacturers need to be achieved in order for the first screen of the platform (recycled content) to be developed and offered, via the newly recruited sales team, to automotive OEMs.

Horizon 2

The goal of the second horizon is for Circularise's protocol to **replace the IMDS** and **incorporate** companies' **target monitoring activities**.

During the years 2020 and 2021, several market insights could be influential for Circularise's activities. For example, materials manufacturers will increasingly need a well sorted stream of recycled feedstock and automotive OEMs will start trying to incorporate recycled materials in

their cars from early in the vehicle design process.

Two other important developments will take place in 2021 as well.
The new European regulations for responsible sourcing of conflict minerals – tin, tantalum, tungsten and gold, often found in batteries – will become effective in January that year (European Commission, 2019). Conflict minerals are so defined because their extraction takes place in politically unstable countries, where their trade can "finance armed groups, fuel forced labour and other human rights abuses, and support corruption and money laundering" (ibid., 2019). This can be a further opportunity for Circularise to expand the range of materials they can prove to be recycled. Proving that these minerals are recycled, in fact, implies that the humanitarian sourcing concerns do not apply.

The other important development that will happen in the same year relates to the IMDS database. Conversations between Circularise, Domo and Covestro revealed in fact that the automotive database's technology is currently licensed to a German company, DXC Technology, until 2021 as well. In that year an open call will be held for other IT companies to propose a new solution.

Circularise's new platform, facing OEMs, should then in horizon 2 replace the IMDS and offer additional value compared to the current version. This additional value comes in the shape of the second platform's screen, targets. Thanks to the data from certificates of recycled content and data from both Europeans and national regulations, Circularise will be able to help automotive OEMs in monitoring progress on set targets. They will be in fact able to do so by compiling thanks to the knowledge on recycled content accumulated thanks to the digitalized certificates.

Lastly, during the second horizon, Circularise should start gathering data from car recyclers about the material compositions of scrapped car. This knowledge will in fact help them build the last screen of the platform, forecasts, in horizon 3.

Horizon 3

The goal of the third horizon is **enabling the use of recycled materials** to guarantee a sustainable future.

Automotive OEMs will need recycled materials in considerable amounts, as to allow them for

the production of whole vehicle lines.

To help them in this endeavour, Circularise will offer estimates and predictions of recycled materials availability in the market. Such estimates, embodied in the last platform screen, forecasts, will be made possible, as mentioned in horizon 2, by data collected from car recyclers.

Vision

After 2025, Circularise could become the standard for tracking materials and measuring their recycled content, the only provider for automotive OEMs of material data and the enabler of a wider use of recycled materials. This is the vision that this project established for Circularise and as such it is also the roadmap's conclusion.

Detailing horizon 1

To complement the roadmap, a detailing of the first horizon is also included. The increase in level of detailing is mostly focused in the bottom layer of solution building, where **tasks** for Circularise and a more structured **planning** are featured. The remaining layers stay basically unchanged.

Aim of the proposed detailed planning is allowing Circularise to start a pilot project with their first automotive clients by the beginning of 2020, by partnering with plastic manufacturer and developing a plastics traceability solution, then adding a sales team to their staff, as accounted for in the new proposed business model.

The first horizon, however, is highly **dependent on Circularise's partnership with plastic manufacturers**: a delay in that process would as well delay the implementation of the business model. A possible alternative to avoid delays would be offering automotive OEMs a first temporary version of the platform with only fabrics' recycled content and add plastic materials once an agreement and partnership with plastic manufacturers is reached.

DETAILED 6-months

HORIZON 1

July | August | September | October | November | December 2019

H1 goal: Implementing recycled content considerations in a new automotive material database

MARKET INSIGHTS

W — Improve the waste value chain

N — Confidentiality and secrecy first

W — Measure recycled content

Actors

Trends and developments

- environmental impact of textiles
- bans on single use plastics
- taxes on single use plastics
- european strategy for plastics in the circular economy
- autonomous cars and electric mobility

VALUE DELIVERED

RECYCLED CONTENT

Measure and track the exact amount of recycled material content in cars

SOLUTION BUILDING

Technologies and resources

- textile tracers
- plastic tracing solution
- data from certificates of recycled content

Partners and HR

- partner up with plastic manufacturers
- develop plastic traceability solution
- recruiting for sales team
- find Au. OEMs clients
- pilot project

Platform development

- develop login screen
- develop recycled content screen
- test and iterate on screens' UX

Personal reflections

As the very last part of this graduation report I would like to share how I experienced this project in first person. Working on this project has been for me exciting, challenging and at times confronting. Overall, as is to be expected, it was a formidable learning experience. From the initiation of this project, quite a lot changed. At the very beginning, my focus was supposed to be more centred on technology and on detailing the platform's screens, as guidelines for the platform were the expected project deliverable.

However, after the research phase and after getting to know Circularise's operations and activities better, halfway through the graduation's timeline, the possibility to address the start-up's business model emerged. This option seemed to be more interesting, for my master's studies in Strategic Design and also more relevant for the project, according to the research findings. At that moment, then, the graduation's deliverables changed and adjusted to this new direction. The platform became a slightly secondary deliverable and the design of a business model emerged as main project outcome.

I appreciate the flexibility and autonomy that was granted by my university and company coaches for me to make this choices.

However, as I said a couple lines above, this project was quite challenging for me. The main challenge I encountered was trying to keep an hold of every aspect of project management while at the same time having to execute the project as well. Project management related activities, furthermore, were so time consuming that it felt like dedicating them the necessary attention was going to be detrimental for my project. Obviously, though, not dedicating enough attention to project management is also detrimental for any project.

Struggling with multitasking, anyway, did not stop me from learning a lot over the course of these months. Key learnings during this project mostly revolve around the differences between the corporates' environment and a start-up's way of operating.

I had already experienced the first thanks to internships and project courses during both my bachelor and master. This project gave me a chance to see how start-ups navigate their day to day activities. It was truly eye-opening to see how much Circularise acts upon the moment's opportunity and changes course with rapid and quick decisions. All the companies I had worked with before – such as Barilla (Italian food multinational), Unilever (Dutch-English consumer good company) and Telia (Scandinavian telecomm operator) – instead excel at keeping a goal-oriented mind-set and building up detailed plans for the upcoming years. Big corporates, having more resources in general, also dedicate a lot more time to establishing company visions and branding, which probably helps in being more goal-oriented in general.

Another interesting opportunity that came to me from this project was getting a peak into the peculiarities of B2B (business to business) compared to B2C (business to consumer). It was especially insightful for me to see how longer and more time consuming B2B sales processes are. At the same time, though, B2B sales are much more close up and personal and really build on direct relationships between people, something that the sales professionals I interviewed also stressed multiple times when talking about their role.

In conclusion, I am glad of the kind of industry scenario that this project allowed me to see and learn from. All that I have learned in these six months will be precious for my future choices and career path as well.

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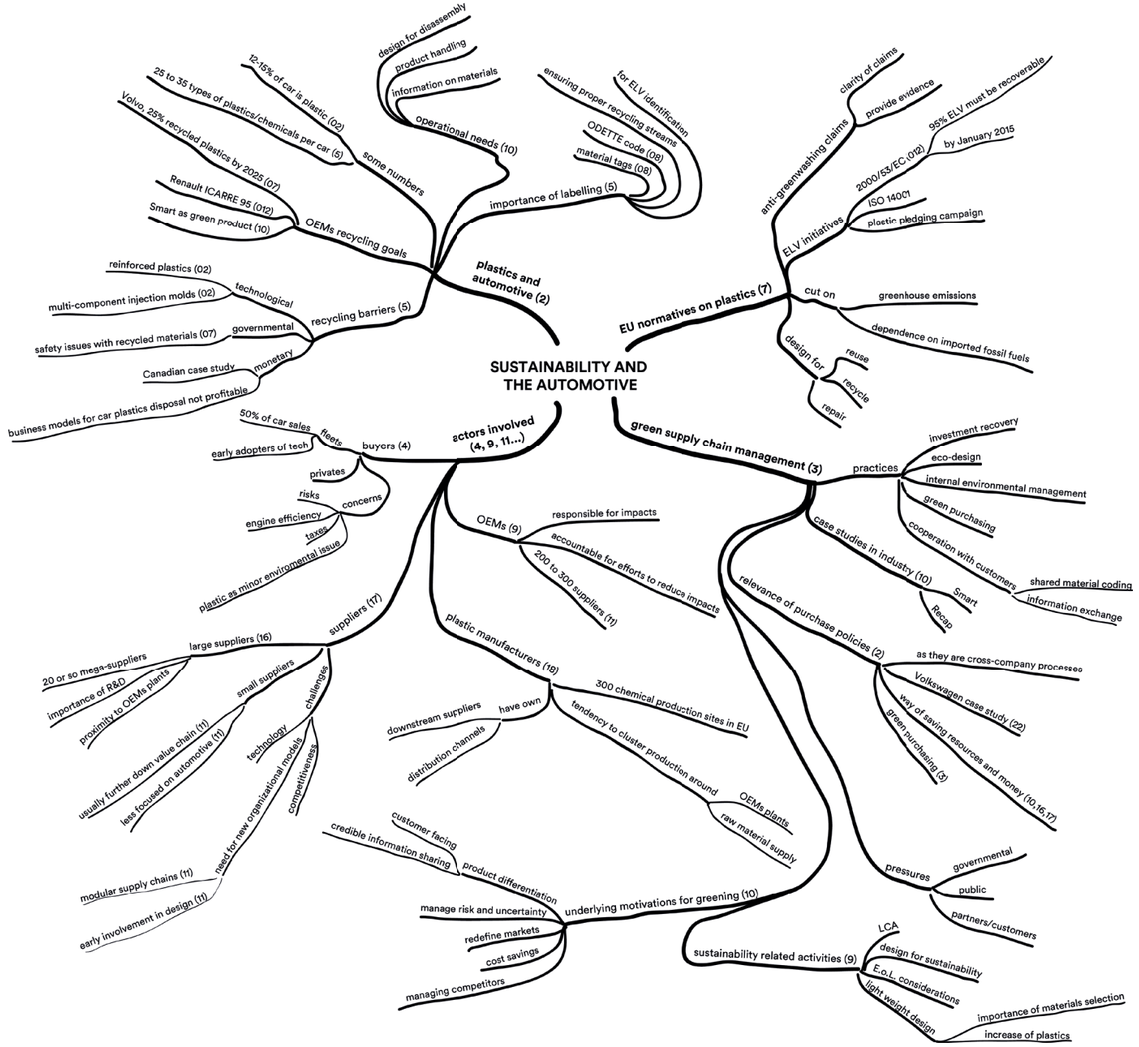
Appendix

Appendix #1
Papers map

The papers map features the literature and resources consulted during the initial research phase. Papers and resources can be found after the map, listed with their respective numbers.



