Don't let the box out!

A holistic approach to capturing material with recycling potential in the e-commerce sector.

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Preface

Here it is. After four months of preparation, six months of research, and a pandemic situation, this master's thesis presents the final research and design project to achieve the master Strategic Product Design at the Delft University of Technology. A personal dream that I had and could not have even imagined how personal this road was. I would like to thank the Industrial Design faculty of the TU Delft for granting me the OTS Faculty Scholarship that allowed me to be here.

My passion and previous background around packaging opened the opportunity to research recycling systems. As this thesis will explain, collaboration is key to create value, and connecting needs will allow the system to perceive a measurable impact. I share this passion with my mentors Rebecca, and Dirk. Brilliant minds that I had the fortune to work with. Thank you for the guidance and the great conversations together.

I would like to extend this gratitude to Gavin Mounce. Our conversations were vital to this research. Even though I wasn't directly immersed at Ds Smith, you were always open to share and contribute to this project.

On a more personal level, this thesis was not created alone. Having valuable people around me was crucial in this journey. First, I would like to thank my family. I left them two years ago, and they knew that this dream might leave me on the other side of the World, and they were strong enough to live it with me. Specially Guty, thank you for being such support as my brother but lso as my friend.

My second family, my roommates. Luca, Jeroen and Priyanka. Three completely different souls that compliment me. We lived a pandemic together, and that made us inseparable. Thank you for every coffee, lunch and dinner that we had shared, but especially thank you for your support and input around my project.

This is also for you, Bram. We found each other on the way, and you have made me feel at home since then. Thank you for being next to me in all this process as my boyfriend, colleague, and friend (depending on what I needed at that moment). Also, thank you to your family, Tonny and Jaap. Your support has been invaluable to me.

Last but not least, I would like to thank you for reading my thesis report. I hope it can act as a source of inspiration to you.

Lorena Hurtado Alvarez

Abstract

The explosion in e-commerce has been undeniable. Our current global situation has urged the different industries to adapt the way they provide their services & products, creating a higher demand for home delivery.

With 66% of Europeans claiming to have shopped online more since the initial lockdown in March 2020 and 82% planning to shop online at the same level or more post lockdown (Samat, 2014), online shopping will remain in the consumption behaviour of potential customers.

Even if consumers considered receiving their packages at their home or decided to pick them up, some other concerns may arise with this new way of purchasing, especially with the packaging system and the further waste disposal issues that the Netherlands has been facing.

The high demand for packaging material and the tight supply of waste paper are pushing up cardboard prices (Velden & Stooker, 2021). Thus, there is an inconsistency in the collection of material for repurposing, leading to an increase in the price of recycled material [+ 214% in May 2021 (TMR, 2021)] and leaving the use of virgin material as a better alternative to meet the demand for cardboard.

With a market estimated to be valued at ~US$ 237 billion by the end of 2019 and anticipated to reach ~US$ 333 billion by 2027 (TMR, 2021), wood pulp became a relevant subject of analysis in this project.

Without a proper strategy to ensure collection and prevent the material from being contaminated, the packaging sector will be forced to bring new virgin material into the chain, which may affect our natural resources in the medium term.

This thesis aimed to identify the potential points where paper-based packaging may become waste. Therefore, a systemic design approach is used to identify the different actors. Then, a strategic solution allows them to set shared needs & impacts and collaborate towards the proposed goal. As a result, a program that incorporates logistic providers, packaging producers and waste collectors was created.

Moots (from the Mayan word that means “roots”) puts the waste collection system closer to the consumer and, in this way, successfully recover, measure, and repurpose waste paper and cardboard. It also evolves the role of the waste collectors where they became a facilitator to enhance collaboration, goal development, implementation, and measurement of objectives with the final aim of reducing the idea of waste.

With the special support of:

DS Smith seenons

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Contents

Aim & approach

The aim of my thesis is to identify the potential points where the paper-based packaging may become waste. Therefore a systemic approach will be used. After the different collaborators are identified and analysed, a strategic solution that allows them to collaborate will be put in place. The goal is to create more visibility on the impact of the material that will be further translated into the governance of the parties involved.
The overarching research question I will be attempting to answer is:

How might we highlight the value of paper-based packaging as raw material and prevented it to become waste?

To be able to cover the spectrum of the challenge, the following sub-questions were included:

- How does the current waste management system work?
- Who are the critical stakeholders around the e-commerce system?
- What other value can be obtained from the waste streams?

The systems approach is a holistic one (Innovation, 2021), which means that all the relevant factors should be considered. Therefore, understanding the context is essential to understand how the parts exist and how they are interrelated and affect each other in the e-commerce sector. This analysis provided me with patterns between the actors and key factors. Based on the above, a future vision is explored. It will point out the proposal of a service network with an explanation of the dynamics structure and overall modification and creating synergy in the current system. A visualisation of the approach is provided in Figure 1.

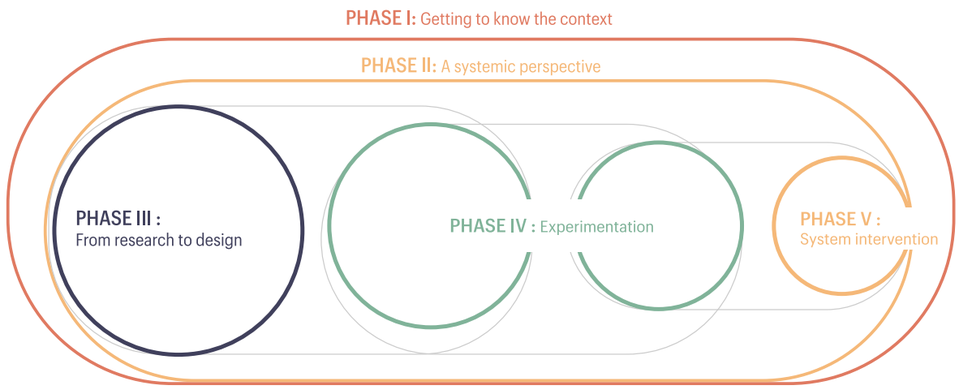

FIGURE 1. VISUALIZATION OF THE HOLISTIC APPROACH


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Introduction

Our current global situation has urged the different industries to adapt the way they provide their services & products, creating a higher demand for home delivery. It's about becoming a lot more sophisticated now that consumers can order almost anything, from jeans to plants or even evening experiences accompanied by physical products.

According to Ecommerce Europe, due to COVID-19, the market of e-commerce providing products under the category of "daily needs" (food, drug store, pet supplies) is perceived to increase sales by 84,2% with a positive public perception of the sector. Specifically in the Netherlands, online grocery sales showed an impressive growth rate of more than 50% between 2015 and 2018 (Belderok et al., 2019).

The convenience of avoiding brick-and-mortar retail has turned e-commerce into a lifeline for many traditional stores. It has also proven resilience by meeting consumers' increased demand and ensuring essential goods and services (Europe, 2020).

Even if consumers considered receiving their packages at their home or decided to pick them up, some other concerns may arise with this new way of purchasing, especially with the packaging system and the further waste disposal issues that the Netherlands has been facing. The high demand for packaging material and the tight supply of waste paper are pushing up cardboard prices (Velden & Stooker, 2021). Thus, there is an inconsistency in the collection of material for repurposing, leading to an increase in the price of recycled material [+ 214% in May 2021 (TMR, 2021)], leaving the use of virgin material as a better alternative to meet the demand for cardboard.

Paper-based packaging has gained a positive perception due to its high recyclability compared to other materials, which has triggered further developments in paper-pulp use in other packaging sectors.
Without a proper strategy to ensure collection and prevent the material from being contaminated, the packaging sector will be forced to bring new virgin material into the chain, affecting our natural resources in the medium term.

PHASE I

Getting to know the context

This phase explores in broad outline the context in which e-commerce is taking place. Next, relevant information on the origin of cardboard and the current status of wood pulp is addressed. Finally, the problem definition is presented.

1.1. The boom of e-commerce

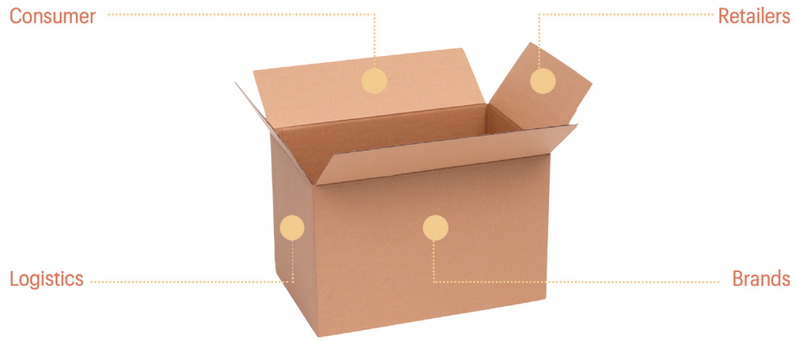
Over time, the way we have been consuming products is evolving according to our needs. Due to the current pandemic situation, our shopping habits are shifting to an online purchase where the requirements of the product have changed along the value chain (Product, packaging, transportation, consumption).

The explosion in e-commerce has been undeniable, with 66% of Europeans claiming to have shopped online more since the initial lockdown in March 2020 and 82% planning to shop online at the same level or more post lockdown (Samat, 2014), making it clear that digital shopping will remain in the consumption behaviour of potential customers.

Moreover, the acceleration of digitalisation of businesses in Europe is noted as a consequence of the pandemic, resulting in the continuous growth of the e-commerce sector (Europe, 2020). But even though local entrepreneurs are present online, their offer is still relatively limited.

While traditional retailing will not be replaced, during COVID times, they have sought different ways to adapt to the online environment. As a result, an attractive alternative has appeared as an environmental solution that will open the opportunity to reduce logistic deliveries. By proposing a model of BOPIS - Buy Online Pickup In-Store- (Samat, 2014, p. 3), logistic providers have been tackling the CO_2 impact on transportation, and the opportunity for small shops to be the ending point for a parcel where the owners may find more attractive the idea of eliminating the worrisome of the package getting lost along the way (Samat, 2014, p. 6). Nevertheless, online shopping is the preference for home delivery, leading to a growing flow of transport movements.

Although 43% of consumers feel guilty about ordering items online, which then arrive with either too much or unsustainable packaging (DS Smith, 2021), the fact is that companies want to preserve the interaction with the consumer, giving now an added role to the primary touchpoint: packaging.



Packaging requirements are higher

It has to serve the many different needs of multiple parties

1.2. Paper-based transport packaging

Different materials are associated withproviding protection during transportation; In the e-commerce sector, the most common material of choice for home delivery parcels has been the corrugated board (most commonly known as 'cardboard'). Since its invention in 1840 (Alec, 1968), cardboard has been transformed into boxes due to its flexibility and resistance. Due to its origin, and as part of the multiple material variables extracted from trees, cardboard belongs to the paper recycling chain, which is considered the most efficient within the recycling processes of different packaging materials.

1.2.1. Packaging "flows"

An adequate pack that gives consumers the trust that their product has been treated properly has become the new standard in a positive purchase perception in the online sector (Parcell, 2007). Therefore, an increased amount of packaging materials has been one of the immediate solutions to preserve the goods' integrity during transit.

With the eminent speed and complexity of modern logistic processes, especially those driven by e-commerce and omnichannel retail, the rapid response has led to excessive use of materials that eventually become waste.

According to Gavin Mounce (e-commerce packaging designer manager) from DS Smith (an international packaging company offering sustainable paper products) has traced that a parcel may have more than 50 different touchpoints in its journey to reach the client. Mounce, G. (2021, April 26). Personal interview [Personal interview], as seen in Figure 2.

FIGURE 2. JOURNEY COMPARISON OF TRADITIONAL RETAIL VS E-COMMERCE (DEUTSCHE POST DHL GROUP, 2019, P. 7)

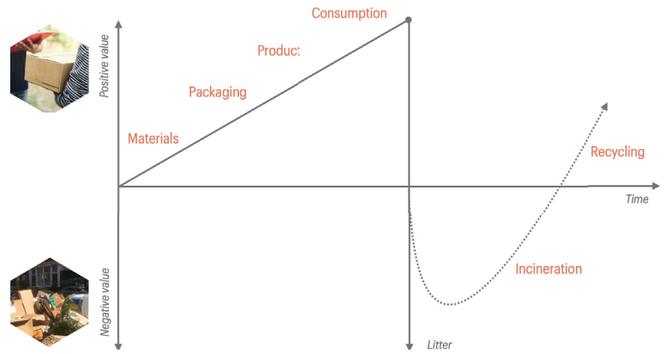


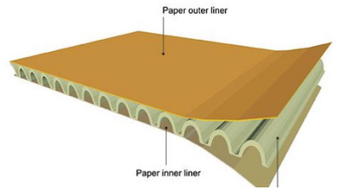
FIGURE 3. THE TYPICAL STEEP VALUE DROP OF PRODUCTS THAT FLOW (ZIJLSTRA Y, GELDER M, 2018, P. 13)

Once the product has reached its destination, the value of the transport packaging becomes null for the consumer. For Siem Haffmans, these kinds of products are described as products that flow. Up to some extend and despite the channel where the product moves, almost all products flow (Zijlstra Y, Gelder M, 2018, p. 13).

A product that flow is often a temporary complement of other products, and analysing their flow principles is essential to make pertinent adjustments (Zijlstra Y, Gelder M, 2018, p. 14).

In this context, transport packaging is the right example of a product in which 'flow effect' should be minimised. It is fundamental for the protection and logistics of a product. It has become "the face of the product" and aims to provide customers with a higher experience. However, today's approaches to packaging are struggling to meet the changing needs of consumers, companies and the environment (Deutsche Post DHL Group, 2019, p. 3).

