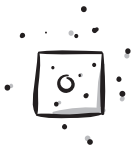
The Potential to Value Circle

Connecting potential to create value in a circular economy

Material

Stakeholders



Context

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Graduation report
Integrated Product Design

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Abstract

In this graduation project the design process: the Potential to Value Circle, for designing from a waste stream is presented. The Potential to Value Circle creates a structured way of working in which the potential of a waste stream is translated to value. Value is generated by combining the perspectives of material, stakeholders and context around a waste stream into a concept direction. Through this process, The Bin guides their clients to take the next steps in becoming part of a circular economy.

This project was done in collaboration with The Bin. The Bin is a startup in the circular economy. They help their clients to become part of a circular economy by creating circular concepts out of their waste streams and setting up a circular system around these concepts. These waste streams can be defined as products at their end-of-life or by-products from a production line.

Currently, the Bin bases its process on the circular frameworks the Value Hill (Achterberg et al., 2016), R9-list (Potting et al., 2017) and the Butterfly diagram (EllenMacArthur Foundation, 2019). These frameworks give the bin a high-level overview of circular value creation. However, they want to have a more step by step process that helps to turn waste streams into circular concepts. This was the essence of their request for this graduation project and resulted in the Potential to Value Circle.

The Potential to Value Circle approaches a waste stream from different perspectives, resulting in opportunities that get turned into a concept direction that uses the waste stream to move towards a circular economy. The Potential to Value Circle is built up in three phases, 1) Analyse, 2) Combine and 3) Formulate a circular design goal. The first phase presents how an understanding of the elements around a waste stream can be created, by analysing material, stakeholders and context. Based on this, potentials are formulated. In phases 2 and 3, the potentials of phase 1 are combined, which allows translating the potentials of the waste stream into opportunities. With these opportunities, a concept direction is formulated that creates value. Three ways of applying the Potential to Value Circle are presented, on which the Workshop is elaborated further. The workshop shows how to work in three hours with the Potential to Value Circle to a circular design goal with the client.

Acknowledgements

Before you is my graduation report, which presents the design process and outcome of a circular design method: the Potential to Value Circle. This project is done with the help and support of many people. Therefore I want to say thank you!

First of all, I would like to thank my supervisory team, Bas Flipsen and Holly McQuillan. You were always helping me to continue and improve my research and design process. Thank you for your enthusiasm and critical feedback on my process and report.

I would like to thank Martijn ten Kate from The Bin. Thank you for coaching me and the opportunities you gave me in and beyond my project. You introduced me to many inspiring people who are already part of a circular economy and people who are motivated to move towards a circular economy. I was able to put knowledge directly into practice with your help. Your enthusiasm motivated me even more to improve the project and to develop myself as a circular designer. Thank you for making me part of your team.

I would like to thank Tjapko Vermeulen for always being there for me and the endless support. Your positive words and many tips to improve myself and the project were of great value for me. Thank you for critically reading my report and sharing your passion for design.

I would like to thank Jord de Kat for your help with the visualisations of the model and the workshop canvas. It was fun working together with you. Thank you for taking the atmospheric photos of me in the office of The Bin.

I would like to thank my family for always believing in me and support during me entire study career. Thank you for the shared baking and board game moments during the weekends.

I would like to thank my friends for making my student days awesome and for the many coffee and tea breaks we had at the IDE Faculty. Thank you for reading my report, and fun and relaxing activities we had besides my project.

And at last, I would like to thank my colleagues at The Bin for the fun lunch breaks and testing of my ideas. Thank you for sharing your enthusiasm for circularity.

Thanks to everyone who supported me in some way during my graduation project. Without you, I was not able to manage this project as I did.

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1

Introduction

This report presents the work and results of the graduation project of Elina Eikelenboom. This project is done in collaboration with ir. Martijn ten Kate from The Bin. The Bin is a start-up in the circular economy, which focuses on designing out waste streams.

The supervisory team consists of Dr. ir. Bas Flipsen, a researcher with a focus on the circular economy, repair and refurbish, and Dr. Holly McQuillan, an Assistant Professor with a research focus on textiles, circular economy and design methods.

The goal of this project was to research and design a design process for The Bin, to give The Bin a structured approach to generating value out waste streams. Within this first chapter, the company and the circular economy are explained. Based on this, the problem definition and research questions are created and the project approach is explained.

*Figure 1 - **Clean Climber project***

1.1 The Bin

The client of this graduation project is The Bin. The Bin is a start-up in the circular economy, which focuses on designing out waste streams. They are based in Utrecht, in de Stadstuin, a work environment for creatives and entrepreneurs. They design circular products, zero waste and circular systems, by bringing material, people and organisations together. The Bin can be described as creative concept developers and with their projects, they increase the imagination of their clients by creating circular concepts made of waste streams created by these clients. By doing this, they want to trigger the transition from a linear economy to a circular economy at a company. They focus on creating structural solutions that are tangible and have commercial value. Not only creating a physical solution for the waste stream, but also making sure it is placed thoughtfully in the context and creates added value. Besides that, they want to achieve a transformation on how compies and clients view their waste. From something that is thrown away, to a new material that has the potential to be part of a circular product and system.