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Appendix #2
Initial research interview guides

In the next pages, the interview guides used for the initial research phase are featured. The interviews conducted were all semi-structured and the guides below include both the main discussion points and the related probing questions.

Interview guide Tier 1 supplier

Part 1: domande introduttive

1. Qual è il suo ruolo in azienda?
2. In che area di mercato opera la sua azienda?
3. Che cosa ha fatto oggi (assumendo che sia una giornata lavorativa come tante)?
4. Qual è l'aspetto del suo lavoro che le piace di più? E quello che le piace di meno?

Part 2: relazioni con clienti e fornitori

1. Chi sono i vostri clienti principali?
2. Che cosa vogliono sapere in merito alle materie plastiche che utilizzate?
3. Cosa si aspettano dalle vostre plastiche in termini di caratteristiche tecniche?
4. Comunicate ai vostri clienti eventuali aspetti di sostenibilità dei vostri prodotti?
5. Le case automobilistiche hanno richieste particolari riguardo ai materiali che usate?
6. Fornite i vostri prodotti direttamente alle case automobilistiche, o no?
7. Che tipo di dati sono più richiesti per valutare la sostenibilità dei vostri prodotti?
8. [Che tipo di informazione (sempre in ottica di sostenibilità) è più importante per I vostri clienti al momento di firmare un contratto con voi?]
9. Avete mai dovuto adattarvi a richieste di sostenibilità da parte di vostri clienti?
10. Cosa ne pensa della piattaforma IMDS?

Part 3: sostenibilità delle materie plastiche

1. Cosa la rende fiero dei prodotti che vendete?
2. Come vi rapportate alla legislazione Europea in materia di plastiche e sostenibilità ambientale?
3. Usate qualche tipo di certificazioni per promuovere/garantire la qualità dei vostri prodotti?
4. Che tipo di dati monitorate per controllare gli impatti ambientali delle vostre plastiche?
5. Avete mai a che fare con il fine vita dei vostri prodotti?
6. Usate materie plastiche riciclate? Se sì, lo comunicate ai vostri clienti? A loro sta bene?

Part 4: futuro e plastiche sostenibili

1. Tra 10 anni, cosa pensa che la sua azienda potrebbe vantare, in termini di sostenibilità ambientale delle vostre plastiche?
2. Che vanto la renderebbe più orgoglioso?
3. Quale è la sua opinione sul tracciare dati riguardo ai materiali che usate per facilitarne il riciclo?
4. Se esistesse un portale dove dati su componenti in plastica potessero essere condivisi con tutti gli attori della catena, che tipo di informazioni vorrebbe poter avere sui materiali che acquistate?
5. E che tipo di informazioni sui vostri prodotti vorrebbe condividere? Anonimamente, o sotto il nome dell'azienda?

Interview guide Tier 2 supplier

Part 1: general questions

1. What is your role in the company?
2. And what is your company's market focus?
3. How does your working day look like? / What did you do yesterday?
4. What's the part of your job you like the most? And the least?

Part 2: sustainability of plastics

1. What makes you most proud in the product you sell?
2. How do you deal with European regulations in regards to plastic and recyclability?
3. Certifications you use to promote your products' qualities?
4. What kind of sustainability data about your plastics do you value keeping and monitoring?
5. Do you deal with anything related to the end-of-life of your products?
6. Do you use recycled plastics? If yes, are your customers informed about it? Are they happy with that?

Part 3: customer relationships

1. What do your customers want to know about your plastics?
2. What do they ask of your plastics, in terms of characteristics or performances?
3. Do you communicate sustainability aspects of your plastics to your customers?
4. Let's take the automotive field. There is quite some plastics in cars, these days… do car brands have specific requests about the materials they buy?
5. What kind of sustainability data do they ask for the most?
6. What kind of (sustainability) information is relevant to your clients at the moment of signing a contract with you?
7. Did you ever have to adapt to this kind of requests? How did you go about it last time it happened?
8. If you can say it, what kind of companies/clients do you mostly work for? (no names needed)

Part 4: future of sustainable plastics

1. In 10 years from now, what do you think you could claim for your plastics in terms of sustainability?
2. Which “future claim” would make you the happiest/proudest?
3. What is your opinion about tracking materials/components in order to make it easier to recycle them?

Interview guide Plastic manufacturer

Part 1: general questions

1. What is your role in the company?
2. And what is your company’s main market focus?
3. What does your working day look like?
4. What did you do yesterday?
5. What’s the part of your job you like the most? And the least?

Part 2: customer relationships

1. Who are your main customers?
2. What do your customers want to know about your plastics?
3. What do they ask of your plastics, in terms of characteristics or performances?
4. How do you communicate sustainability aspects of your plastics to your customers?
5. Let’s take the automotive field. There is quite some plastics in cars, these days… do car brands have specific requests about the materials they buy?
6. Do you work directly for car companies, like BMW, Volvo etc., or not?
7. What kind of sustainability data do they ask for the most?
8. [What kind of (sustainability) information is relevant to your clients at the moment of signing a contract with you?]
9. Did you ever have to adapt to this kind of requests? How did you go about it last time it happened?
10. What are your thoughts about the IMDS system?

Part 3: sustainability of plastics

1. What makes you most proud in the product you sell?
2. Do European regulations in regards to plastic and recyclability affect your work/ company?
3. Any certifications you use to promote your products’ qualities?
4. What kind of sustainability data about your plastics do you value keeping and monitoring?
5. What happens to your products at their end-of-life? Do you deal with that?

6. What about recycled plastics?
7. What can you tell me about design and development for recyclable plastics?

Part 4: future of sustainable plastics

1. In 10 years from now, what do you think you could claim for your plastics in terms of sustainability?
2. Which “future claim” would make you the happiest/proudest?
3. What is your opinion about tracking materials/components in order to make it easier to recycle them?
4. If there was a platform where all information on plastic components could be shared along the whole value chain/supply chain, what kind of information would you want to see there?
5. And what kind of information would you like to share?
6. Would you share it with your company’s name, or anonymously?

Interview guide OEM

Part 0: general questions

1. What is your role in the company?
2. What are your daily activities like?
3. What’s the part of your job you like the most? And the least?

Part 1: IMDS use and contents

1. What do you know about IMDS?
2. What kind of info is there and who is it beneficial to?
3. How?
4. Do any other tracking of parts and materials (eg. MATlabels) communicate with the IMDS?

Part 2: automotive supply chain

1. What kind of stakeholders do you mostly work with?
2. How do you get information from them about the plastics they use?
3. Which department in the company decides for the materials of new car models?
4. Do you communicate directly with cars dismantlers?
5. What kind of information do they have about the plastics that are present in Volvo cars?

Part 3: understand (list) current claims

1. What can you tell me about the use of recycled plastics in Volvo trucks?
2. How do you monitor them and measure them (quality and quantity)?
3. What kind of data can you use to meet the targets set by the EU “pledging plastics” campaign?
4. How do you share this data with the EU? And with whom, in the EU?
5. Do you communicate the presence of recycled plastics to the end buyers?

Part 4: EU regulations

1. What else is the EU pushing when we talk about recycled plastics in cars?
2. How do you go about meeting EU targets?
3. Do your goals in terms of recycled plastics influence your suppliers?

Part 5: future claims

1. In some years from now, what do you think you could claim for your plastics in terms of recyclability?
2. Which “future claim” would make you the happiest/proudest?
3. What kind of tracking materials/components in order to make it easier to recycle them do you think should be in place?
4. If there was a platform where all information on plastic components could be shared along the whole value chain/supply chain, what kind of information would you want to see there?
5. And what kind of information would you like to share?

Interview guide Car dismantler

Part 1: dismantling process overview

1. How does the process of recycling a car look like?
2. What are the roles/responsibilities you have?
3. What’s the part of your job you like the most? And the least?

Part 2: ARN tag information

1. What kind of information in registered on the ARN tags?
2. Who scans the tag and for what reason?
3. Have the tags changed/improved/eased your work as dismantler?

Part 3: missing information on car parts

1. What kind of information do you still think you’re missing on the cars that arrive to you?
2. What kind of information do you wish you had on cars?
3. How do you experience the communication with other stakeholders in the car industry ?
4. What kind of relationship do you have with plastic manufacturers or compounding companies?
5. What kind of information do the other stakeholders share with you?

Part 4: EU regulations context

1. What kind of European regulations have influence on your work?
2. What do you do in regards to plastic parts in cars?
3. Any plastic parts that are actually valuable?
4. Parts in plastics that are valuable but are too much of a fuss to extract?
5. How much do you know about the plastic recycling process (so what happens next after you pile up the cars in the compactor)?

Appendix #3
SWOT analysis triangulation

Circularise's current business model, centred on textiles, was analysed in a SWOT matrix that is included in the report. The illustration in the next page, instead, shows which strengths, weaknesses, threats and opportunities were matched to derive opportunity areas for the new business model.

The strengths/weaknesses and opportunities/threats were matched on the basis of qualitative, intuitive considerations, as to balance or enhance the first with the seconds or vice versa.

Appendix #4
Opportunity areas

The opportunity areas identified above are hereby named. The most promising ones, explained in the report, are underlined in red.