Corrugated board is produced from virgin and recycled wood pulp. By combining various papers together in the form of paper layers, a board is produced with a structure of liners and fluting (DS Smith, n.d.). The thickness of each liner is a variable to consider since it plays a crucial role in the structure and resistance needed for the future box.



1.3. From one value to another:
Keeping the required conditions of the material to be recycled.

Consumers product value is subject of continuous change (Haffmans, 2018, p. 38); currently, the value of transport packaging is lost when it reaches its destination; It turns into waste in seconds. With the crescent demand of all online buyers, the e-commerce sector is just expecting to keep on growing up an average of 14% in at least 13 categories (Streng & Knippenberg, 2020, p. 11). On the other hand, Recycling paper has reached a high level of control (Haffmans, 2018, p. 79), but it is not perfect yet.

Consumers are prepared to separate all paper from the rest of their waste but are often unaware that grease and small amounts of leftovers spoil paper's processing potential (Haffmans, 2018, p. 79).

Nonetheless, the demand for paper to produce paperboard has increased thanks to online consumption, which has left the recycling chain in trouble, as it has not found enough raw material to be able to produce pulp.

> *Paper is quite simple to recycle, yet 55 percent of the global paper supply comes from newly cut trees*
>
> *(The World Counts, 2021).*

Wood pulp is a mix of water and recycled paper that under controlled conditions can be re-formulated to transformed into useful paper for the cardboard industry).

Each ton of recycled paper can avoid the use of 17 trees; 1,440 liters of oil; 2.3 cubic meters of landfill space; 4,000 kilowatts of energy and 26,500 liters of water. (The World Counts, 2021)

WOOD PULP

Reaching "the perfect flow" of materials in the sense that no waste is produced is often addressed as 'closing the loop' (Haffmans, 2018). Cardboard is primarily made from old paper, but during the corona crisis, the collection has been compromised due to the excess of transport packaging used in the e-commerce sector mainly.

Either the collection was stopped mainly due to the possible risk of contamination, or the collection points have been exceeded their capacity. The situation has compromised the "flow" of a material that has been recognised as one of the most recycled and environmentally friendly materials.

1.4. Problem definition:
The upcoming wood pulp crisis.

Due to its origin, the returnability of wood pulp has been taken care of in such an extent that it is the highest ranked when it comes to using it for a recyclable process.. The packaging industry claims that the Dutch high recycling rates make the country 'one of the leaders in Europe' (Nazaruk et al., 2021); and, according to the European Environment Agency (EEA), the Netherlands is fourth in the EU in terms of recycling municipal waste, with 54% being recycled in 2019. For this reason, wood pulp has been considered an attractive alternative raw material to other sectors.

Given the profound challenges of eliminating CO2 emissions from petrochemicals and plastics, material substitution has become an interesting line of research for start-ups and innovators that are looking to provide solutions more "eco-friendly."

The use of pulp in a multitude of industries such as wood and paper manufacturing, packaging, and food/ beverages has played a vital role in market growth (TMR, 2021). With a market estimated to be valued at ~US$ 237 billion by the end of 2019 and anticipated to reach ~US$ 333 billion by 2027 (TMR, 2021), wood pulp became a relevant subject of analysis in this project.

Without a constant and fluent collection source, high container prices, higher pulp and energy prices and limited capacity at paper mills, the prices of waste paper and cardboard have been reached all-time highs. In addition to a significant issue with the percentage rates presented by both EEA and the packaging lobby in the method of calculating recycling.

According to the EU, all collected and sorted waste counts as recycled while 'pollution' such as left-over liquid in a bottle is also included (Nazaruk et al., 2021). However, with no clear boundaries on what is claimed as recycled, the stated percentages may not indicate the whole picture.

An article from the Lighthouse Reports (du Saar Nouska, Hoogenraad Laura, n.d.) found that Dutch waste, marked as recycled, was shipped to Turkey. Some of the 54% actually ends up being shipped incinerated or shipped overseas.

With no clear measurements and an increasing demand for wood pulp-based packaging in all levels (primary, secondary, tertiary), new pressure for the pulp industry's supply chains arose and a pulp crisis is envisioned in the short term.

FIGURE 4. RELEVANT EXAMPLES OF MATERIAL SUBSTITUTION WHERE WOOD PULP IS THE NEW RAW MATERIAL.

Conclusion

A clear impact in the way of purchasing products may align different actors to evolving in their current way of working.
The outcome of the context research triggers my curiosity to look for the links between the e-commerce sector and understand how e-commerce saturate the current recycling system.
It is also expected to find how the relationship with the different stakeholders may prevent deviation of transport packaging material that might potentially become waste.

"At the end of the day, recycling needs waste, and since economic growth is, by default, connected to a continuous increase in consumption of materials and energy, recycling businesses thrive on the growth of the amount of waste."

Siem Haffmans, Author of Products that flow.

PHASE II

A systemic perspective

This phase introduces the main actors around e-commerce and explicitly exploring the waste disposal system. Then, it explains the systems approach and the research questions of the analysis. Finally, the key factors of the analysis are presented.

2.1. Approach to literature review

2.1.1. Systems approach

A linear-based production model responds to the economic structure we currently have, where the value of the product is not meant to last, and it fulfils a need under the concept of being produced, purchased, consumed and disposed.

To fully achieve sustainability, the change in the conception and life expectancy of products should be accompanied by an orthodox economic structure that Joanna Boehnert described as economics driven by value rather than values driven by economic value as is the case with the current economic system (Boehnert, 2019).

On the other hand, transitions appear in breaking point moments and should be used to enter new models that may align our income system towards ecologically viable and socially accepted process (Boehnert, 2019). Due to the pandemic situation, our consumer behaviour has looked at online purchasing as a convenient substitution to satisfy our needs. This is the right breakup moment to act towards a shift that may lead us to assure and secure the recycling systems behind transport packaging.

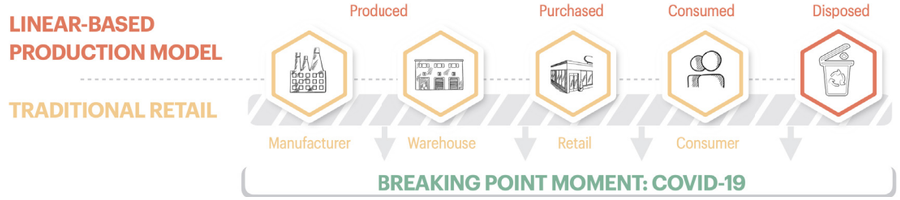


FIGURE 5. Journey comparison of traditional retail vs E-commerce (Deutsche Post DHL Group, 2019, p. 7)

To understand the changes that arouse this way of consumption, and potential leakage points for paper packaging material, a system analysis was considered.

The research questions used to perform this analysis were:

RQ1: How might systems-oriented design help to understand the connection behind paper-based packaging?
RQ2: How does the ecosystem around paper-based packaging works?
RQ3: Who are the main actors around the ecosystem?
RQ4: What are the connections behind the actors involved?

The primary source of information to answer these questions consists of academic publications, public available material such as news articles, annual reports and research reports that involve the topic of recyclability, waste management or policies towards a circular economy. Once the actors were known, some of them were supported by interviews with relevant people in the sector and allowed me to better understand the needs and ways of working.

2.2. System visualization

System oriented design mapping strategies can contribute to more effective visualisations of economic systems to help reveal structures, dynamics and flows in economies on various scales (Boehnert, 2018). Considering all the logical actors, the goal was to reveal the context and relationships between the parties involved visually. Understanding the relationship between economic value and social values is central to comprenhend how practices, behaviours, and values supporting sustainable ways of living can be generated by design (Boehnert, 2018).

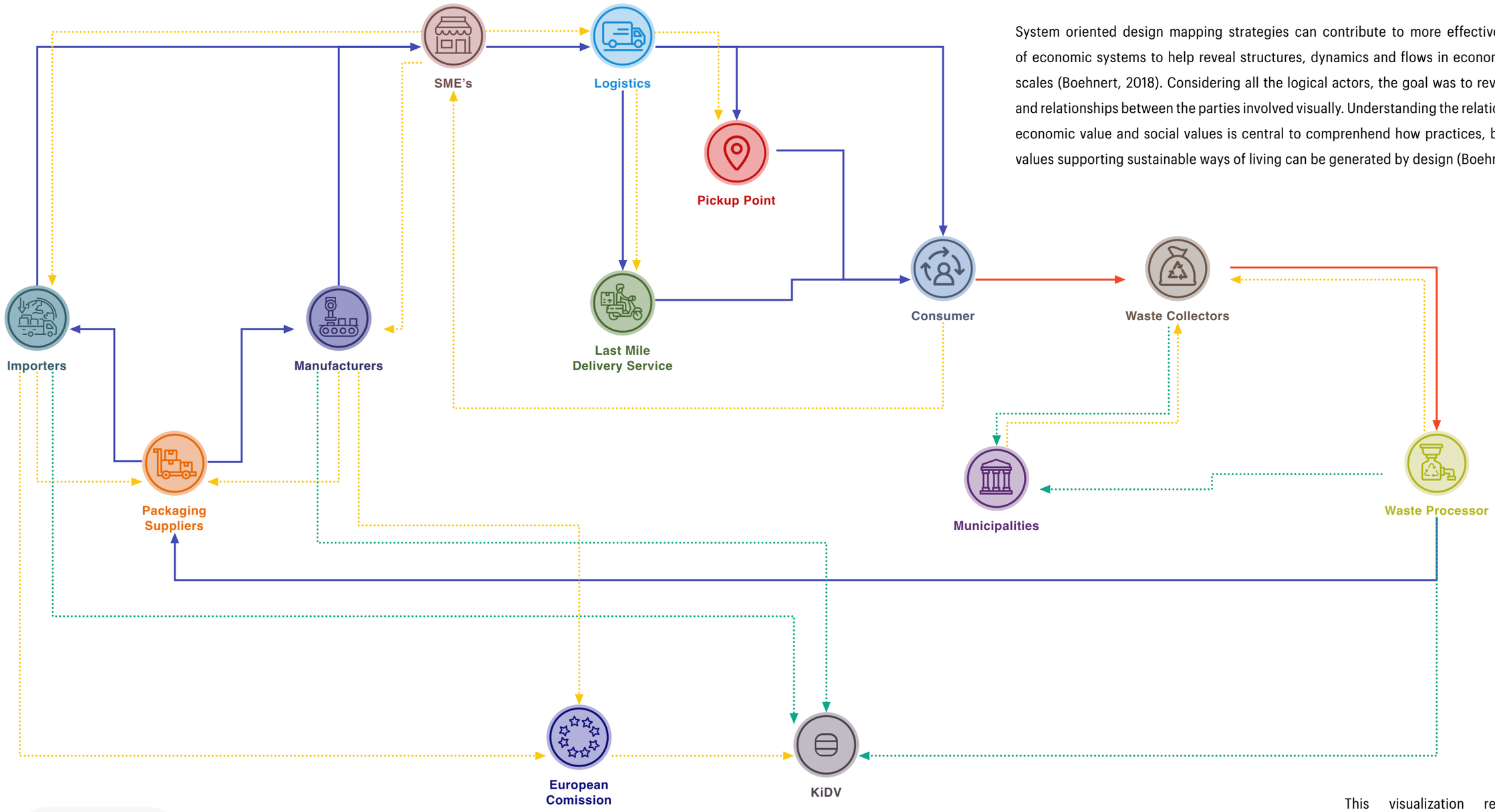


FIGURE 6. System Visualization

This visualization represents the connections around the more important actors around the e-commerce sector. Part 2.3 will explain in more detail those connections.

2.3. Description of the system

To be able to map the connections around the e-commerce sector, desk research was performed to identify the actors involved. The main figures are **retailers, logistic services, consumers, government, waste collectors and processors, transport packaging producers, and digital services.** Later in the process, specific actors of the system were contacted to perform an interview and take more particular characteristics of each one.

Retailers

After the pandemic crisis, consumers started to appreciate buying local products at local stores and online shopping. More and more consumers, including the baby boomers, are now familiar with the advantage of online (Samat, 2014). Being able to receive the essential goods with just one click results in a more convenient way of buying. After one year, it seems that e-commerce will just keep growing, changing traditional brick-and-mortar retail perception. Customers expect the same level of service, choice, and convenience from retailers, whether interactions are face-to-face or online (Deutsche Post DHL Group, 2019).

Nevertheless, retailers and brands are aware of the push towards a digital and connected world, seeking to create a seamless and continuous journey for their customers (Kezzler, 2020, p. 3).

As a result, traditional retail stores have been exploring new touchpoints that can be combined with an online experience. Thus, omnichannel seems to be the right approach to remain relevant for the consumer. However, local stores in smaller sectors that cannot have the resources to transform their business models have also explored the possibility to become a touchpoint in the online experience. The possibility of BORIS (Buy Online Return In-store) and BOPIS (Buy Online Pickup In-Store) give them access into this online presence that they will not be able to achieve alone (Samat, 2014, p. 3). By collaborating with the parcel logistics companies, the small retailers can remain relevant and considering a sustainable and possibly convenient location to deliver a parcel. At the same time, they can obtain a fee per each package received. On the other hand, the local retailer 'win back' customers they were previously served at e-commerce.

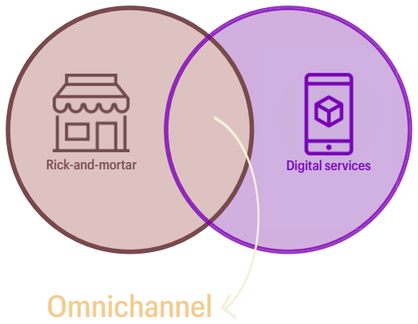


FIGURE 7. THE RICK-AND-MORTAR CHANNEL AND THE TRANSITION TO OMNICHANNEL DUE TO E-COMMERCE.

Digital services

As mentioned before, digital transformation is one of the keys to the evolution of retailers and logistics providers regardless of the sector (Skoda, 2021). Living through a lockdown, consumers took advantage of technology and sought to cover different services digitally. As a result, all sectors had to adapt quickly, and now the consumer has adapted to have any product or service at the click of a button.

For this reason, the e-commerce and logistics community has been required to cope with a growth that goes far beyond what was previously expected. A study from Roland Berger suggests that online grocery shopping in the Netherlands will grow by an annual rate of 14 per cent and is expected to reach a total market value of EUR ~7.7 bn in 2030 (Belderok et al., 2019).

Platforms that have long been online have no problem delivering a customer experience that is now becoming a standard for retailers looking to enter e-commerce. However, coupled with new services and experiences that have emerged online-only, digital outings will have to be complete and efficient, from payment to automation now that purchasing online represents 10-20% of total sales (Kezzler, 2020).

Today, consumers not only want their orders to be fulfilled accurately and immediately, but they are also expecting the shipment to be free and transparent, and best if their purchases can seamlessly arrive the next day, if not the same day (Skoda, 2021). This agility can be achieved through omnichannel, which is one of the critical components of our new normal (Skoda, 2021).

Relevant insights from retailers & digital services

· Retail points are evolving trying to cope with online shopping. Traditional retail stores have been exploring new touchpoints that can be combined with an online experience. BORIS (Buy Online Return In-store) and BOPIS (Buy Online Pickup In-Store) give them access into this online presence that they will not be able to achieve alone (Samat, 2014, p. 3)

· A parcel point is a hinge for a service area between online and offline shopping. But the collaboration and the communication between a local retailer, parcel carrier and consumer are not yet optimal. There are various areas to make improvements.

· Online grocery shopping in the Netherlands will grow by an annual rate of 14 per cent and is expected to reach a total market value of EUR ~7.7 bn in 2030 (Belderok et al., 2019).

Transport packaging producers

Packaging design is constantly moving forward with new ideas, new shapes, and opportunities to surprise and delight customers (DS Smith, 2015). When it comes to packaging that can evolve quickly, paper-based transport packaging producers have an ecosystem that, by structure, provide them with the complete process from the pulp processing, paper making and cardboard transformation (DS Smith, n.d.). Therefore, this industry is always looking to advise its customers with the best option to protect their products.

Gavin Mounce, current e-commerce manager of one of the most important paper-based packaging companies in the world, DS Smith granted me an interview that allowed me to get a better overview on how this industry is looking to help to preserve the paper material in good conditions. **[The detailed interview can be found in Appendix C].**

The central role of Gavin's work is to help their clients to translate their packaging conditions through the proper paper structure, size according to the product and strength specifications. He mentioned the following key insights that will become essential for the further steps on this thesis:

- "Over-packaging" exist because of the limited time spent analysing the products to be shipped and the belief that customising a package is more costly. One of the efforts that this industry is pursuing is to analyse and instruct their clients with the proper ratio of material and protection. A survey of e-commerce executives found that 60% of them believe that more than a quarter of their packaging is empty space, and research across product categories indicates that the empty space in e-commerce packaging ranges from 18% to 64% (European Commission et al., 2020, p. 120). Currently, e-commerce businesses see packaging as a way of replacing the shop floor experience and extending brand messaging into the home. Still, over-packaging may create a negative experience for the end consumer [Mouce, G. (2021, April 26)].

- The need of communicating the circularity of the material. Ds Smith has been pushing their current business models to be able to capture the paper material before it becomes waste; this has led the company to analyse how can they collaborate with stakeholders in the supply cycle to create the right reverse networks to capture and re-process the paper (DS Smith, 2015).

Relevant insights from transport packaging producers

· Paper-based transport packaging producers have an ecosystem that, by structure, provide them with the complete process from the pulp processing, paper making and cardboard transformation (DS Smith, n.d.)

· "Over-packaging" exist because of the limited time spent analysing the products to be shipped and the belief that customising a package is more costly.

· More exploration about how to set up the right reverse logistics is needed to capture and re-process the paper.

· There is a need to communicate to consumers how the circularity of the material should be achieved.

Logistic Services

A traditional brick-and-mortar retail has been working based on a streamlined model; linear and simple. Most products are packed on pallets and shipped in bulk from a distribution centre (DC) to the retail store (Deutsche Post DHL Group, 2019, p. 10). The convenience that e-commerce has brought to users has made that large products such as bicycles or furniture are now shipped through the parcel networks of logistics companies. The touchpoints presented on an individual product got increase since the manipulation is higher. These types of shipments have the potential to introduce significant handling and operational challenges for logistics service providers. We are talking about a re-structure inside their warehouses and transportation but also specialized packaging solutions to ensure product integrity and protect personnel, equipment, and other packages in the system.

With such a variety, Warehouse packing operations today are finding themselves in the middle of a complex optimization problem, constrained by the need to balance carton quantity, fill efficiency, and lower cost (Deutsche Post DHL Group, 2019, p. 11).

Logistics companies bear the burden of handling hundreds of products that now come in different sizes and measurements under different conditions. In addition, they will be responsible for ensuring that the product arrives on time and in good condition at its destination. Thus, improving the decision making at the moment of designing the transport packaging may reduce the burden placed on operational personnel.

They are increasingly bringing data and analytics into their joint efforts to optimise packaging processes since the foundation of all data-driven is a comprehensive digital representation of each SKU that is not always available. For example, in the fast-moving consumer goods industry and the fashion industry, the SKU mix is constantly changing as new product lines, and seasonal collections are introduced (Deutsche Post DHL Group, 2019, p. 29).

Knowing that the demand for purchases in the e-commerce sector will increase, leading logistics providers are now exploring new means of delivery such as drone delivery or unmanned ground vehicles (Deutsche Post DHL Group, 2019, p. 30)

Relevant insights from logistic services

· The convenience that e-commerce has brought to users has made that large products such as bicycles or furniture are now shipped through the parcel networks of logistics companies.

· These types of shipments have the potential to introduce significant handling and operational challenges for logistics service providers.

· Logistic companies are increasingly bringing data and analytics into their joint efforts to optimise packaging processes. Warehouse packing operations are finding themselves in the middle of a complex optimization problem, constrained by the need to balance carton quantity, fill efficiency, and lower cost.

Consumers

The recent COVID-19 pandemic has accelerated the shift to online sales and altered consumers' digital lifestyles and behaviours globally. In 2018, 22 per cent of Dutch consumers said they have bought their groceries online at least once in the last six months (Belderok et al., 2019, p. 4). Of the Dutch consumers who shop online, consumers in the age group of 18-44 are most likely to do so, driven by saving time and money (Belderok et al., 2019, p. 2).

According to DS Smith, almost 3 in 4 people are unclear on which types of packaging can and cannot be recycled. Another previous study uncovered that European adults admit to throwing 41% of their recyclable material into general waste (DS Smith, 2021, p. 6).

As mentioned before, consumers have been favoured by home deliveries, which has also influenced the way they dispose of the logistics packaging. Statista suggests that Netherlands citizens receive at least 12 parcels at home per year (McCarthy, 2021). Products from categories such as Food/beverages, pet-care, healthcare, clothing, hygiene/beauty or gardening are the most preferred (Belderok et al., 2019, p. 11).

Above 90 per cent of the parcels arrived in cardboard packaging (McCarthy, 2021). Once they review that the purchased product is in the desired conditions, the consumer is ready to dispose of the transport packaging until they realised that the waste disposal points had been saturated.

Photo by Lorena Hurtado

41 per cent of consumers admit throwing the recyclable material next to the bin (in a worst-case scenario, in the general bin), due to the lack of capacity of the ones assigned to their neighbourhoods. Now, the rest may have a spot at home where they accumulate the cardboard waiting for the bins to be emptier. Once they have collected enough cardboard, they will look at their options and if they are sick of the boxes around, it is likely they will dispose of the material wrongly.

Relevant insights from consumers

· The current situation has accelerated consumer behaviours towards a digital world. Therefore, online sales and altered digital lifestyles have increased.
· Consumers receive an average of 12 parcels per month. The transport packaging can be likely translated into waste for the user.
· When the bins or waste points are full, consumers have no idea what to do with the cardboard packaging. Since they consider cardboard as an 'environmentally friendly material', they are likely to dispose of their boxes in the 'restfval bin.'

Government

The way consumers have been asking for products has made producers satisfy their needs. At the end of the lifecycle, the disposal and treatment of the residuals has always been part of the government duties. Considering the lack of landfills and insufficient treatment capacity, The Netherlands has pushed a change in waste management since the late '80s.
Up to now and by decree, when it comes to paper and wood-based packaging, at least 43 per cent (by weight) of recycled material should be used in its composition (Packaging Management Decree, 2014, p. 18).

Therefore, the Country has carried a good reputation of separation of residuals (Rijkswaterstaat Environment, n.d.). Nevertheless, "today's problems often arise as unintended consequences of yesterday's solutions (Series & Sterman, 2003)" and over the years, the excessive use of packaging -and of course globalisation- has shown some weaknesses that have appeared with the evolution of consumption.
To tackle the problem, The Netherlands has decreed some policies that have been helping the system to continue functioning. By giving freedom to each municipality, it is intended that waste management is flexible. However, the main challenge is the active participation of a wide range of people and companies that are also in a constant evolution of their requirements.

For this research, it is important to understand how the government regulates the different parties to ensure different materials collection, separation, and recyclability. In the Netherlands, the designated organization is the KiDV: Kennisinstituut Duurzam Verpakken.

Due to the constant movement of products from different countries, The Netherlands has named the producers as Manufacturers -if they are based in the country- or Importers -if the product comes from another country even though it is part of the European Union- (Packaging Management Decree, 2014, p. 3).

Both are obliged to cover the cost of separation of packaging in the country; meaning that they should pay a percentage of the production volume as a tax (Packaging Management Decree, 2014, p. 8). Once everyone have reported the amount of materials they have brought to market, KiVD analyses this data vs what the different collection services have reported, at the end, producers can request a tax refund. This process occurs annually. This tool is based on estimations given by the collectors and processors; there is no accurate measurement behind the data (Nazaruk et al., 2021).

Relevant insights from Government

· The Netherlands is part of the European Commission, and it aligns their goals to them. However, there is freedom of waste management in the different municipalities.
· The KiDV: Kennisinstituut Duurzam Verpakken is the designated organisation to analyse, measure and reports the quantities of packaging produced vs collected.
· At a national level, the country states that manufacturers and importers are obliged to cover the cost of separation of packaging, meaning that they should pay a percentage of the volume production as a tax every year.
· At least 43% (by weight) of the wood-base packaging sold in the Netherlands must be recycled.

Waste collectors & processors

Access to collection systems depends on the decisions made by each municipality (European Commission et al., 2020). Citizens are responsible for waste separation, and municipalities rely on them to comply/ actions for the package to enter the recycling stream correctly.

Unfortunately, the good recyclability of paper has created a “false relieve” on the impact of not disposing properly of this material. When it comes to paper, citizens may not feel a responsibility for the correct disposal of the material since “it’s just paper”. European adults admit to throwing 41% of their recyclable material into general waste (DS Smith, 2021).

Contrary to citizens, businesses are obliged to dispose of their waste in the manner that best suits them. Therefore, different companies offer their services with varying plans of payment and collection times. It makes sense due to the amount of waste, and it leads to a proper separation. Moreover, with the right collaborations, packaging producers can negotiate the return of the paper packaging involved in the logistics of the different products, helping the recyclability of the material, since it is not exposed to any external contamination [Mouce, G. (2021, April 26)].

With the boom of online shopping, e-commerce services have encountered a problem with the standardisation of the paper-based packaging that supports during logistics, leading to its overuse. However, it can be challenging to produce objective metrics related to over-packaged products, so the focus here is on recycling and reuse (Eurostat, 2018, p. 47).

Since COVID, the points of the collection have been “on the edge”. Different local news has shown cities with piles of cardboard next to the containers, questioning the way in which the recycling percentage has been measured over the years and the final destination of all the waste streams. Recent investigations by the Lighthouse Reports found that Dutch waste, marked as recycled, was shipped to Turkey or India (Nazaruk et al., 2021).

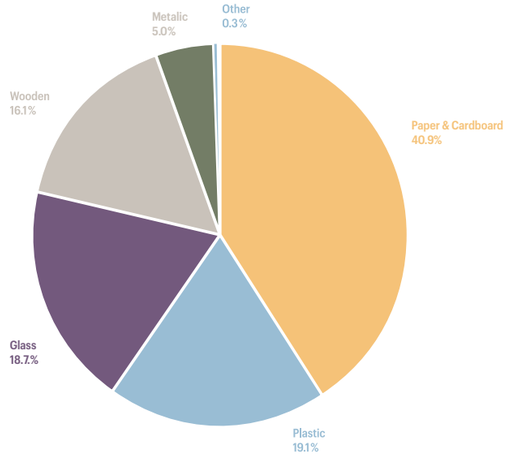


FIGURE 8. Packaging waste generated by material

The dominant packaging material, by weight, is paper/cardboard, followed by plastic and glass. However, the use of both plastic and paper/cardboard packaging has increased over the past 20 years.
(European Commission et al., 2020, p. 11)

Looking further in the collection and processing system, The Netherlands has six plants where the fibre pulp is processed and transformed into a new paper that will potentially become cardboard (Rademaker & Marsidi, 2019), which is not enough for the amount of paper-based packaging material rolling around the country; leading again to the exportation of the waste [As seen in Figure 7].