Opportunity areas

S1-T10	CO-CREATION OF SMART VALUE CHAINS
S1-T1	COACHING COMPANY IH-HOUSE VENTURES
S1-O11	DEVELOPMENT OF INDUSTRY SPECIFIC SOLUTIONS
S1-O2	FURTHER MATERIALS EXPANSION
S2-O10	USE INORGANIC TEXTILES AS STARTING POINT FOR NEW MATERIAL TRACING
S2-O4	TRANSFER KNOWLEDGE OF CURRENT MARKET INTO NEW OFFERINGS
S3-T1	OUTSOURCE NON-KEY ACTIVITIES TO IN-HOUSE VENTURES
S8-O5	NEW OFFERING TO AID COMPANIES' TARGETS MONITORING ACTIVITIES
S8-O2	FIRST ENTRANT IN NEW CRITICAL MATERIALS MARKETS
S8-O1	EXPAND CUSTOMER BASE
W1-O8	DIVERSIFY CERTIFICATIONS RANGE PER INDUSTRY
W1-O7	DEVELOP OFFERS TARGETING OEMs INSTEAD OF MATERIAL MANUFACTURERS
W1-O1	EXPAND CUSTOMER BASE
W4-O8	CREATION OF NEW REVENUE STREAMS FROM NEW CERTIFICATIONS
W4-O7	CREATION OF NEW REVENUE STREAMS FROM NEW OFFERINGS
W4-O2	CREATION OF NEW REVENUE STREAMS FROM NEW MATERIALS
W8-O13	TARGET SALES OFFER TO OEMs
W11-T10	DEVELOPMENT OF SMART VALUE CHAINS AS OFFERING FOR NON-PAYING CUSTOMER SEGMENTS
W11-O1	TARGET CUSTOMER SEGMENTS WILLING TO PAY FOR OFFERING

Appendix #5
Environment mapping

Here is the complete mapping of the automotive and plastics industry used as a basis for choosing between plastic manufacturers and automotive OEMs as main customer segment to target during the designing of the new business model for Circularise.

The environment mapping consists of four parts listed below with their respective page numbers.

Market forces

Issues

The main issues the automotive industry is facing these days revolve around the disruption of existing business models, brought forward by the shift from car ownership to car usage (Canzler, 2016). The increase of electric and autonomous vehicles is also impacting the industry and showing a lack of infrastructure and a need for updated regulations respectively (Becker, 2009). latest issue that comes with electric vehicles are the dangerous materials contained in the batteries and the difficulties to ensure their correct end of life treatment and recovery (Ramoni, 2013).

Segments

In the automotive market the most relevant customer segments are the automotive OEMs themselves, because of their influence on the whole system (see Map 4 p.37) in terms of materials specifications. Other relevant actors are the material manufacturers, as they collaborate with OEMs in aligning roadmaps for material developments. The other actors that are also part of the system, such as Tier 2 and 1 supplier, buyers and recyclers are less influential and therefore less interesting.

Needs and demands

One crucial aspect in the automotive industry is the OEMs' need to have a complete overview of the materials present in their vehicles to fulfil the requirements of end of life producer's responsibility regulations (Kumar, 2004). This results in a strong demand for information from the suppliers that takes shape in the IMDS system. Such a need from the OEM is also related to buyers' expectations of transparency and trustworthiness. In addition to that a significant customer demand revolves around sustainable mobility (Cohen, 2014).

Switching costs

Competiveness in the automotive market is quite high, as several interviewees mentioned (see p.24, 25). This means that it's relatively easy for the most powerful parties, such as automotive OEMs and those Tier 1 suppliers that fall under the category of "Megasuppliers", to

switch between smaller Tier 2 suppliers (Aláez-Aller, 2010). Long customer relationships and outsourcing of activities, such as in the case of modular supply chains, make this dynamic more difficult between OEMs and Tier 1 supplier (Sedgwick, 2013). When looking at buyers, customer loyalty to brands is quite low and does not influence purchase decisions (Koller, 2011).

Revenue attractiveness

Revenues in the automotive market are shifting with the insurgence of leasing and renting models (Canzler, 2016). As far as materials pricing goes, the material manufacturers still keep most influence over decisions on the matter (Cavusgil, 1996).

Industry forces

Competitors

Main competitor for Circularise in the automotive industry is the companies' traditional way of monitoring the suppliers via third parties or internal auditors. Other start-ups, such as OriginTrail, Vechain and Bext360, also developed new traceability systems that could be put to work in the automotive industry. This however does not seem likely, as the focus industries of those competing start-ups differ greatly.

New entrants

Little disruption is happening, in the automotive sector, when looking at the B2B environment. When B2C is concerned, instead, the most recent mobility players, like Uber and Lyft, are impacting the market (Canzler, 2016). Neither of these players are however relevant for Circularise's activities. What could be of relevance, instead, are new technologies powered by artificial intelligence, that would allow for automatic materials recognition (Beigbeder, 2013).

Substitute products and services

Smart value chains could threaten Circularise's offers in the automotive industry. Fortunately, it seems as the implementation of such smart value chains is not to be expected already in the upcoming years, which leaves Circularise room to gain advantage as first mover in that direction (Valkokari, 2011).
It is also worth mentioning that material manufacturers are developing their own recycling methods to ensure the best possible quality of recycled materials. When it comes to plastic specifically, this takes the shape of chemical recycling (see Textbox 5). Nowadays in its infancy, chemical recycling could, once fully scaled to industry size, prove to be an easy substitute to Circularise's services (see Textbox A1).

Suppliers and other value chain actors

Key players in the value chain are once again material manufacturers and automotive OEMs. Circularise's current business model mostly depends on the first ones, but, as mentioned a few paragraphs earlier, and as well in the design guides, partnerships with material manufacturers are one of the start-up's strengths..

Stakeholders

The automotive market is a heavily populated one. High-level stakeholders include national governmental bodies and the European Union too. One more relevant stakeholder group that needs to be considered is the Control Union (see Textbox 3, p.15) and all trusted third-party certification givers.

TEXTBOX A1
Chemical recycling

Chemical recycling is the newly discovered process of converting polymers back to their basics components, monomers. These monomers can then be used by plastic manufacturers to produce new plastics, from recycled feedstock, that would maintain the same characteristics as plastics made from virgin feedstock (Achilias, 2007).
However, this process has not yet been scaled to reach industry size. The initial investments of building plants and crackers to separate the polymers is in fact quite elevated (BASF, 2019).

Key trends

Technology trends

Connected vehicles are soon going to become a market standard. The rise of the Internet of Things won't only affect vehicles, but also supply chain operations. Embedded electronics have in fact the potential to improve efficiency in communication processes (Cai, 2014). Automatic recognition of materials by smart cameras and such could however threaten Circularise's offerings (Beigbeder, 2013).

Regulatory trends

Regulations on recycled content are being pushed onto automotive companies and suppliers by the European Union. Incentives and discounts on taxes are in fact going to apply according to new regulations on the matter, which are expected to become effective in the upcoming months (Hartmann, 2019). Furthermore, several European governments have their own policies to reduce the use of plastics, such as the case of France with its newly restrictive policies and the ban on single-use plastics (Dilling, 2019). In addition to these, regulations for the automotive industry apply also on CO_2 emissions and a wide range of other vehicle characteristics (European Commission, 2019).

Societal and cultural trends

Most interesting societal trends to influence the automotive industry are the increase of consumers' attention to an environmentally friendly behaviour and the shift from car ownership to the use of mobility services (Canzler, 2016). The first trend can have positive effects on Circularise's activities.

Socioeconomic trends

New conglomerates are happening: on Monday the 27th of May, FCA proposed a 50-50 merger to the Renault group (Gapper, 2019). This action will result in creating a huge OEM player, with a strong base in the European market. Looking at European policies in terms of environment and promotion activities towards recycling, one of the main drives to such action is the desire to cut dependence on imported materials and resources (European Commission, 2018).

Macroeconomic forces

Global market conditions

The automotive market is globally put under severe stress and disruption by all the new players entering it, as already mentioned above. The material manufacturers, at the same time, are increasingly shifting towards incorporating sustainable measures into their products and plastic manufacturers make no exception, as the growing research on bio-plastics shows (European Bioplastics, 2019). Overall, however, market growth is slow, another potential benefit for Circularise who could provide the players in this field with some competitive advantage.

Capital market

In the Netherlands, where Circularise is based, and in Europe in general, private investors are wary to invest in start-ups (Consultancy EU, 2019). Minor issue for Circularise, as the star-up mostly finances itself with European projects and paid pilots with material manufacturers.

Commodities and other resources

For Circularise, the certificates from Control Union are easy to obtain, considering that the material manufacturers will keep asking for them. Expert human resources that are able to work with the start-up's protocol should not be too challenging to find, as blockchain developing skills are highly valued in the market (Wall, 2019). Other than these two, no commodities or resources, even in the automotive industry, will impact the start-up's activities.

Economic infrastructure

Without delving too deep in this investigation, it will suffice to say that the economic infrastructure in Europe does not prove to be a significant challenge for Circularise. This is as well proven by the successful development of the textiles tracing pilot conducted with Summit Company and Inditex in Europe.

Appendix #6
Design iterations

Three design iterations of the final platform delivered have been performed, as a way to define the value proposition. In the next pages, details about the screens designed and the feedback received are featured and the way they build onto each other is showcased.

Links to the interactive online versions of the different platform designed are included.
In order to obtain more relevant feedback, evaluation of the different designs has been performed with Circularise founders and experts from automotive OEMs only.

Iteration 1

Tools: Adobe Illustrator and InVision Studio
Interactive version: https://invis.io/WKRYHSFU5NH
Tested with: Automotive Designer, Product Management and Strategy Intern, Circularise founders

Login

First screen of this iteration is a login page (Figure A6.1). For as trivial as this might seem, a login page is necessary, as it fits better with the automotive OEMs' passion for confidentiality. Databases such as the IMDS, in fact, can only be operated by assigned individuals, who have their own user credential to enter the system. This also helps in case accountability needs to be established.

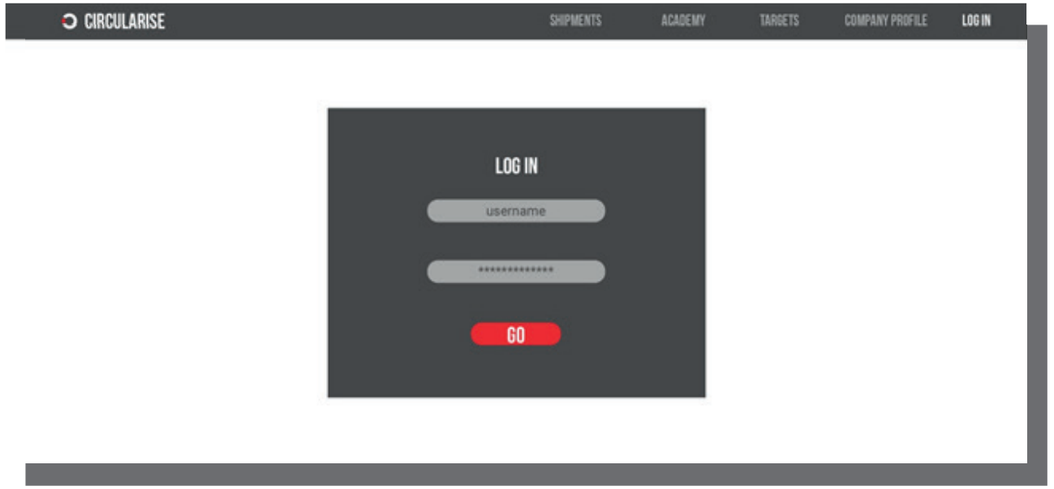


Fig. A6.1
Iteration 1, login screen

The response to the login page was positive. The experts who tested it had no remarks other than the fact that logging in felt normal. Some interesting feedback on this page came from the automotive designer: instead of targeting only Innovation and Environment managers, this platform should be, according to him, accessible to Design and Manufacturing managers as well, as the contents of the following screens seemed to him relevant early in the design phase.

Shipments

Second screen in this platform design is an overview of the materials shipped to the company, with the recycled percentage present in each of them (Figure A6.2). A list of materials characteristics is also included as that is relevant information for automotive OEMs. This screen, containing information about recycled percentages, is the closest one to match the offer of digitalized certificates that already forms part of Circularise's current value proposition. The relevance of this offer stays intact for the automotive industry, because OEMs are interested in making claims about their sustainable practices, (see report Chapter 3).

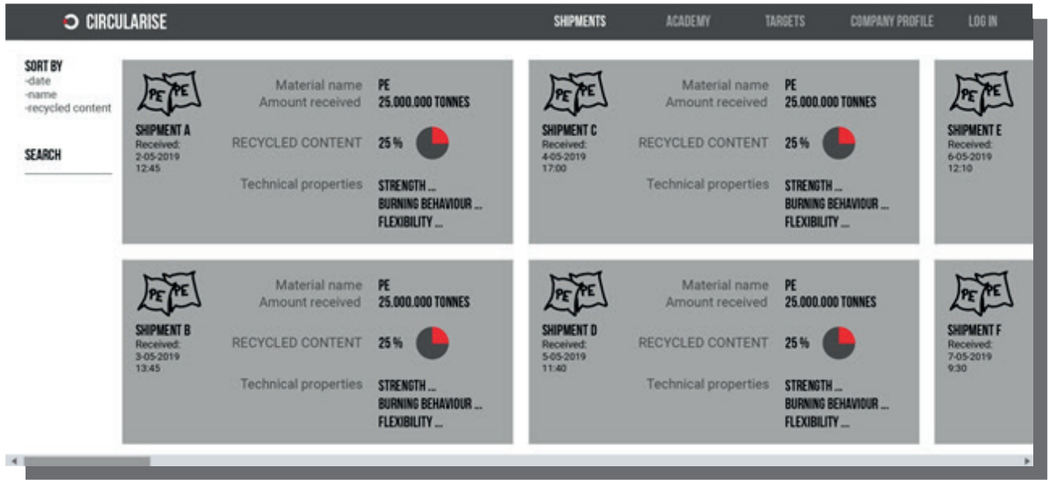


Fig. A6.2
Iteration 1, shipments screen

Feedback received on this screen highlighted how materials are not considered in terms of shipments, but in terms of batches, as only batches share the exact same characteristics. The Product Development and Strategy Intern also made an interesting remark: materials used in automotive are a multitude and such an overview could be valuable for each one of them.

Academy

Here is where information can be found on the trends surrounding recycled materials and on the newest developments on the matter (Figure A6.3). Such information is relevant for the automotive companies to stay aware of the market and possibilities. It is also a potential space for collaboration between the different stakeholders. The idea behind this screen originated from an insight where Circularise was defined as the "enabler" for an industry-level collaboration towards the use of recycled materials. The lack of information that automotive companies have around the possibilities of recycled materials was also evident from interviews conducted by Circularise in the early phases of their collaboration with plastic manufacturers.

Fig. A6.3
Iteration 1, academy screen

Feedback on this screen from the Product Development and Strategy intern revealed how several car brands already possess something they call “Market Dashboard”. On such dashboard, all information about regulations, materials and upcoming developments is featured. Given the confidentiality of such information, however, the Market Dashboard is not a collaborative tool. From Circularise’s perspective, this tab was the least relevant and most difficult to fit into the company’s profile and capabilities. For this reason, in the next iteration this screen was not included.

Targets

This is an overview for automotive companies to check on their progress regarding the use of recycled plastics (Figure A6.4). Internal targets that companies already have are integrated to the targets set by the European Union. The insights that motivate this tab are the lack of an industry-wide standard for computing the presence of recycled plastics in cars and the influence of European policies and targets on recycled materials use, as the aforementioned Plastics Pledging Campaign (see report Chapter 3).

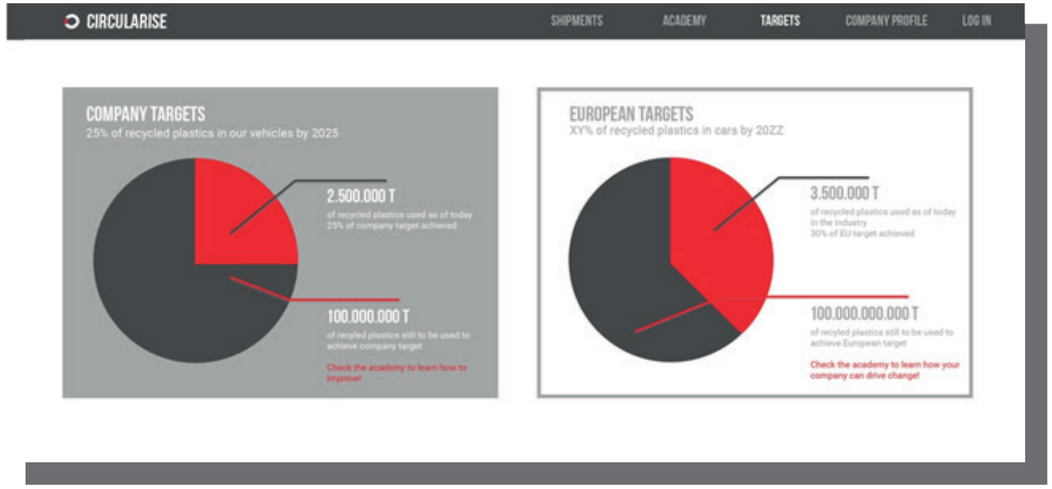


Fig. A6.4
Iteration 1, targets screen

Feedback on this screen was overall positive. The Automotive Designer stated that “hard numbers are good to have for automotive companies, because they are quite fond of bluffing and always claim the rosiest scenario to be true”. Potential improvements for this screen were suggested in terms of leaving options for personalization. Automotive companies, it was pointed out during the screen’s evaluation, are also quite fond of “doing things themselves”, so the option to change the company targets should be incorporated.

Company profile

This last screen contains an overview of the company’s use of recycled plastics and its evolution in time (Figure A6.5). In this screen, an anonymized comparison with other companies in the same industry is shown, as to drive a positive competitiveness on the use of recycled plastics as well. Driving insight behind the design choices was the knowledge that the automotive industry is a highly competitive one. This design tries to leverage upon such competitiveness. Details of the screen, such as the CIRCSCORE visible in the bottom right corner of the page, were used as mere points to spark discussion, rather than completely defined a priory during the design of the screen.

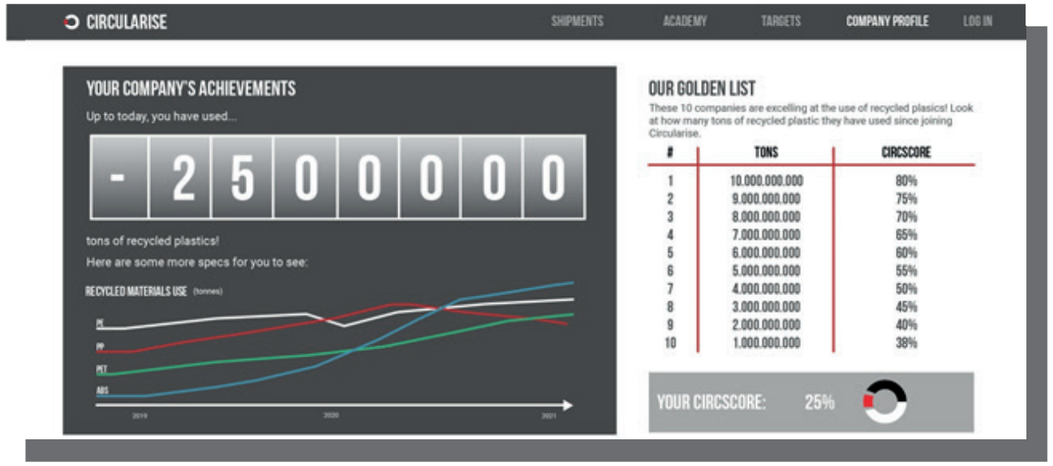


Fig. A6.5
Iteration 1, company profile screen

Feedback on this screen showed how some of the content was slightly repetitive and the overview was not that necessary. “It doesn’t really give much extra information compared to the screen before” was some of the feedback received. The CIRCSCORE also did not spark much interest, as it was difficult for those evaluating the platform to see a way that they could use such information without knowing which competitors were outperforming them in the list. In the further iterations, then, this screen went through quite some changes to become more relevant.