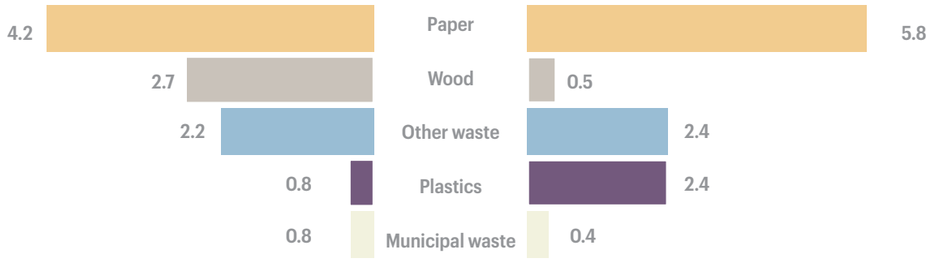


FIGURE 9. Exports and imports of waste from/to the European Union, By waste category (Eurostat, 2019)

Last, the waste collectors are critical allies on measuring and reporting recyclability of the materials to the government. With poor metrics, the reliability of the amount of recycled waste remains vague. When the materials are sorted in the different containers, it already counts as recycled, but the quality of what is actually re-incorporated to the cycle remains unclear (Nazaruk et al., 2021).

Relevant insights from waste collectors & processors

- Waste collectors are key allies on the measurement and reporting recyclability of the materials to the government. However, with poor metrics, the reliability of the amount of recycled waste remains vague.

- Access to collection systems depends on the decisions made by each municipality (European Commission et al., 2020). For the citizens, it depends on the decisions made by each municipality (European Commission et al., 2020). Citizens are responsible for waste separation, and municipalities rely on them to comply/take action for the package to enter the recycling stream correctly.

- When it comes to paper, citizens may not feel responsible for the correct disposal of the material since “it’s just paper”, and when the right bin is overload, the immediate solution might be disposing of it in the general container (restvfal).

- Businesses are obliged to dispose of their waste in the manner that best suits them. Different companies offer their services with varying plans of payment and collection times. It makes sense due to the amount of waste, and it leads to a proper separation.

- 40.9% of the packaging waste disposed of is paper and cardboard. The Netherlands does not have enough facilities to transform the paper, leading it to be shipped to Turkey or India (Nazaruk et al., 2021)

2.4. Conclusion:
The key factors

- Our current economy affects the adoption of sustainable solutions

Dr. Boehnert (Boehnert, 2019) described how sustainable and socially the future of a system depends on the priorities embedded in the systems that determine what is designed. If, from now on, the priority goes to preserve, align and highlight the values in the products and make them last, we would be challenging the current capitalist structure, where collaborations are not easy to achieve, and the rule of "who is shining the most" is applied. I agree with Dr. Boehnert; "an ecologically sustainable future depends on a reorientation of the economy", where the "redesign" of the economic system is a social and political problem and not a technocratic one (Boehnert, 2019, p. 4).

- Regulation and measurement of waste streams:

There are local, national and European regulations; they are connected in the goals & scopes but not in how they are measure and executed. Accurate data could allow regulatory institutions to control better and measure the materials to be recycled, thus having more precise information on the country's recycling impact and, therefore, its contribution to the European Union.

- Waste streams are not collected in the same way for citizens & businesses:

The Netherlands has adequate civic education on waste disposal. Therefore, citizens are aware of their actions inside and outside their homes regarding waste separation. However, when any of the streams exceeds the amount available on the market, the waste system will suffer an excess that will make citizens change their behaviour towards their waste management.

Yet, companies, retailers on any scale and Horeca, have the responsibility to manage their waste privately. This allows them to look for the waste management company that best suits them. Therefore, there is an opportunity to offer customers attractive added values such as flexibility in their waste management contracts or more detailed information on waste management and traceability.

- Collaboration with the actors of the ecosystem to achieve circularity of waste streams:

However, there is an opportunity to shorten the packaging waste that citizens consume, but also a chance to look for points of contact and collaboration within the system where packaging material is kept in optimal conditions and reduces its possibility of becoming waste, thus looking to create closer circularity inside the ecosystems.

Mapping supports an understanding of complex systemic processes that enables more the identify possible points of intervention

(Boehnert, 2018)

PHASE III

From research to design

This phase describes the future vision of the project that will further help the ideation process with different stakeholders. The ideation process followed the use of narratives as a source of engagement. Finally, some ideas are described, and the design goal is defined.

3.1. Future vision
Based on the key factors

According to the analysis in the previous chapter, the possibility of exploring a transition from our current models to a more sustainable one will depend on the values that are highlighted. Furthermore, considering the e-commerce sector and cardboard as the material to be preserved, an opportunity to link the actors is envisioned.

The vision is as follows: **"An opportunity to connect needs that create new channels to capture material with recycling potential and therefore reducing & accurately monitoring the environmental impact".**

The collaboration will aim to also create connections with current services and business models, where the needs are connected and, in that way, the environmental impact is reduced and monitored for all the actors involved. When this collaboration is achieved, it will work as a small loop that will be self-sustained.

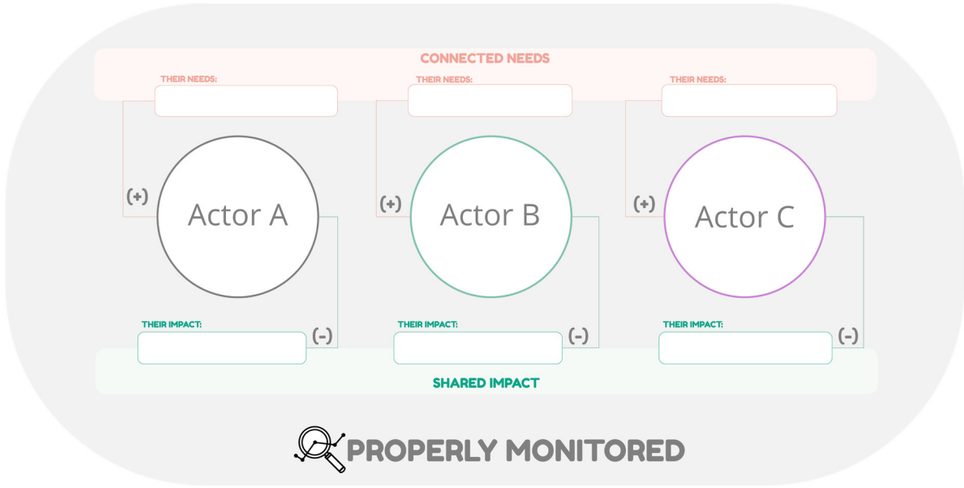


FIGURE 10. Future vision visualisation

"When a system is challenged, it will defend itself to preserve the status quo. This means that when we design a radical proposition, there will be loud and powerful rejections of our work"

Dr. Rebecca Price

3.2. Ideation process

To create the final approach to the design goal, an ideation session with the actors that contributed to the research phase took place. For this session, a narrative technique was used to engage the participants to ideate around an established framework.

3.2.1. Literature review

In general terms, the use of narratives allows participants to know the context of the project and empathise with the situation described. Dr. Price describes narratives as a way to remain open to ambiguous reading and allow the narrator and narratee to fill gaps in detail by drawing upon their own imagination (Price et al., 2018).

For this session, the idea is to keep inspiration open under the boundaries of the story and use these narratives as a tool to start the conversation to build the first ideas. It did not need it to be perfect; therefore, a low-fidelity narrative allowed me to describe the story perfectly.

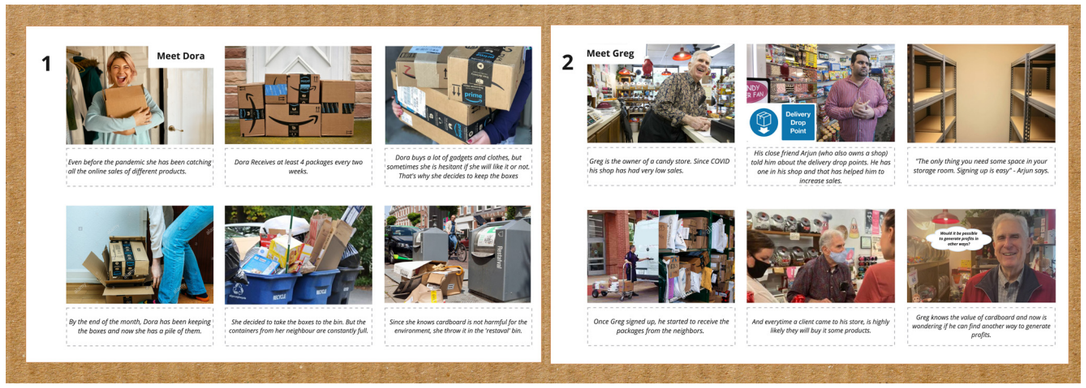


FIGURE 11. EXAMPLE OF THE NARRATIVES USED TO GUIDE THE IDEATION SESSION

3.2.2. Participants

Once the narratives were selected, they became part of a 1.5-hour online ideation session were actors from the waste disposal system (Seenons), e-commerce (Good Case), and transport packaging producers (Ds Smith) were opened to collaborate (3 participants).

FIGURE 12. DESCRIPTION OF THE PARTICIPANTS

The participants were introduced to the project with a previous meeting and a small presentation during the session (see Appendix E). The session took place on zoom and Miro.

As facilitator, I prepared two narratives; the first engaging the participants about the purchase journey of a consumer of e-commerce and the second one about the current retailers that have added a pick-up point collection centre in their stores and emphasising the pains and goals of the cardboard.

Ds Smith is a leading provider of sustainable fibre-based packaging worldwide, supported by recycling and papermaking operations and currently playing a central role in the value chain across sectors, including e-commerce, fast-moving consumer goods and industrials. With a clear commitment to leading the transition to the circular economy, Ds Smith has been exploring reverse logistics models, design capabilities and innovation strategy that sits at the heart of this response.

Seenons is a waste management start-up based in the Netherlands founded in 2019 and currently active in the country's most important cities. The start-up plans to bring companies, logistics partners, municipalities, and waste processors together with an app to achieve fine-grained waste collection and separation. With the use of this app, they want to work towards a circular economy step by step.

Good Case is a start-up based on an e-commerce model that introduces consumers to tasty, sustainable food in small, easy steps and aims to give more visibility to Dutch food start-ups that attach great importance to sustainability and animal friendliness.

3.2.3. Workshop development

The first narrative was shown to the participants, and then individually brainstormed on solutions to solve the following question: “How can we show Dora the value of cardboard?”

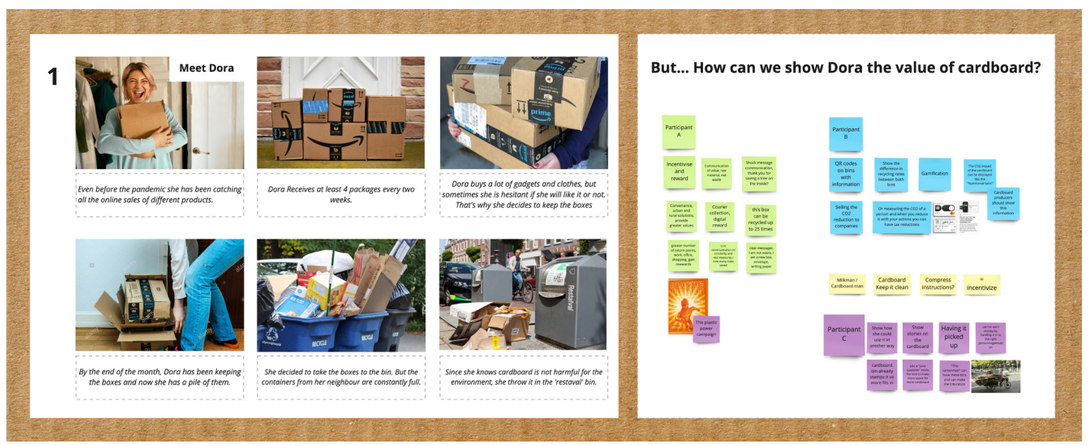


FIGURE 13. NARRATIVE AND BRAINSTORMING FROM THE IDEATION SESSION

Due to the engagement of the first narrative, the participants took more time than expected in the brainstorming part, leading me to adjust the session and just use this first narrative to explore both touchpoints: The direct delivery to consumers and the pick-up points. By involving myself in the conversation, the participants started to put in their ideas the second touchpoint.

Then, a merging period, where they mixed and matched different ideas to create rough concepts. Finally, the session ends with a grading discussion about the abovementioned concepts, where the participants rate them according to an action priority matrix.

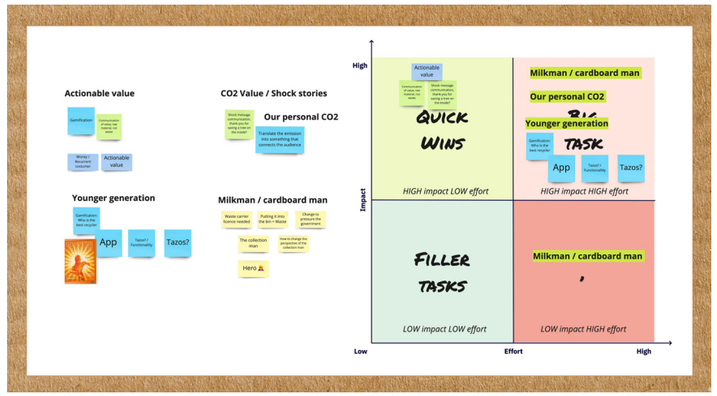


FIGURE 14. CONCEPT AND RANKING FROM THE IDEATION SESSION

3.3. Final ideas

This ideation session led to two main ideas that will be further developed and tested with the consumers. Two of the ideas are described in more detail below.