Iteration 2

Tools: InVision Studio
Interactive version: https://projects.invisionapp.com/prototype/cjwhc9mg400078b01qts72wu5/play
Tested with: Advanced Regulations and Global Recycling manager, Circularise founders

Login

The login screen remained unchanged since the previous iteration (Figure A6.6). The intended users of this platform are Sustainability, Regulations and Recycling, Design, Material Procurement, or Manufacturing managers. In such manner, the information available on the platform could influence the company’s activities from the early design phases.

Fig. A6.6
Iteration 2, login screen

Recycled content

In this screen the material's recycled content is shown and given more centrality compared to iteration 1 (Figure A6.7). Materials are presented in terms of batches and not shipments anymore. The title of the tab therefore changed, to realign with these priorities. In the side bar menu, added in this iteration, a list of materials shows how Circularise's protocol could fit more than just plastics. Fabrics are in fact added to the list and in a longer term perspective several other materials could be integrated in this interface too.
The top menu bar shows that information on this page can be sorted according to car model, material batch or single component. This addition to the first iteration was made with the aim to get a better understanding of how the automotive OEMs examine their vehicles when looking at this kind of information.

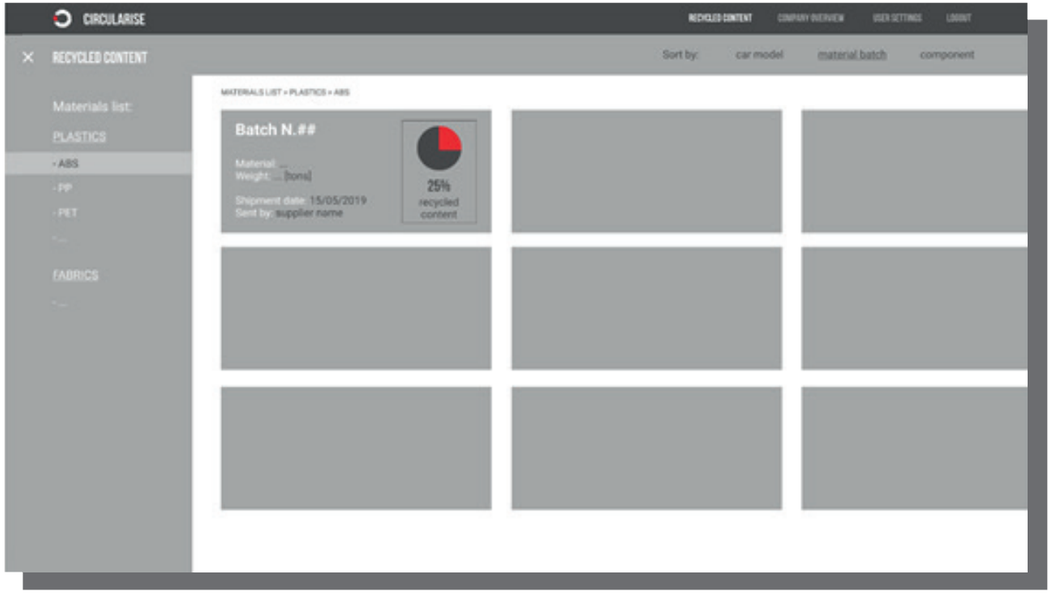


Fig. A6.7
Iteration 2, recycled content screen

Feedback on the information shown on screen was valuable. The Advanced Regulations and Global Recycling manager, in fact, pointed out how in the automotive industry, cars are divided and sorted by vehicle lines. Vehicle lines have then a further partitions, as materials are separated between "interiors", "exteriors" and "under the hood". These three parts of the car, in fact, are composed of different materials, with varying technical properties and specifications, connected to the solicitations the materials have to endure. Having the proposed screen include information over plastics, textiles and potentially other materials was well received too, as recycled content is looked at for "recycled non-metallic materials" as a whole. However, worries were expressed about how this platform and the tracing system behind it might involve substantial costs to the end product. Considerations on the pricing, which were not included in this iteration, make up quite an important part in iteration 3 instead.

Company overview

This tab incorporates information from two tabs present in iteration 1: "Targets" and "Company Profile" (Figure A6.8). The company's target in terms of recycled materials are shown together with the progress made towards achieving it. The possibility to edit the target is also included. A line of text below the company target allows the company to look at the same information but for the European target instead.
On the side, two bars show an overview of the use of recycled materials. The top one shows the overall use of a certain material, in this case generically "plastics" divided between "recycled feedstock" and "virgin feedstock". This information is shown in such way as to improve on how it was included in the "Company Profile" screen of iteration 1. In that screen, in fact, the use of recycled plastic was just shown in terms of numbers and growth on a graph. In order to improve sustainable behaviours, though, a comparisons between the use of virgin and the use of recycled feedstock seemed more relevant. The bottom bar shows the cumulative amount of recycled plastics used per year, or on a quarterly basis. Sorted in such manner, this data can give a good overview of fluctuation in the use and of yearly trends.
The side-bar menu presents a list of other targets automotive OEMs include in their sustainability reports (FCA Group, 2019) that Circularise's protocol could, in the long term, track and integrate.

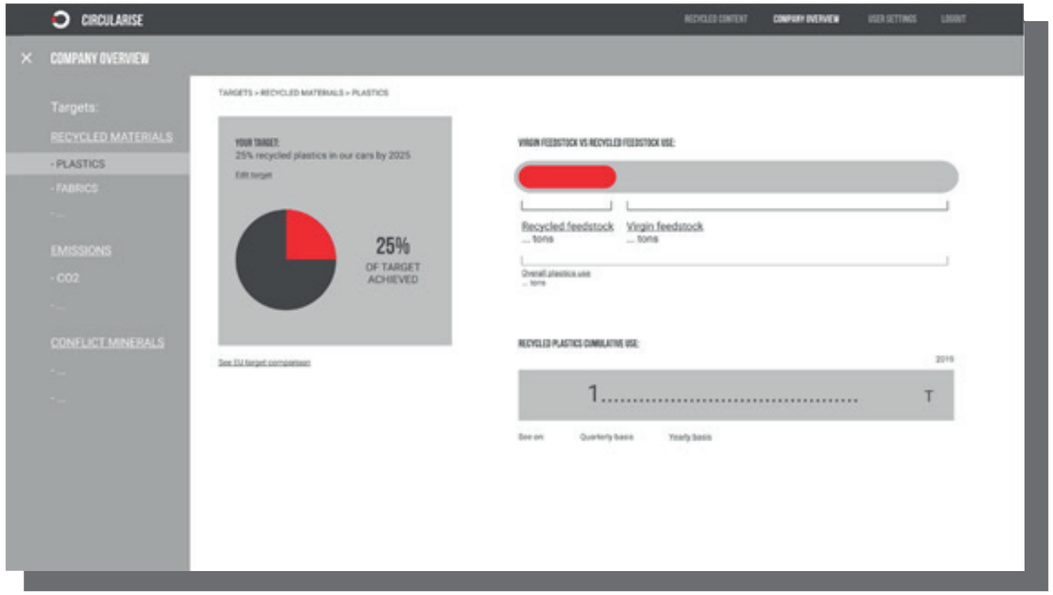


Fig. A6.8
Iteration 2, company overview screen

Feedback on this page confirmed the relevance of seeing the European targets and added the importance of national targets to the list: "I know about Renault, they have a lot of pressure from their own government, the French government is pretty strict on plastics nowadays" stated the interviewed manager. More visibility seemed to be necessary for the European target, because of its relevance for the company's operations. The overview on this page was considered useful to motivate suppliers and internal stakeholders towards a use of recycled materials instead of virgin: "It [our use of recycled material, Ed.] has dramatically decreased through the crisis 10 years ago. It's strange enough, but we had to reduce workforce and you need a lot of workforce to track that and to constantly motivate suppliers, but also own internal engineering departments to track that. This might be of course an argument for such a platform which may ease the tracking.". Little feedback was received on the contents of the side-bar menu, so the decision was taken to iterate on that and test it again in the next version of the screens.

User settings

This screen was added to leave some more room for customizing the information on the platform (Figure A6.9). The feedback received from the Automotive Designer in iteration 1 in fact pointed out how little was allowed for the user to do. The option to choose the materials to track fits well with the regulations regarding the use of recycled content in safety parts. Parts that are critical for safety cannot contain recycled feedstock, as it emerged from an early interview: *"For the products we produce, for the parts, it has to be virgin materials, we cannot use scrap material, because it's safety part, so using recycled is illegal"* stated the Sales Manager of a Tier 2 supplier. It makes sense, then, to include the option of not tracing those materials used exclusively for safety parts.

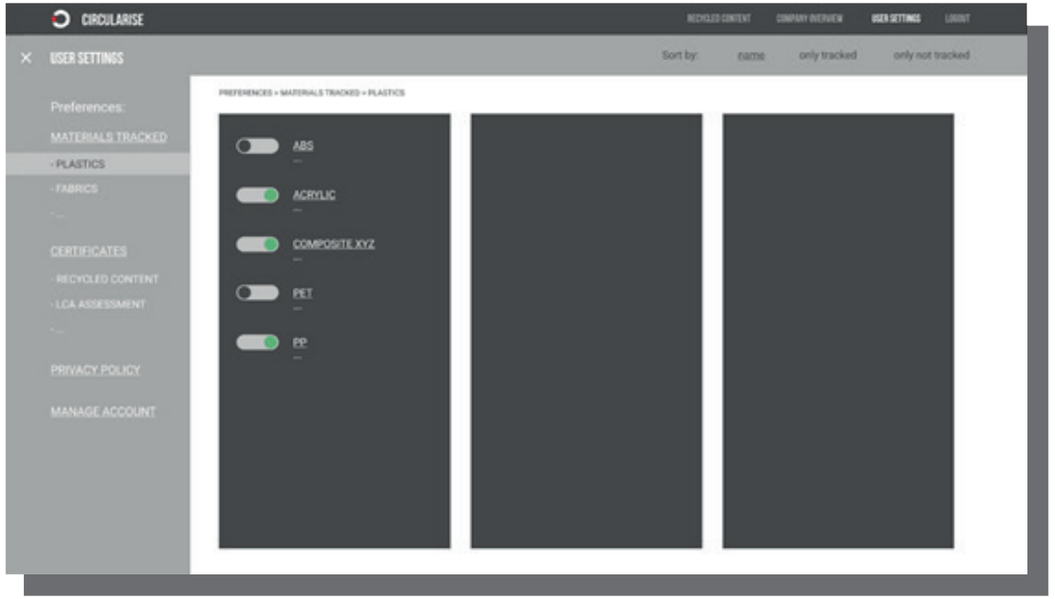


Fig. A6.9
Iteration 2, user settings screen

Feedback received on this screen was quite interesting. Leaving the option to choose which materials to track, in fact, gave way to a question about pricing. Pricing considerations, for this platform, as said before, had not been taken into account in the first two iterations, but were instead included in the third one presented below.