Our personal CO2 Value: A shocking story to be aware on how to reduce the consumer CO2 foodprint.

The participants, in their role of experts in their areas, agreed upon the idea of starting to communicate in a direct/shocking way the consequences of not recycling properly the cardboard. By translating this emission into common examples, the goal is to create a call to action and help the consumer to dispose of the material properly while they obtain gratification for their positive impact by making tangible their CO2 reduction.

The cardboard man:

The participants envisioned the opportunity to collaborate with other parties involved in the e-commerce sector to being able to create a reverse-logistic that may help approach sooner to the consumers and capture the paper-based packaging before it becomes waste; they called “the carboard man” based on the idea of the milkman that back in the days used to collect empty bottles to provide with filled ones.

The participants consider that, if any of this concepts is connected with parties such as logistic services, waste collectors and packaging producers, it may help to reduce not only the consumer CO2 footprint but also will benefit the cycle of the cardboard material to remain in good conditions to be transformed into pulp within the facilities that the Netherlands has. In this way, it can also be prevented to go beyond seas and get transformed far away.

After the ideation session, further research on the possibilities of both ideas was executed and led to a direction for design.

3.3.1 Seenons on board

After the ideation phase, where the leading participants agreed to help me without any retribution, Seenons was interested in the direction of the ideas achieved during the session. They recognised that this research is aligned with their ambitions and decided to become an ally during the last part of it. Ultimately, the outcomes of this project will become a guideline for future projects at Seenons and my contribution to the growth of this start-up.

3.4. Direction for design

3.4.1. Selection of the context & and actors involved

Taking the idea of the “cardboard man” led me to consider the journey of a consumer expecting a parcel as the proper context to place the new collaboration. Considering the COVID situation, the opportunity to evaluate a merger with the logistics providers and the waste collectors is aimed. Two touch points were assessed: A home delivery parcel and a pick-up point parcel.

Consumer

For this reason, an empathy map was created (Figure 15) based on 5 participants. The conversations provided me with information to creat two consumer personas: “The returner shopper” and “The conscious consumer”.

The returner shopper: A person that order several pieces and then return what is not to their liking. Someone constantly expecting a package and that knows for sure that will return something, therefore a route to the drop off point is part of their life.

The conscious consumer: Someone with specific preferences. Therefore, online shopping open a world of opportunities. A person that preserved the package and wait until he has enough material to be disposed, since the bin is not close by his current place of living. Someone that also likes to research more about different alternatives to take care of the environment

Reviewing with current e-commerce consumers was approachable for the project, which led to that direction for validation.

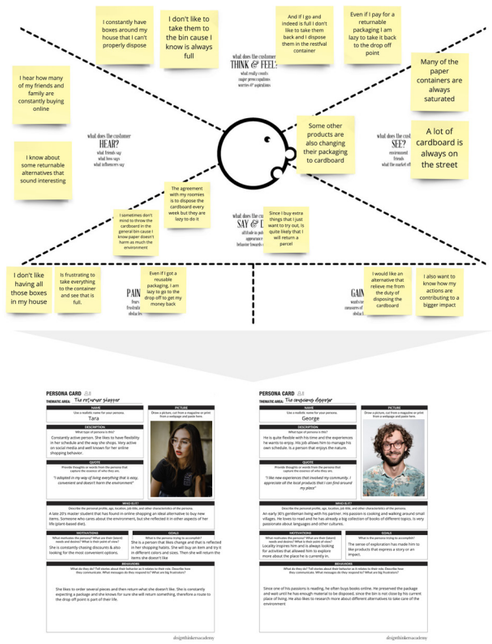


FIGURE 15. Consumer Empathy map & personas
[Detailed information can be found in Appendix F]

Driver

By working closely with Seenons, the opportunity to interviewed logistic drivers was now open. It allowed me to also understand the needs of another critical stakeholder for this implementation, the logistic drivers. Empathy maps and personas are presented in (Figure 16).

The experienced driver: A persona that has been driving for more than 30 years and with plenty of experience with logistics. Someone that has been in different business; from delivering flowers, parcels up to delivering packaged food (hello fresh kind of concept). To make the job more efficient, this persona knows how important it is to optimize their routes, therefore once he got the information from his supervisor, he review it to make the route according to what he knows.

The novicious driver: Is a persona taking some time off from his studies to become a delivery driver. This work provides him with enough money to be covered for a month. Someone still living with their nuclear family. Technology is quite easy to handle for this persona, since he has been in contact with any type of device and app. Being a driver will be his first official job.

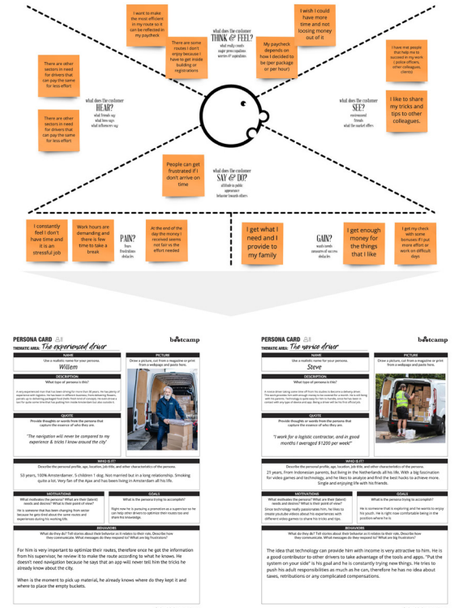


FIGURE 16. Driver Empathy map & personas
[Detailed information can be found in Appendix F]

3.4.2. Design goal

In summary, the project's goal is to design a reverse-logistics intervention that preserves the cardboard as raw material and creates a convenient channel to dispose of it properly, assuring that its cycle will be fulfilled and, recyclability will be achieved. To gain a better overview on the values, pains and gains of the personas previously described, a value proposition canvas was created.

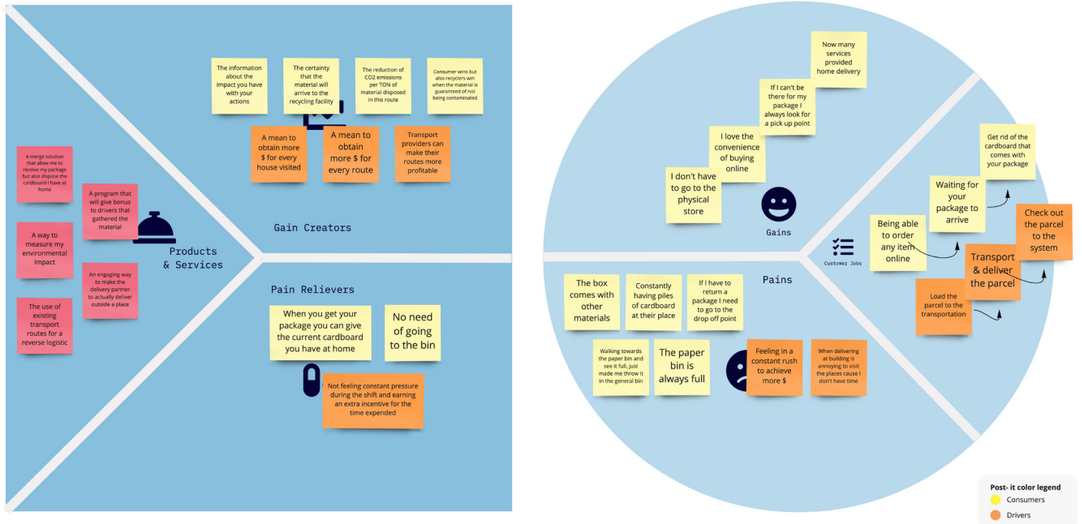


FIGURE 17. VALUE PROPOSITION CANVAS
[DETAILED INFORMATION CAN BE FOUND IN APPENDIX G]

> *" In the context of innovation, narratives and storytelling contribute to the realisation of novel solutions in a number of ways"–*
>
> *Dr. Rebecca Price*
> *(Price et al., 2018)*

PHASE IV

Experimentation

This phase explains the reasoning behind the use of sustainable business models experimentation. It explains the touchpoint found to create a business model experiment. The use of narratives for the experiments is described, and the results of the experiments are presented.

4.1. Sustainable business models experimentation

To create a bridge between the previously described future vision and the design goal, the use of the Ecology of Business Models Experimentation map provided me with a framework that enables a systemic form of sustainable business model experimentation (Bocken et al., 2019, p. 1). Here, innovation is about creating superior customer experience and firm value by addressing societal and environmental needs through the way business is done. To have a better overview of the framework, please consult Appendix H.

In four different steps, some questions regarding the aims, the resources, identification of dependencies and the new value proposition were resolved. The idea is to get to know the boundaries of the innovation that will take in place in the current business model and label the new one as "experimentation" to highlight the iterative nature of a process of trial and error (Bocken et al., 2019, p. 4).

4.1.1. Description of the experimentation

On this occasion, I decided to use the business model of logistics providers as a basis and, in this way, to carry out the customer touchpoint experiments. The objective was to find out which was the best point of contact with the customer and if this generated an interaction intention. So, the user finds another alternative to dispose of the cardboard (As illustrated in figure 18).

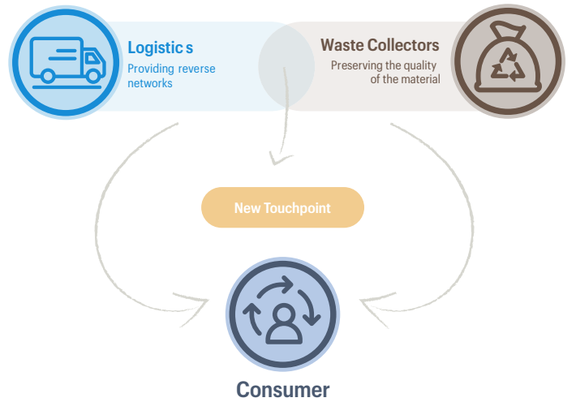


FIGURE 17. BASED ON THE ECOLOGY OF BUSINESS MODEL EXPERIMENTATION MAP BASED.

4.2. Experimentation practices

All the service starts with the consumer purchase; thus, the experimentation takes place on the customer journey of an online purchase at the phase where they wait for the package to arrive. The experiments were conducted using narratives with the help of a digital prototype that simulated the waiting and delivery of a parcel.

4.2.1. First experiment with consumers

The first experiment took place in a “Pick-up point locker” in which the user could pick up his package using a password that could open the locker. The part that triggers the experiment occurs at the moment the user picks the product from the locker. The application sends a pop-up ad that mentions an alternative to dispose of the carton.

With a sample of 5 users previously selected based on the personas created in phase III, the measure of the success of this touchpoint was evaluated with the performance of the user journey.

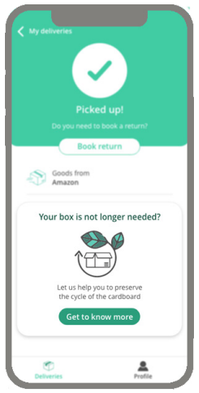


FIGURE 18. SCREEN WITH THE POP-UP AD

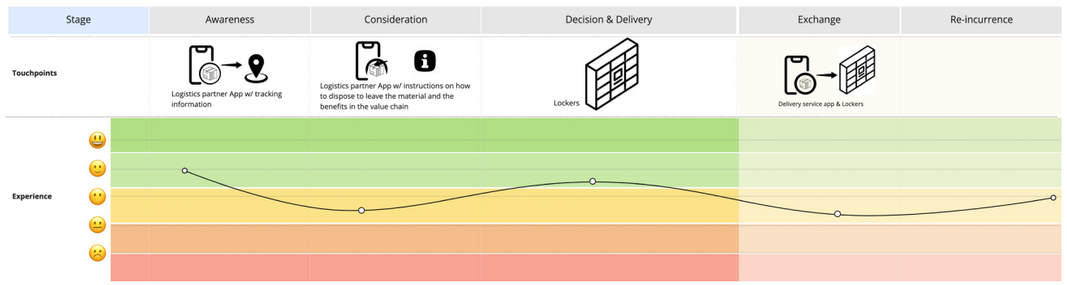


FIGURE 19. USER JOURNEY FIRST ATTEMPT
[DETAILED INFORMATION CAN BE FOUND IN APPENDIX J]

Conclusion first experiment

- The first attempt showed that consumers are not used to automated pick up points, which may create more confusion around the way of working that may affect the attention to capture the transport packaging material.
- Consumers point out that this solution may work better in a home delivery situation.
- In the situation where consumers knew about how the lockers work, the idea of leaving the packaging inside was convenient. Further in the process is up to the logistic provided to review if this operation will also work in their daily goals and will not affect their schedules. Perhaps the highlight and actual reward will be for the drivers that may need to manipulate again the material.

4.2.2.Second experiment with consumers

With these first insights, I decided to create a second version of the prototype, changing the user journey to home delivery and changing the instructions provided beforehand. In this experimentation, the user will need to instruct in advance that they would like to dispose of cardboard material under the conditions the ad is showing. So, again I created a narrative that aligns with this journey.

I used a sample of another five users previously selected based on the personas created in Phase III and evaluated the performance with the user journey.