Some more general feedback on the platform was also incorporated in iteration 3. Specifically, the availability of recycled materials, proposed in iteration 1, in the "Academy" tab as data that material manufacturers could share with automotive OEMs, resurfaced from one of the interviewed experts. As a consequence, a way to incorporate that information was added in iteration 3. Finally, Circularise founders observed that overall the prototype was not self-explanatory. Such characteristic had not been a problem in the course of the pervious testing rounds, as the experts were for the whole time guided through the prototype. However, in the next iteration, this feedback has also been taken into account and a short explanatory text has been added to every screen.

Overall, interesting information confirmed by testing this prototype was that no comparable systems are available to automotive companies as of now. More also emerged on the way OEMs collect data on recycled content. Their current method is simply based on auditing each supplier to get estimates of recycled content in the materials received: *"And actually, I..., it is a bit of a difficulty for us to calculate what we have in our vehicles. So there are different methods that you may have heard of, the IMDS database, where our suppliers put in their information. Unfortunately, the quality of information in the database is not quite good, there's not a good discipline. They are using different definitions, calculation methods, and the only alternative we currently have and are using at our company is actually to track each and every supplier individually"*. In the OEM with which this platform was tested, such an activity is a full time task for one/two people per geographic area. Knowing this helped considerably in testing a pricing for the platform in iteration 3.

Iteration 3

Tools: InVision Studio
Interactive version: https://projects.invisionapp.com/prototype/cjvwbsf82007my601ybybq0q9/play
Tested with: former Interior Design Coordinator, Product Development and Strategy Intern, Circularise founders

Recycled content

This screen takes the same basic content of iteration 2, the recycled material content, and arranges it accordingly to automotive OEMs' ways to look at cars (Figure A6.10). Doing so provides the added value of fitting into the industry's workways and processes. This connects

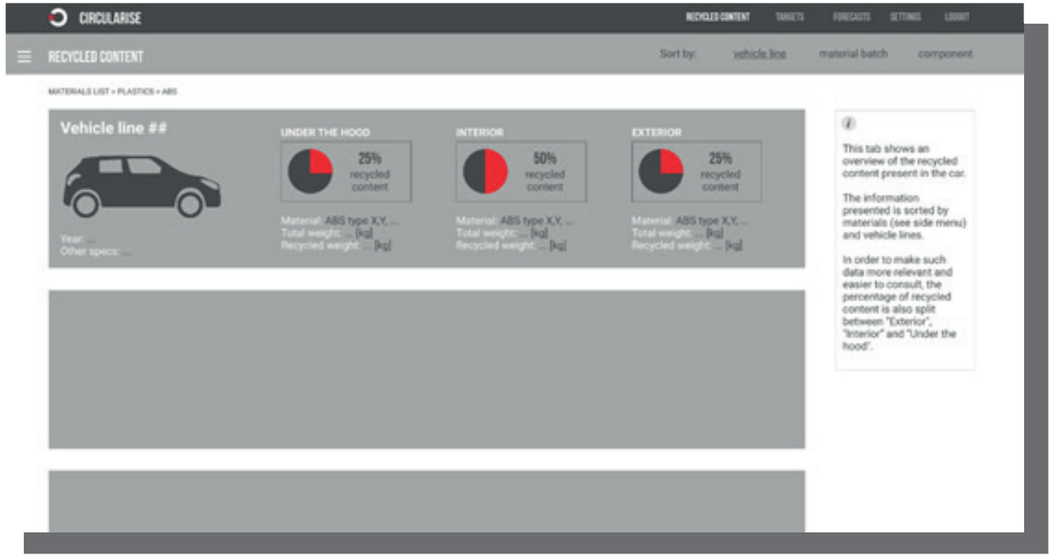


Fig. A6.10
Iteration 3, recycled content screen

back to the first opportunity area identified, developing industry specific solutions. The text on the side gives indications of the tab's content. The side-bar menu (as well as the login page) was left unchanged, and it is hence not shown again.

Feedback on this screen highlighted once again the importance of batches, as materials used vary greatly, in their recycled content, from batch to batch. From the perspective of the former Interior Design Coordinator, this screen was surprisingly not considered to be useful. Sustainability considerations, in the company this expert worked at, are not left to the designers, it seems. Assuming that Design managers might want to access this platform seems then to not always be realistic.

Targets

This screen shows all targets regarding recycled materials used that OEMs must adhere to,

Fig. A6.11
Iteration 3, targets screen

both the internal ones and the ones imposed by the European Union and local governments (Figure A6.11). The target, just like in the previous iteration, is shown in both text and percentage of achievement. The first target replicates Volvo's internal target of 25% recycled plastics by 2025. The European and the French targets are instead just fictitious examples, as fictitious are the percentages of target achieved assigned to each of the three targets. The content of the bars below is the same as in the previous iteration.

Feedback on this screen mostly showed that the way the data is retrieved to check on progress is not automatically clear. In the next iteration, the final design, this matter shall be addressed, as it should be clear that the information contained in the first tab is the source for this overview as well. A question was also raised about who would input the information related to European and national targets, whether it should be Circularise or the automotive company itself. Another consideration for the final design to address. Lastly, one of Circularise's founders noted how the bottom right bar looks more like a field to input data than a number and this detail will then also be taken care of.

Forecasts

As mentioned at the end of iteration 2, a desire to know recycled materials availability was advanced by the Advanced Regulations and Global Recycling manager. Such knowledge, according to him, would enable the company to take decisions upfront about the wider use of recycled materials.
One of the issues of recycled materials is, in fact, their availability on the market, as also mentioned in several interviews of the initial research phase: "I think more important is the availability, that you always have this material available" mentioned the company owner of a Tier 2 supplier when talking about his company's use of recycled materials. This tab then tries to provide forecasts of the availability of recycled materials in the market, based on their presence in cars sold so far and on their predicted life cycle and recovery rate (Figure A6.12). This data would be possible for Circularise to obtain with two different strategies. Initially, by strengthening their partnership with recyclers and in a second moment, once a critical mass of materials are tracked with their protocol, by simply extracting the data from the database of digitalized certificates.

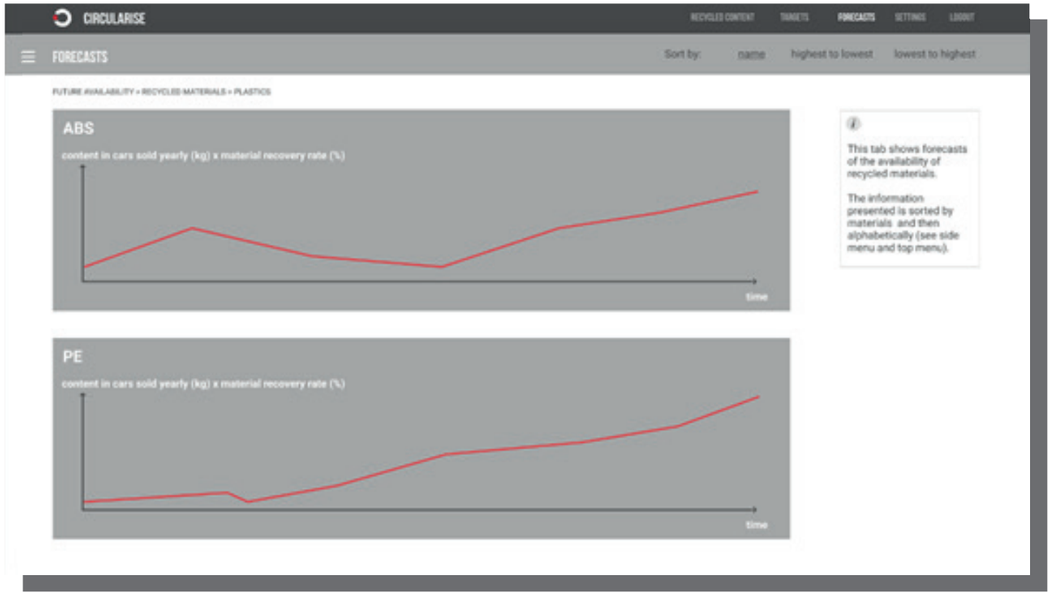


Fig. A6.12
Iteration 3, forecasts screen

Feedback on this tab mainly addressed how the labelling on the axes was not transparent enough to grasp the information quickly. Furthermore, Circularise founders questioned the utility of such forecasts for automotive OEMs. Such utility is best explained in the words of the Advanced Regulations and Global Recycling manager who demanded this information to begin with: *"we know that the availability of material from secondary resources is changing a lot, and when we start to produce a vehicle, we would of course, ideally want to see that there's a source where we have a guarantee that recycled material will come over the next years, over the production time of the vehicle, in a constant way, so that we can produce, let's say, 1000 vehicles each day".* Basically, the information in this tab could ensure automotive companies that the recycled material they could be using won't run out halfway through production of the vehicle line it's being used for. As such, this assurance could encourage automotive OEMs to choose

for recycled materials more often and with more confidence than they do now.

Settings

The last tab, settings, was used in this prototype to spark discussions in terms of the pricing ranges this platform could have. However the numbers and options visible below are not quite arbitrary (Figure A6.13).
Considerations were made onto what kind of similar digital services could be used in a comparative benchmark. Comprehensive pricing considerations have however already been included in Chapter 5 of the report and won't be repeated here.