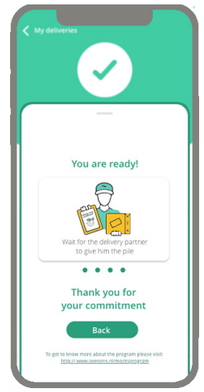


FIGURE 20. SCREEN WITH THE POP-UP AD

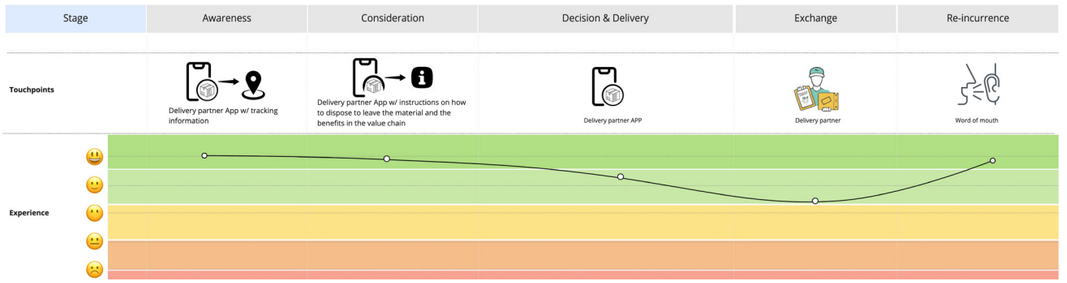


FIGURE 21. USER JOURNEY SECOND ATTEMPT
[DETAILED INFORMATION CAN BE FOUND IN APPENDIX J]

Conclusion second experiment

- In the second scenario, the interviewees felt identified with the situation since they read the narrative.
- They understand what they must do with the material to have it ready when the service is received.
- They are not looking for any kind of reward, but they are looking to understand how their impact is helping to achieve recyclability goals. This action makes them feel curious about it.

The interviewees were optimistic about the alternative and would like to be able to give away other materials (glass or plastic).

- Overall, the communication through the channel of the delivery service is convenient, and the instructions on how to dispose of the material are clear. A better explanation of the impact of their actions are creating may be an opportunity to engage them to continue separating and providing this material.

(To get more detail of the consumer’s response, check Appendix I – Feedback user flow)

4.2.3. Third experiment with drivers

Since the output of the drivers is essential, I created a third experiment. On this occasion, I had the opportunity to be on a safari delivery where I joined a driver in daily work. This experiment was conducted differently since I wanted to have the journey of delivery and their inputs about a new way of working. I now conducted the narrative while I told a story to the driver, then he added and complemented the story, which gave me good information to settle a good deal for the drivers to adopt a new step in their delivery process.

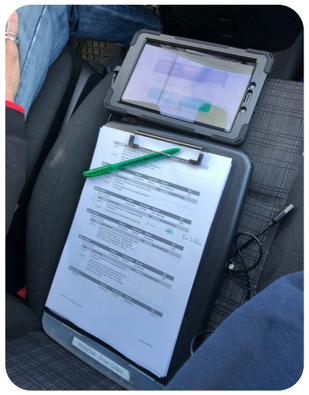


FIGURE 22. DRIVER'S TOUCHPOINTS

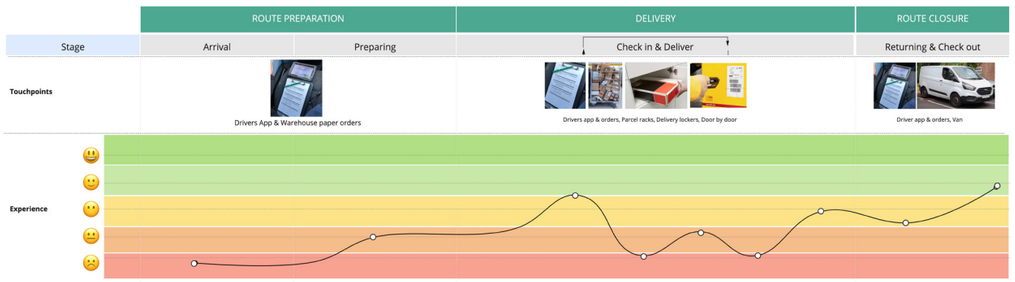


FIGURE 23. USER JOURNEY THIRD ATTEMPT
[DETAILED INFORMATION CAN BE FOUND IN APPENDIX J]

Conclusion third experiment

- Drivers included a moment to review all the packages to be delivered and arrange them according to the stops they will have in their daily routine.
- They have the responsibility of delivering the packages and being aware of their means to do the job (Van, tablet, cellphone).
- Time is the most important way of measure their performance, and that eventually will become money. So, therefore, they looked to make their time always efficient.
- They are different ways of working. For delivering parcels, the most common is time / per route or package delivered. Creating return routes will depend on the way the driver is hired.
- Being able to share a day in the life of a delivery driver made me more aware of the physical and emotional impact they have at their work.

4.2.4. Conclusion of the experiments

These experiments aim to provide me with insights around the stakeholders that will become essential to consider in the next phase. Therefore, it became a way to prototype the potential intervention between two business models. In addition, measuring the experiments with the journey mapping was a helpful visualisation of the pain points that can be addressed to create more engagement on the final proposal.
The final design step is geared towards generating new business models based on partnerships and collaborations that foster shared value dimensions for multiple stakeholders across multiple business models (Bocken et al., 2019, p. 7).

PHASE V

System intervention

This phase outlines the final proposal of this project and aims to describe the reasoning behind moots, a program developed by the waste collector partner and, in this case, by Seenons. It explains the objective and how the program works with the different actors. Finally, a growth roadmap is presented as a strategic plan for the program.

5.1. System intervention
Moots collecting program.

Based on Figure 10. Future vision visualisation, the research demonstrates the importance of collaboration with other partners to achieve a higher goal. Even though the needs may appear different, there is a chance to align them to pursue a more significant impact. Here, the intervention of Seenons as facilitator of this conversation is essential.

A collection program that travels around the system was created to ensure that cardboard will succeed in the recyclability chain, and this action will complement higher environmental goals.

By creating reverse logistics, the program will help reduce the CO2 emission of the actual route while assuring the quality of the material. Last, by also partnering with cardboard manufacturers, the material can be reprocessed, also creating ecological value for these partners.

According to the World Economic Forum, a 'next-level' of climate action is required (WEF, 2021, p. 5). What all actors in the system have in common is the need for logistics to transport their goods. For this reason, addressing supply-chain emissions offer our actors the opportunity to multiply their climate impact. The WEF proposed this way of working as a means to "decarbonised own direct operations" and achieve net-zero supply with minimal additional cost (WEF, 2021).

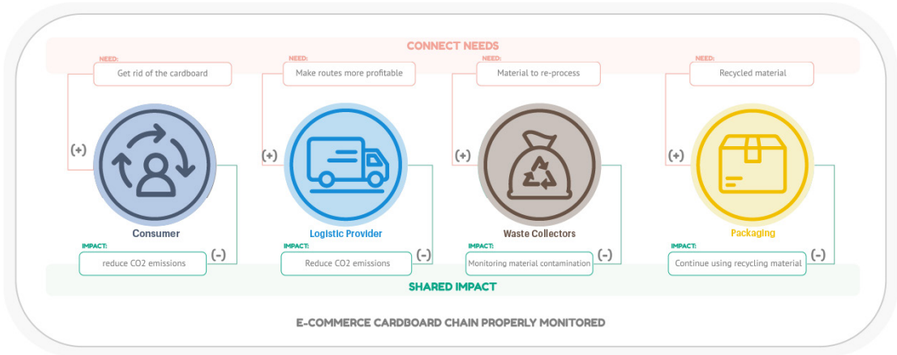


FIGURE 22. SHARED & NEEDS DIAGRAM

5.1.1. Why a program?

By definition, a program is a set of related measures or activities with a particular long-term aid (Cambridge, n.d.). However, programs can be powerful agents of change, both toward greater alignment between the customer and corporate interest and toward a culture of systemwide innovation in product and business models (Berg et al., 2018). All stakeholders have sustainable objectives to achieve. This program will provide the means to collaborate and contribute to their goals, coupled with a good reputation for collaboration that works as good publicity and marketing.

5.2. Description of the program

Moots (from the Mayan word that means “roots”) is a program that incorporates our mentioned stakeholders into the design process, goal development, implementation, and measurement of objectives.

The responsibility of this program suits more to the capabilities and knowledge of a waste collector/processors; therefore, Seenons can participate as a trustful source of communication to all the parties, the consumer, and the further emission analysis. To illustrate how it might look like in the systems flow, Figure 23 Shows the connection in colour brown.

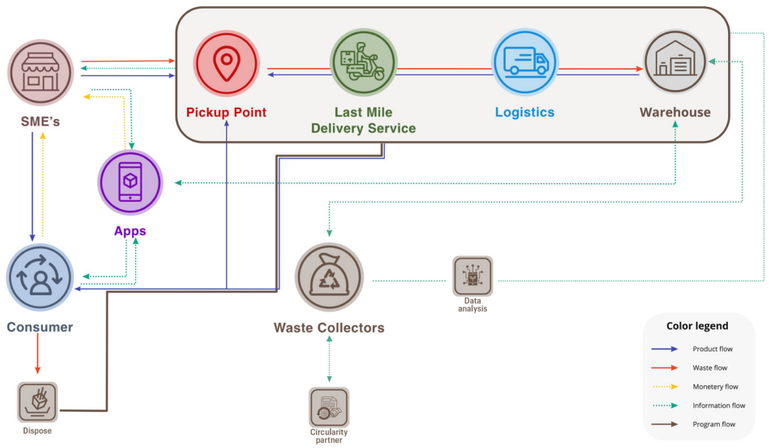


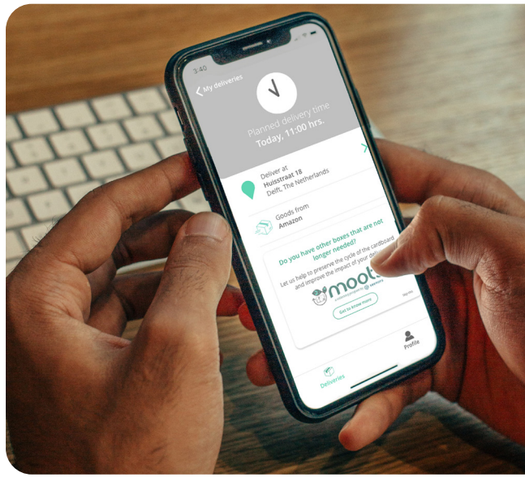
FIGURE 23. VISUAL REPRESENTATION OF THE PROGRAM

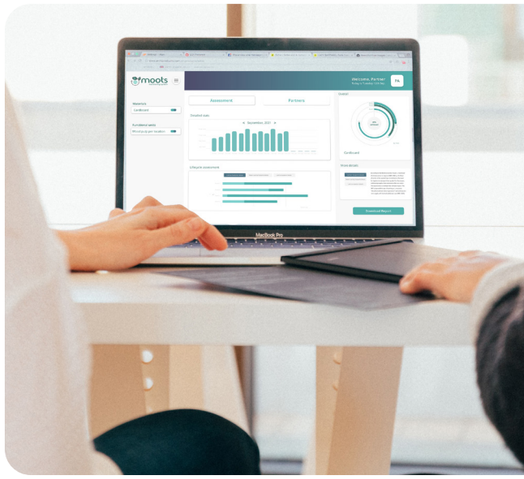
Even with a sustainability agenda in place, companies often encounter problems with execution. This risk can be potentiated when working in collaboration. Therefore, to bring more discipline to their sustainability efforts, companies would do well to follow four principles commonly associated with performance management (Berg et al., 2018): select focus areas, set measurable goals, conduct cost-benefit analyses, and create incentives for employees and suppliers.

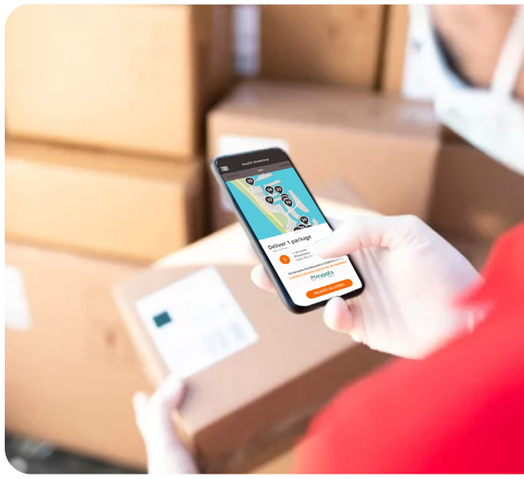
5.3. Objective of the program

Moots is conceived by the idea of opening a link that allows the actors involved to collaborate. In this way, consumers have another option to dispose the carboard that have at home. Therefore, the objectives of the program are built according to the actor’s needs.

- **Prevent material contamination:** With a closer approach to the end-user, the material will be capture in good conditions.
- **Create transparency in value chains:** The traceability acquired during the process allow all the parties to build value chain emissions and exchange data.
- **Optimize for Co2:** By designing a value chain that flows in reverse logistic networks, the reduction of CO2 will be achieved.
- **Engage actors:** Information will allow the integrability of emissions metrics and track performance to claim and engage externals on the program.
- **Push ecosystems:** Last, this program aims to push regulators and policymakers to create markets for green solutions and sign off-take agreements to make green solutions more economical





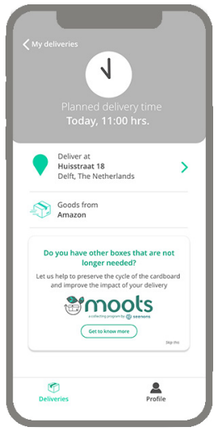


5.4. How does it look for the actors?

5.4.1. For consumers

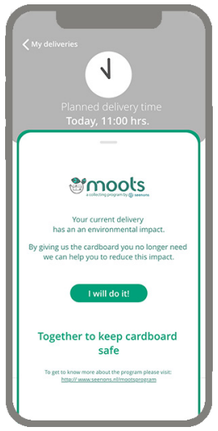
The first approach to the program will be through the delivery notifications from the logistic partners while waiting for a parcel. Usually, the client can access this information as soon as the package is shipped.