Feedback on this tab focused mostly on how low the proposed price seems to be. Having settled for such a low pricing allowed to spark discussion and gain more insights on what kind of prices B2B offerings have in the automotive sector. The Product Development and Strategy Intern, in fact, compared the offer of the platform against sales forecasting reports. In the automotive company he works for, sales forecasting reports can cost anywhere from 50.000 € up to 100.000 € a year. The former Interior Design Coordinator also shed some light into automotive pricings. He couldn't think of any directly, or indirectly comparable offers, but he mentioned that a senior manager in the field earns somewhere around 200 € an hour. Both these numbers were extremely useful in the final calculations of revenue streams for the new business model, featured in the report's Chapter 5.

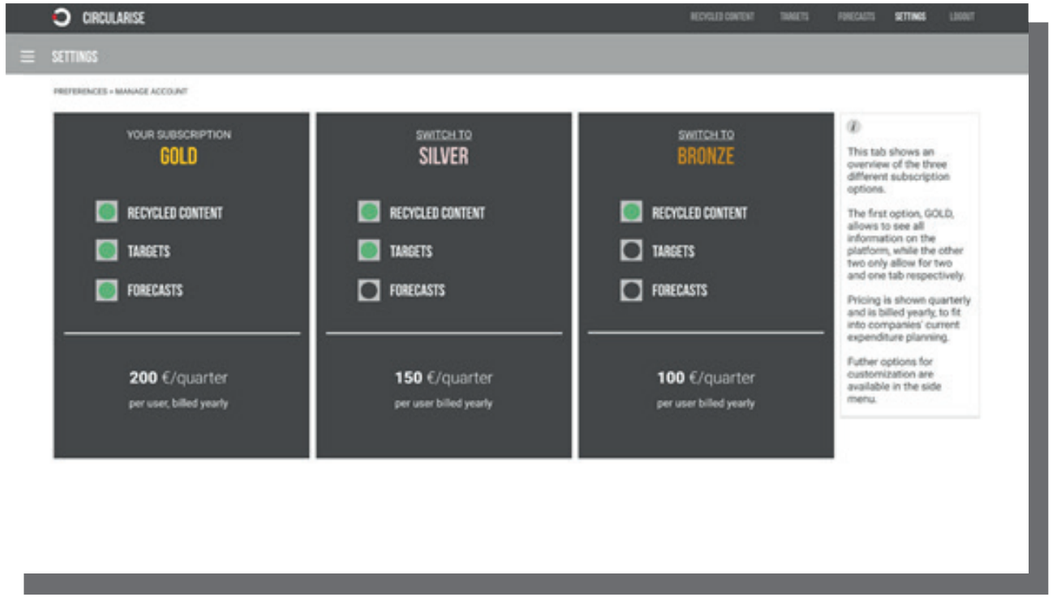


Fig. A6.13
Iteration 3, settings screen

Appendix #7
Prototype testing interview guide

In the next pages, the interview guide used for testing the second iteration of the platform is featured. The interviews conducted were again semi-structured and the guide below include both the main discussion points and the related probing questions.

Screen 1 _ recycled content

1. What do you see on this screen?
2. Do you have a similar overview of recycled content for the materials you use?
3. How would you use such overviews to communicate with internal/external stakeholders or suppliers?

Could you please click on the side bar menu?

1. Which materials would be most interesting for you to monitor?
2. Do you track any of the materials you use in cars?
3. Further comments?

Screen 2 _ company overview

1. What do you see here?
2. How could this overview help you in your daily job?

Click on the side-bar menu, please

1. What kind of targets does Ford (and automotive companies in general) mostly care about?
2. Any further comments?

Screen 3 _ user settings

1. Are there materials that are most relevant to trace than others, when it comes to plastics?
2. Why is that?

Click on the side-bar menu please

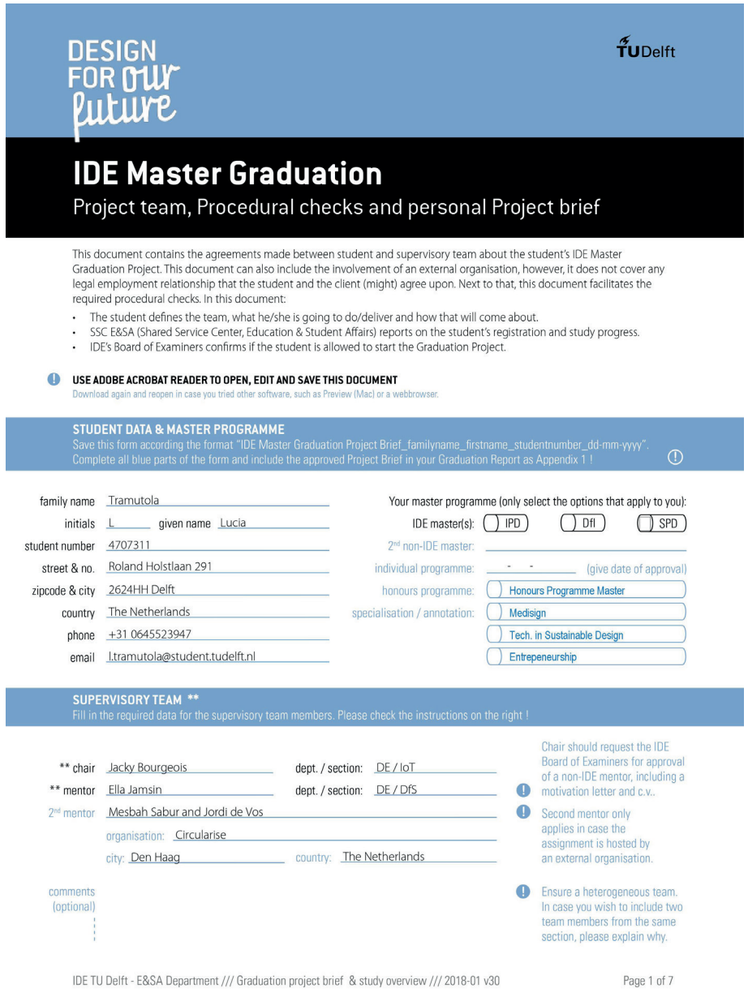
1. What would you like to see under “certificates”?
2. How important are privacy concerns to you, for your daily work?
3. Final comments?

Last but not least, I would like to ask you some more general questions about this platform and the use you would make of it, if it was available to you.

1. How would you use this platform?
2. If this was a service, how would you pay for it? (monthly, yearly, quarterly)
3. What would make it worthwhile paying for?
4. Are there any similar services in the industry already?
5. How do you generally pay for B2B services?

Appendix #8
Prototype testing interview guide

The last appendix featured here is the original briefing of this project, approved by the Board of Examiners in date 18-04-2019.



DESIGN FOR our future

TU Delft

IDE Master Graduation

Project team, Procedural checks and personal Project brief

This document contains the agreements made between student and supervisory team about the student's IDE Master Graduation Project. This document can also include the involvement of an external organisation, however, it does not cover any legal employment relationship that the student and the client (might) agree upon. Next to that, this document facilitates the required procedural checks. In this document:

- The student defines the team, what he/she is going to do/deliver and how that will come about.
- SSC E&SA (Shared Service Center, Education & Student Affairs) reports on the student's registration and study progress.
- IDE's Board of Examiners confirms if the student is allowed to start the Graduation Project.

USE ADOBE ACROBAT READER TO OPEN, EDIT AND SAVE THIS DOCUMENT
Download again and reopen in case you tried other software, such as Preview (Mac) or a webbrowser.

STUDENT DATA & MASTER PROGRAMME
Save this form according the format "IDE Master Graduation Project Brief_familyname_firstname_studentnumber_dd-mm-yyyy".
Complete all blue parts of the form and include the approved Project Brief in your Graduation Report as Appendix 1 !

family name: Tramutola
initials: L. given name: Lucia
student number: 4707311
street & no.: Roland Holstlaan 291
zipcode & city: 2624HH Delft
country: The Netherlands
phone: +31 0645523947
email: l.tramutola@student.tudelft.nl

Your master programme (only select the options that apply to you):
IDE master(s): IPD / Dfl / SPD
2nd non-IDE master:
individual programme: - - (give date of approval)
honours programme: Honours Programme Master
specialisation / annotation: Medisign / Tech. in Sustainable Design / Entrepeneurship

SUPERVISORY TEAM **
Fill in the required data for the supervisory team members. Please check the instructions on the right !

** chair: Jacky Bourgeois — dept. / section: DE / IoT
** mentor: Ella Jamsin — dept. / section: DE / DfS
2nd mentor: Mesbah Sabur and Jordi de Vos
organisation: Circularise
city: Den Haag — country: The Netherlands
comments (optional)

Chair should request the IDE Board of Examiners for approval of a non-IDE mentor, including a motivation letter and c.v..
Second mentor only applies in case the assignment is hosted by an external organisation.
Ensure a heterogeneous team. In case you wish to include two team members from the same section, please explain why.

IDE TU Delft - E&SA Department /// Graduation project brief & study overview /// 2018-01 v30 — Page 1 of 7

Procedural Checks - IDE Master Graduation

TU Delft

APPROVAL PROJECT BRIEF

To be filled in by the chair of the supervisory team.

chair Jacky Bourgeois date - - signature

CHECK STUDY PROGRESS

To be filled in by the SSC E&SA (Shared Service Center, Education & Student Affairs), after approval of the project brief by the Chair.
The study progress will be checked for a 2nd time just before the green light meeting.

Master electives no. of EC accumulated in total: ____ EC

Of which, taking the conditional requirements into account, can be part of the exam programme ____ EC

List of electives obtained before the third semester without approval of the BoE

YES all 1st year master courses passed

NO missing 1st year master courses are:

name date - - signature

FORMAL APPROVAL GRADUATION PROJECT

To be filled in by the Board of Examiners of IDE TU Delft. Please check the supervisory team and study the parts of the brief marked **.
Next, please assess, (dis)approve and sign this Project Brief, by using the criteria below.

- Does the project fit within the (MSc)-programme of the student (taking into account, if described, the activities done next to the obligatory MSc specific courses)?
- Is the level of the project challenging enough for a MSc IDE graduating student?
- Is the project expected to be doable within 100 working days/20 weeks ?
- Does the composition of the supervisory team comply with the regulations and fit the assignment ?