1



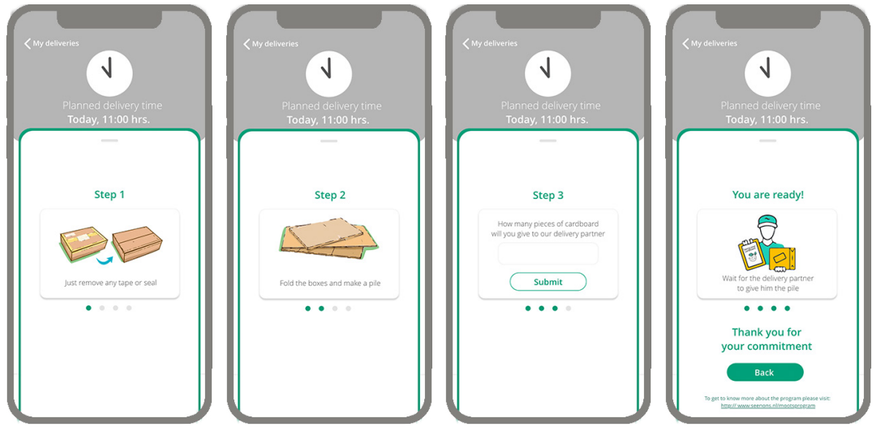
An ad will appear and will ask the client “do you have other boxes that are no longer needed?” then the ad will also encourage the consumer by mentioning the benefits.

2



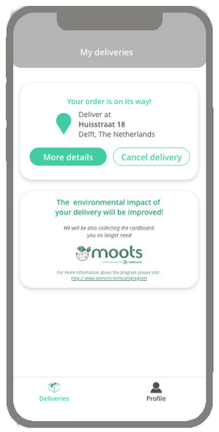
By clicking the button, a pop-up window with more detailed information will be displayed. Here the consumer gets to know more about what they need to do to contribute to the program.

3



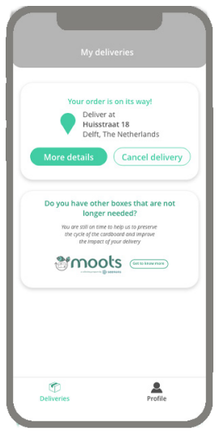
Here a clear and short explanation about how to prepare the cardboard will be displayed. The client can follow the instructions and in a last step it should mention how many pieces of cardboard they will be giving to the partner.

4



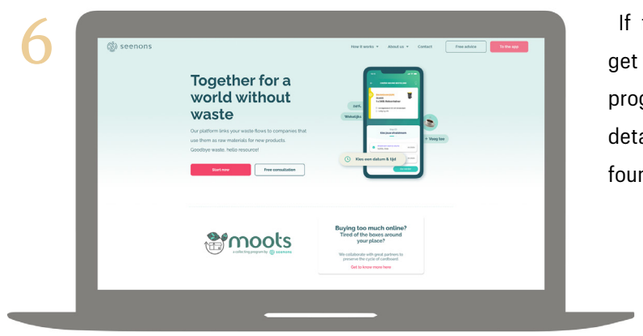
Finally, if the client decides to contribute, another box of information will remaind them to have the material ready to be picked-up.

5



If the client is still hesitant, the ad will change the communication, and it will try to encourage the client. Or, simply if they don’t have any cardboard to contribute, they can skip the ad.

6



If the consumer wants to get to know more about the program and the impact, detailed information can be found at Seenons website.

5.4.2. For delivery partners

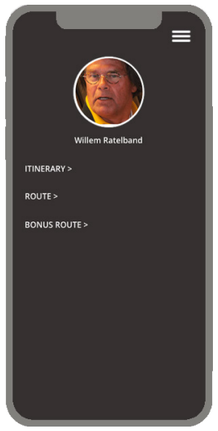
Since we will be working around the last-mile process, there are two important facts to consider.

First, logistic providers may have their own last-mile operations, but it has been easier and more affordable to hire external parties to do this last process. Therefore, a need to engage the delivery partners (drivers) is needed. One of the opportunities detected in Phase IV (about the drivers) was the feeling of lack of time to perform an extra task. For this reason, a bonus compensation in the route where they will pick up cardboard will be put in place.

How does the bonus can work?

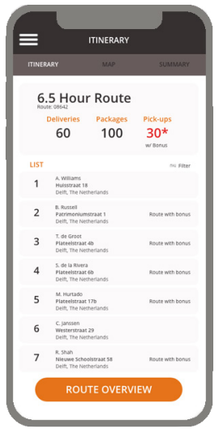
The following screens were based on common assets and functions of different logistic providers, and it aims to exemplify the Bonus compensation for the delivery partners. Before using the app, the delivery partner needs to understand their Bonus compensation, how it works, their responsibilities, and how it will look in their daily operations.

1



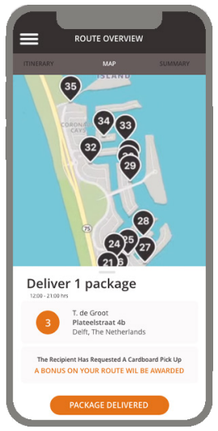
Normally, both external parties and logistic providers will use the same platform to track the delivery of the parcels. On the bonus route, they will have a summary of how the bonus works.

2



When they are about to start the route, information about location, quantity of packages to deliver and now routes with bonus should be provided through the app.

3



Finally, if the client decides to contribute, another box of information will remaind them to have the material ready to be picked-up.

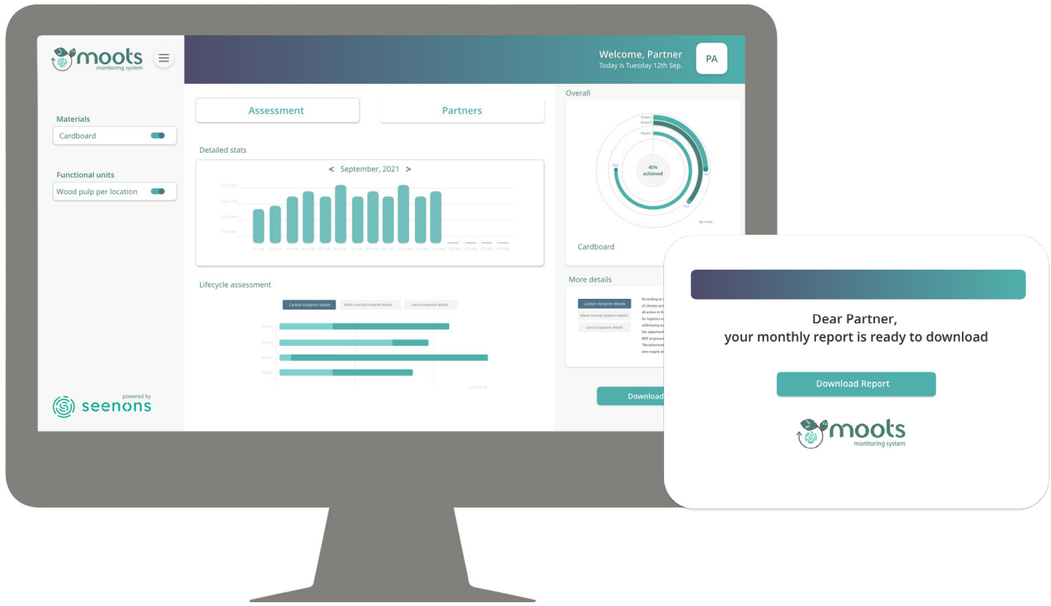
About the reverse-logistics

The second factor involves the cost of the reverse logistics. Typically, the task of the delivery ends when the truck is empty. Therefore, a new incentive should be put in place to encourage drivers to go back to their warehouse with the potential material they collect from the same route. Applying reverse logistics will reduce costs, improve quality, and increase cleanliness.

5.4.3. For waste collectors: Seenons

The proactive approach from a waste collector to establish and set up a reverse logistics process implementation should encompass concepts such as life cycle analysis and design for the environment (Mishra, 2014). Moots becomes the right way to document and validate the information, which will become a value-added activity that generates a rate long-term competitive advantage for the actors involved.

This program not only opens a direct channel to the consumers but it allows to track and trace the material captured, and the reduction on the CO2 emission of its collection. Now, Seenons as a waste collector service, can provide a platform that lets all the actors to review “live” information and continuously monitoring it (as seen in the example below).



Prototype of moots dashboard.

Here the information is displayed according to the partners preference. An overall per route is displayed. Information about LCA per route is also provided. The platform will allow to download a report.

5.5. Implementation
Tops & Tips

For the different points to consider, the implementation phase was reviewed with Seenons. The company recognized that there is a high potential with this intervention since they have had some conversations with logistics providers to set up a reverse logistics. Seenons stated several points to consider for a potential implementation.

- Volumes are crucial in both ways. The demand of the service should aim to be one to one, meaning that they should pick up material from every house where they have a delivery. For this reason, the implementation should start small and both parties should establish the most convenient city and routes to try out the new collaboration.

- Quality of the material must also be validated and monitored. Seenons also consider essential to have a space in the warehouse where the material should be storage in a higher quantity and once a big container is full, send their transport to collect it.

- Time is key for the route to be profitable. Seenons identified that a challenging point could involve an inappropriate preparation of the material to reduce the time during the exchange with the logistic partner. Material manipulation starts with the consumer. Nonethelessless the material should be properly transported by the logistic providers. A shared responsibility will assure that both (logistics and waste collectors) are taking proper care of it.

- The bonus compensation should be settled between waste collectors & logistic partners. This is in my point of view, the most challenging part of the program. Due to the different ways of working at the last-mile delivery (described in phase X), the bonus compensation should be attractive to the delivery partners. Financial support may be needed from other areas, but this program meets the necessary characteristics to be part of the CSR (Corporate Social Responsibility); where companies aim to look for new ways of working that can benefit all aspects of society, including economic, social, and environmental (Mishra, 2014).

- Ensure the data sharing to perform the impact analysis. Both parties (waste collectors and logistics providers) should be able to exchange data information about the route, quantity of material, and kg re-processed, with no restrictions.

5.6. Growth roadmap

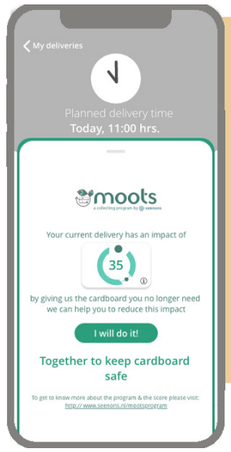
The roadmap illustrates the growth of the Moots program for the upcoming years, see figure 24. For this roadmap, three horizons were defined according to the needs & impacts of each actor. The different horizons will be further explained.

Seek:
In the first horizon, is essential to set the goals of all the actors involved. For this reason, Seenons should become the facilitator between all the parties to gather and co-create the goals to achieve. This part will create the needs & impact framework. In parallel, the monitoring platform should start the try-outs. Seenons use software development to achieve their goals towards zero waste, therefore, the company understand the process to follow for the development. The program will start in the main city of the country (Amsterdam).

Engage:
The efforts to implement the program will only be visible if the user commits to its contribution. Therefore, the second horizon will seek to prepare new added values for the clients.

*** New touchpoints** will be put in place and now, the client will have the possibility to leave the cardboard at pick-up points.

*** The moots score:** Here, Seenons will have enough information to rate the environmental impact of delivery according to estimations of routes.



With the moots score,the consumer will get a score based on:

-Circularity: how well an individual product minimises waste by reusing and recycling resources to create a closed-loop system.

- Climate Impact: how greenhouse gas is emitted during the process of delivery.

-Ecosystem Impact: how heavily the delivery impacts biodiversity and water depletion.

Expand:
The program will expand to other touchpoints where cardboard is “flowing”. Here the idea is to replicate with these actors the early stages and start expanding this new channel. Seenons should aim to pursue new logistic providers such as home delivery services, which may also encounter other challenges with other materials (such as different on the go plastics). When a new actor enters the program, a new alignment in needs and impact should be assessed.

mools a collecting program by seenons VISION

An opportunity to connect needs that create new channels to capture material with recycling potential and therefore reducing & accurately monitoring the environmental impact.