Content: APPROVED NOT APPROVED

Procedure: APPROVED NOT APPROVED

comments

name date - - signature

Personal Project Brief - IDE Master Graduation

TU Delft

Enabling data sharing in a circular economy project title

Please state the title of your graduation project (above) and the start date and end date (below). Keep the title compact and simple.
Do not use abbreviations. The remainder of this document allows you to define and clarify your graduation project.

start date 18 - 02 - 2019 12 - 07 - 2019 end date

INTRODUCTION **

Please describe, the context of your project, and address the main stakeholders (interests) within this context in a concise yet complete manner. Who are involved, what do they value and how do they currently operate within the given context? What are the main opportunities and limitations you are currently aware of (cultural- and social norms, resources (time, money, ...), technology, ...)

Circular economy, according to the definition by the Ellen McArthur's foundation, aims to "redefine growth, focusing on positive society-wide benefits". It does that by standing on three pillars: actively eliminating waste and pollution, regenerating natural systems and keeping products and materials in use.

However, to achieve this successfully, traceability and transparency of materials and sourcing should be granted all along the supply chain. In fact, transparent communication of materials' sourcing/provenance/recyclability could open up new business opportunities for car manufacturers as well and modify their retail strategies. Circularise's protocol is an interesting solution to this dilemma, as it allows traceability along the supply chain.

Circularise is a Den Haag based start-up that developed an open protocol focused on labelling products, materials and components to improve traceability and recyclability in the PLM (product lifecycle management). Leveraging the standard regulations of the European market, Circularise's protocol is based on smart contracts, written onto a blockchain. The information written there is accessed and recorded via smart tags that are placed on materials, products or single components.

Currently, as part of the Horizon 2020 project, Circularise is working with plastic manufacturers for materials traceability along the supply chain. These plastic manufacturers sell their products (structural plastics, in most cases) to a number of companies, among which several well-known names in the automotive sector.

Three main stakeholders are involved in the depicted scenario:
Plastic manufacturers – claim makers
Automotive companies – claim seekers
Buyers – private or corporate

For plastic manufactures, Circularise's protocol offers an easy and trustworthy way to make claims regarding the product they sell.
Automotive companies benefit from the traceability of the plastic materials they use, as they can leverage on them to make claims regarding the sustainability of their cars, such as, for example, the percentage of recycled plastics.
The kind of traceability Circularise can offer, would also be relevant for the car buyers, as consciousness around the environmental impact of cars is rapidly growing. Being able to access a clear overview of information about the supply chain could in fact allow the buyers to make more conscious sustainable choices.

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introduction (continued): space for images

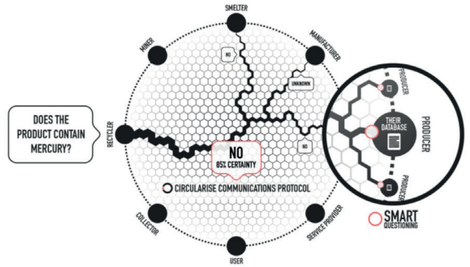


image / figure 1: Circularise's protocol (www.circularise.com)

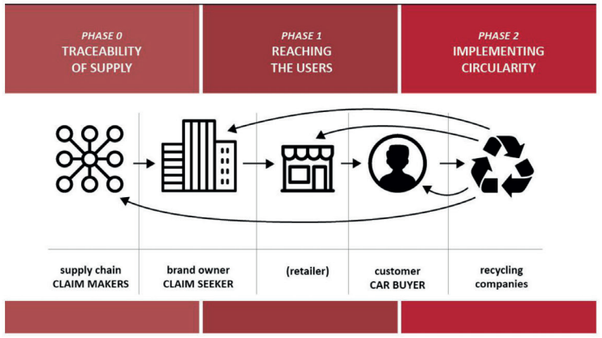


image / figure 2: Supply chain from manufacturers to end user, with Circularise's activities in phases

PROBLEM DEFINITION **

Limit and define the scope and solution space of your project to one that is manageable within one Master Graduation Project of 30 EC (= 20 full time weeks or 100 working days) and clearly indicate what issue(s) should be addressed in this project.

Circular economy thrives on transparency and the possibility to verify claims regarding the provenance of materials, components or products and their movements in the supply chain. Navigating the complexity of the supply chain's system is not an easy feat, though, especially for product buyers.

As a consequence, when manufacturers or retailers make claims about the provenance, sustainability or recyclability of the products they sell, buyers have a difficult time establishing their truthfulness. This becomes frustrating for both consumers and brand owners, as it creates an atmosphere of mistrust and uncertainty.

How might then Circularise's protocol be best applied by manufacturers and brand owners to overcome this barrier, boost their business and increase their number of buyers?

A focus area will be picked in order for the evaluation to be thorough. Such area will be automotive retail, as Circularise is in these very days initiating a project with a number of plastic manufacturers and some automotive companies that believe in taking actions for increasing their transparency and sustainability.

ASSIGNMENT **

State in 2 or 3 sentences what you are going to research, design, create and / or generate, that will solve (part of) the issue(s) pointed out in "problem definition". Then illustrate this assignment by indicating what kind of solution you expect and / or aim to deliver, for instance: a product, a product-service combination, a strategy illustrated through product or product-service combination ideas, ... In case of a Specialisation and/or Annotation, make sure the assignment reflects this/these.

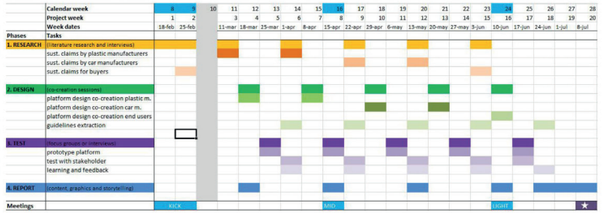
This project will investigate stakeholders' response to claims about plastics traceability and recyclability in the automotive field. Goal of this project is to design guidelines for an optimal communication platform that allows the different users to access an overview with relevant information.

In order for the end results to be relevant, the project will involve research on three main topics:
1- sustainability claims made by plastic manufacturers to car manufacturers
2- sustainability claims made by car manufacturers to customers
3- sustainability claims that influence buyers' behaviour and buying decisions
Priority will be given to the first two topics, as potentially more relevant, if a choice seems to be necessary.
From such investigation, a list of claims will be drawn and common interests found between the three main stakeholders. These will be the base on which guidelines for a communication platform will be designed, together with stakeholders.
Thanks to such a platform, Circularise will be able to act as intermediary and help buyers in taking more informed decisions around the sustainability of their new vehicles purchases. Automotive companies and retailers will also benefit from the use of this platform, as the information showcased there will prove the truthfulness of their claims around tracing, sustainability and recyclability of their products.
Guidelines will be tested thanks to prototypes of the platform. Several iterations will be conducted on a design solution and used to collect feedback from stakeholders. However, the guidelines will remain the main deliverable of this project, as, given the speed at which a start-up operates, a finalized design of the platform may quickly become irrelevant for Circularise.

PLANNING AND APPROACH **

Include a Gantt Chart (replace the example below - more examples can be found in Manual 2) that shows the different phases of your project, deliverables you have in mind, meetings, and how you plan to spend your time. Please note that all activities should fit within the given net time of 30 EC = 20 full time weeks or 100 working days, and your planning should include a kick-off meeting, mid-term meeting, green light meeting and graduation ceremony. Illustrate your Gantt Chart by, for instance, explaining your approach, and please indicate periods of part-time activities and/or periods of not spending time on your graduation project, if any, for instance because of holidays or parallel activities.

start date 18 - 2 - 2019 12 - 7 - 2019 end date



I plan to work full time on this project, starting before the end of February. The first week of March I will be on a study trip to Stockholm, so that will count like holiday from my graduation. Other than that, I plan to take two days of holiday on the 11th and 12th of April, to visit the Fuorisalone in Milan. For the rest, I will not plan further holidays, as it is necessary for me to graduate in the first half of July.

My project will see three main phases, research, design and testing, that will be overlapping in iteration cycles. A cycle will last two to three weeks and each cycle will build on the findings from the previous one. This planning approach will allow me to make sure my research stays relevant and will help me gain feedback on my deliverable early on.
The focus of the first cycle will be on the buyers. My main objective will be finding out claims, related to plastics sustainability, that appeal to car buyers. The second and third cycle will focus on the brand owners and on the plastic manufacturers respectively.

The last three weeks, planned under reporting, will serve as buffer time in case of any delays in my planning and will help me for a final check on my storytelling and graphic design.

Throughout my project, I plan to involve Circularise as much as possible, in order to develop a solution that is relevant to them and targeted to their needs. To do so, I will work at their office at least one day a week.

MOTIVATION AND PERSONAL AMBITIONS

Explain why you set up this project, what competences you want to prove and learn. For example: acquired competences from your MSc programme, the elective semester, extra-curricular activities (etc.) and point out the competences you have yet developed. Optionally, describe which personal learning ambitions you explicitly want to address in this project, on top of the learning objectives of the Graduation Project, such as: in depth knowledge a on specific subject, broadening your competences or experimenting with a specific tool and/or methodology, ... Stick to no more than five ambitions.

Back at the beginning of this academic year, when I started considering options for my graduation project, I decided to use my last semester at university to explore new fields.
This project gives me the perfect option to do so, as it revolves around circular economy and technology at the same time.
These two broad fields are extremely relevant these days and I believe their combined action can drive positive change. Hence, the decision to take on this challenge.

Throughout the following 20 weeks, I want to make use of tools I learned during the course of my master, such as creative facilitation and roadmapping.
At the same time, I would like to improve my skills in qualitative interviews and try my hand at co-creation.

The project with Circularise will allow me to do so, as it will put me in touch with both retailers and end users, giving me a chance to hopefully organize and facilitate a creative session with both. Co-creation will come in handy at the end of my project, when designing a solution targeted to the end user, together with the end users themselves.

FINAL COMMENTS

In case your project brief needs final comments, please add any information you think is relevant.

Lucia Tramutola _ master thesis

Chair_ Jacky Bourgeois
Mentor_ Ella Jamsin
Coaches_ Mesbah Sabur, Jordi de Vos

TU Delft, July 2019