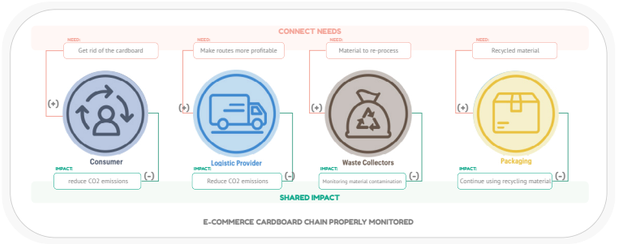
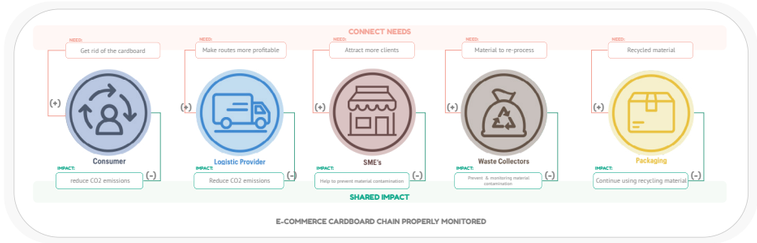
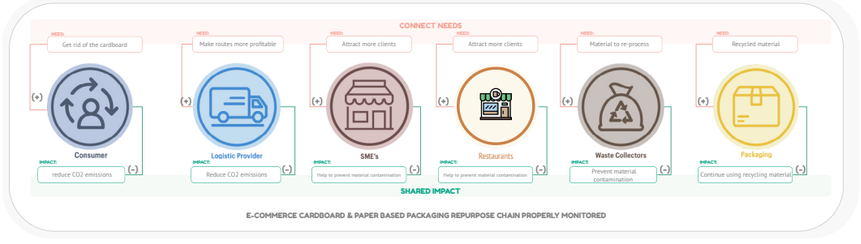
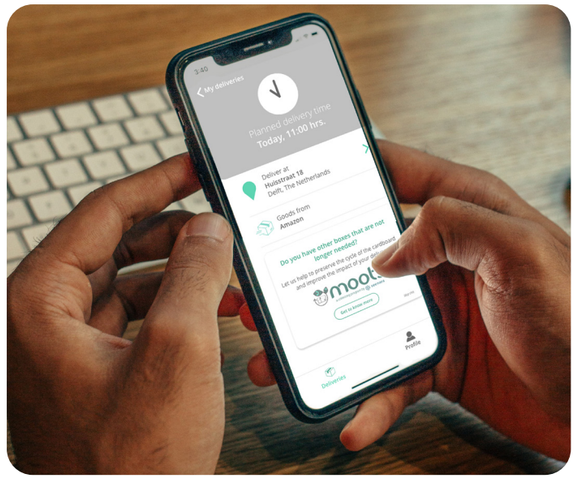
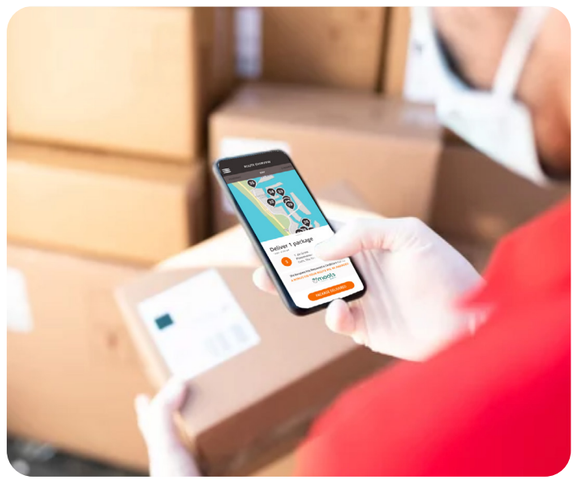
	2021	SEEK	2022	ENGAGE	2023	EXPAND
NEEDS & IMPACT						
CONNECTIONS		Logistic Provider: Logistic Partner 1				Logistic Partner 2
				Pick up points from logistic provider 5		Pick up points from logistic provider 10
						Home delivery partner 1
		Warehouse container centre 1		Warehouse container centre 1		Drop off point at logistics provider pick up point 10
				Pick up points from logistic provider 5		Pick up points from logistic provider 10
		Packaging: Local paper mill & packaging producer 1		Local paper mill & packaging producer 3		Local paper mill & packaging producer 5
TECH		Development of the platform to monitor app API to connect logistics providers software with the monitor app API to connect logistics providers software with the monitor app		Maintenance and performance supervision of the monitor app & the customer digital point Maintenance and supervision of the information Maintenance and supervision of the information		Creation of a delivery score
DATA		Analysis of Data & elaborating reports				
				Design of the drop off points for retailers		
LOCATIONS		Amsterdam area				Utrecht area

FIGURE 24. VISUAL REPRESENTATION OF GROWTH ROADMAP

Potential impact & recommendations

This section addressed will describe the potential impacts around Moots and the recommendations to succeed with the program.





- The Moots program has been tailored according to the stakeholder's needs. These conversations are now guided by a collector who understands how to generate initial dialogues to find the ideal partnerships for collective impact. Here, Seenons encounter an opportunity to be the facilitator of conversations and the guardian of the information.

- Allow the material to return safely to the source. One of the biggest dilemmas in reprocessing material is to keep its origin "as pure as possible". Creating servitization in the collection of materials will not only allow for transparency of their origin, but also allow for certainty of their impact. This opens a business opportunity behind the management and analysis of the parties.

- With the exponential increase of online shopping, many companies are looking for ways to "decarbonize their supply-chains", Moots is now attending the need of wood pulp to create cardboard. Nonetheless, **this program can be shaped according to the actors involved, always considering the needs & impact and the value chain to analyse.**

- Corporate Social Responsibility as an integral part of their brand image and public relations (Investopedia & Fernando, 2021). The program meets the necessary characteristics to be part of the CSR activities of a company, where the aim is to look for new ways of working that can benefit all aspects of society, including economic, social, and environmental (Mishra, 2014).

- **Dare to share your collective wins.** Consumers now more than ever are looking to support brand & companies that have a sustainable agenda. With this program there is a direct contribution from them, and they can feel more engage to your Company if it is involved in collaborative programs that aim for a change.

- The policies and laws need to change: Moots program will challenge the current policies that don't allow materials considered waste in the same channel as the new products. To be able to fully achieve circularity in other streams (such as swill or coffee grains, for example). There should be reforms to apply in our current laws that make this way of working more feasible.

moots
a collecting program by seenons

Conclusion

The relevance of new ways of working to enhance collaboration and proactively reduce the idea of waste is perhaps the most challenging goal when you are trying to prevent a material to be contaminated. For this reason, new and engaging ways to collect material should be put in place. I recognize this as the most important competitive advantage from Seenons. Being a startup opens the opportunity to explore further how can we plan the waste disposal system of the future.

Start small but think big. Collaborations working in a small scale: It is clear that when a system is challenged, it will refuse to change right away. Taking into account the donut model a collaboration will fulfill its purpose if it flow within the same area. But the best way to achieve a total change is by achieving small changes. Due to the climate emergency, several companies (bigger and smaller ones) are willing to invest in new ways of working that can help them analyzing, monitoring and preventing an environmental impact.

The Netherlands, a country that leads with the example.
When it comes to circularity, The Netherlands has opened different discussions and opportunities for research and development. It has been pleasing to work on such relevant problematic that has being tackled from different perspectives and is being proactively pushed at different levels.

Estimations can be vague if the information is not precise: A lot of the things I encountered is that the process of sharing information can be weak if there is not right alignment there. Solutions like block-chain may help to let the information be shared safely when confidentiality is managed. This will also create more sense of safety from all the parties.

Personal reflection

This journey has ended, and I would like to share the most important factors that made my journey a rollercoaster.
First, I am proud to have finished my master's degree during a pandemic where everything had to be adapted in a moment. One of two years full of mixed feelings about being abroad and having the support of your family far away. Going over financial matters and making sure everything worked out.

Perhaps the biggest challenge was to remain confident in my abilities and not give up when the doors of graduation opportunities were slowly closing. As designers, we aim for perfection; it is at our core. The way this perfection is measured is what put me in doubt so many times. Understanding that it is okay not to feel good, that the graduation process is not linear (sounds familiar, right?) and learned to give yourself time and space is essential to your physical and mental health. There will be many moments where you will doubt what you do, but taking a break and getting back to your work will allow you to have a new and fresher perspective on your work.

By following my instincts, I built and developed a project that highlighted more my passion for sustainability and confirmed that my resilience had grown to such a level that I decided to do my graduation thesis without the support of a company.

Reflecting, I was able to explore systems design, and now, it is a topic that passionate me and will continue influencing my professional career. I connected with brilliant minds with the same passion and urge to change and improve a system that needs to be updated.
And I confirm that everything happens for a reason. As strategic designers, if we don't see an opportunity, we build it. By selling my skills and ways of working, this project opened the doors to continue my professional career at Seenons, a great start-up aiming at what I want to contribute to this society, Changing the idea of waste.

Bibliography

- Alec, D. (1968). Package and print; the development of container and label design. Faber & Faber.
- Berg, A., Schlag, N., & Stuchtey, M. (2018, January 8). Getting the most out of your sustainability program. McKinsey & Company. https://www.mckinsey.com/industries/retail/our-insights/getting-the-most-out-of-your-sustainability-programBelderok, A., Einwachter, M., Van Aalst, M., Winkelman, J., & Veul, R. (2019). The Dutch grocery sector in 2030. 1–12. file:///Users/RobbertJan/Downloads/roland_berger_dutch_grocery_sector_2030.pdf
- Bocken, N., Boons, F., & Baldassarre, B. (2019). Sustainable business model experimentation by understanding ecologies of business models. Journal of Cleaner Production, 208, 1498–1512. https://doi.org/10.1016/j.jclepro.2018.10.159
- Boehnert, J. (2018). Anthropocene Economics and Design: Heterodox Economics for Design Transitions. She Ji, 4(4), 355–374. https://doi.org/10.1016/j.sheji.2018.10.002
- Boehnert, J. (2019). Ecocene Economics and Design: Nature-Inspired Economies and Transition - Design. EAD 2019 – Running With Scissors. https://hdl.handle.net/2134/35159
Cambridge. (n.d.). Program definition. https://dictionary.cambridge.org/dictionary/english/program
- Deutsche Post DHL Group. (2019). Rethinking Packaging: A DHL perspective on the future of packaging in the logistics industry. https://www.ellenmacarthurfoundation.org/assets/downloads/Reuse.pdf
- DS Smith. (n.d.). How corrugated board is made. https://www.dssmith.com/sheetfeeding/insights/about-corrugated/how-corrugated-board-is-made
- DS Smith. (2015). One step away from zero waste Introduction. 1–24.
- DS Smith. (2021). Has the COVID-19 pandemic changed.
du Saar Nouska, Hoogenraad Laura, L. S. (n.d.). Recycling lies. Lighthouse Reports. https://www.lighthousereports.nl/investigation/recycling-lies/
- Europe, E. (2020). Impact Of The Coronavirus On Business. Forbes, January, 1–5. https://www.forbes.com/sites/sarwantsingh/2020/03/02/impact-of-the-coronavirus-on-business/#501c19664414
- European Commission, Directorate-General for Environment, Eunomia, COWI, adelphi, Ecofys, & Milieu. (2020).
- Effectiveness of the essential requirements for packaging and packaging waste and proposals for reinforcement.
- Eurostat. (2018). Packaging waste statistics - Statistics Explained. https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Packaging_waste_statistics#Waste_generation_by_packaging_material
- Haffmans, S. (2018). Products that flow : circular business models and design strategies for fast-moving consumer goods. In M. van Gelder, E. van Hinte, & Y. Zijlstra (Eds.), Circular business models and design strategies for fast-moving consumer goods. BIS Publishers.
- Mishra, R., & Napier, R. (2014). Reverse Logistics: Antecedents of Successful Implementation and Firm Performance Effects. Journal of Supply Chain and Operations Management, 12(2), 33–49. http://www.csupom.org/PUBLICATIONS/2014-2/JSCOM_2014_2_3.pdf

-Innovation, S. (2021). Systems design Principles. Si Platform. https://doi.org/10.4324/9780203400975_chapter_11
- Investopedia, & Fernando, J. (2021, September 4). Corporate Social Responsibility (CSR). Investopedia. https://www.investopedia.com/terms/c/corp-social-responsibility.asp
- Packaging Management Decree, 6 Angewandte Chemie International Edition 54 (2014).
- Kezzler. (2020). Winning online shoppers with digital packaging.
- McCarthy, N. (2021). Online Shopping: Where The Parcels Are Piling Up. Statista. https://www.statista.com/chart/18396/average-number-of-parcels-received-per-person/
- Nazaruk, Z., Buurman, R., Benelux, R. N., Buurman, R., & Benelux, R. N. (2021). Dutch recycling strategy needs a rethink : ' we don ' t know what is going on '. 1–6.
- Parcell, D. (2007). Understanding customer experience [14]. Harvard Business Review, 85(6), 137.
- Price, R., Matthews, J., & Wrigley, C. (2018). Three Narrative Techniques for Engagement and Action in Design-Led Innovation. She Ji, 4(2), 186–201. https://doi.org/10.1016/j.sheji.2018.04.001
- Rijkswaterstaat Environment. (n.d.). Elements of Dutch waste management. Retrieved August 12, 2021, from https://rwsenvironment.eu/subjects/from-waste-resources/elements-dutch-waste/#Use ofvariousinstrumentstostimulatepreventionandrecycling
- Samat, S. (2014). Local Retail.
- Series, W. P., & Sterman, J. D. (2003). SYSTEMS THINKING AND MODELING FOR A System Dynamics :
- Systems Thinking and Modeling for a Complex World. European Journal of Computer Science, 21(3), 35–39.
- Skoda, E. (2021). From agility to big data.
- Streng, R., & Knippenberg, L. Van. (2020). Shopping Tomorrow (Issue September).
- The World Counts. (2021). The World Counts. https://www.theworldcounts.com/challenges/consumption/other-products/environmental-impact-of-paper/story
- TMR. (2021). Pulp Market set to witness surge in demand over the forecast period 2019 -2027. KSU | The Sentinel Newspaper.
- Velden, L. Van Der, & Stooker, C. (2021). Explosion of online shopping drives up cardboard prices. 1–7. https://fd.nl/ondernemen/1386588/explosie-webwinkelen-jaagt-kartonprijs-omhoog-kuf1cakamC4M
- WEF. (2021). Net-Zero Challenge: The supply chain opportunity. January, 1–46. https://www.weforum.org/reports/net-zero-challenge-the-supply-chain-opportunity
- Zijlstra Y, Gelder M, H. E. (2018). Products That Flow: Circular Business Models and Design Strategies for Fast Moving Consumer Goods.

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