The Bin expressed their need for a structured process that helps them find the potential of waste streams for clients of The Bin. These waste streams are currently thrown away, but the client feels that there is a potential to repurpose it for a product within their company. By repurposing their waste streams the client moves towards a circular economy. A client does not have the knowledge required to make these steps on their own, so they come in contact with The Bin who can help them to make this transition.

1.2 Circular economy

The Bin helps companies to shift from a linear economy to a circular economy. Therefore an understanding is needed of what the current linear economy and circular economy are. In this subchapter, a first understanding of a circular economy is given. In subchapter 2.1, a deeper understanding is created, where designing circular concepts within a circular economy is discussed.

The current linear economy follows the take-make-use-dispose principle from Dokter et al (2021). Materials are taken, products are made and after use, they are thrown away and either burned or used as landfill. However, this economic system is unsustainable because of its increase in waste production (King et al., 2005), finite resource depletion and causing climate change (Moreno et al., 2016). Therefore, the government continuously creates and enforces legislation for companies to move towards a circular economy.

Within this report, two perspectives of the concept of a circular economy are considered. The perspective created by the concept of sustainable development by Korhonen et al (2017) and the multiple dimensions of the economic system (Kirchherr et al., 2017). Both are explained below and helped to understand how the transition from a linear economy to a circular economy can be approached.

Sustainable development is defined as ''development that meets the needs of the present without compromising the ability of future generations to meet their own needs.'' (WCED, 1987). Together with its three dimensions (see Figure 2); economic, environmental, and social, Korhonen et al. (2017) suggest that a successful circular economy contributes to these three dimensions of sustainable development. In addition, a ''circular economy contributes by highlighting the importance of high value and high-quality material cycles in a new manner'' (Korhonen et al. 2017).

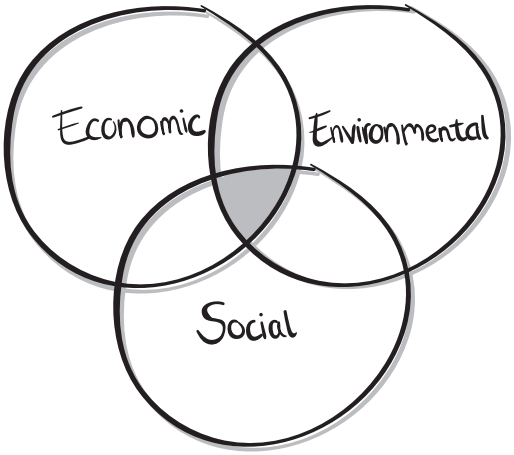


Figure 2 - Three dimensions of sustainability (Korhonen et al. (2017))

Findings from Kirchherr et al., (2017), who analysed 114 definitions of a circular economy in literature, indicate that a circular economy is illustrated by definitions of literature as a combination of reduce, reuse, and recycle activities. However, a circular economy must be understood as a fundamental systematic change, rather than bits of reducing, reusing, and recycling, to ensure the impact in the long term. This fundamental systematic change creates environmental quality, economic prosperity, and social equity. It operates at three distinct levels: micro level (products, companies, consumers), meso level (eco-industrial parks), and macro level (city, region, nation and beyond) (Kirchherr et al., 2017) (Figure 3).

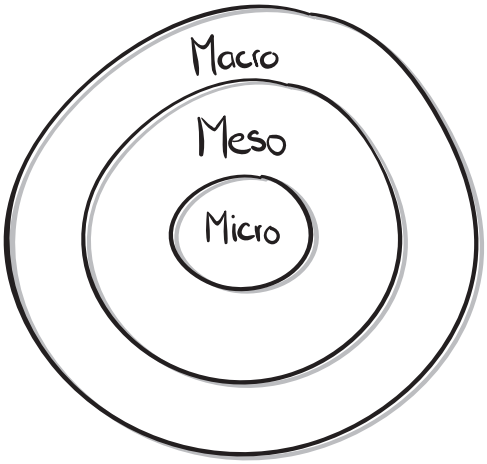


Figure 3 - Three levels of operation (Kirchherr et al. (2017))

Conclusion

In conclusion, it can be said that is important to take an approach which operates both on different dimensions (Korhonen et al. 2017) and on multiple levels(Kirchherr et al., 2017). This increases the impact of moving towards a circular economy, where economic, environmental and social aspects contribute, while operating at micro, meso and macro level.

1.3 Query from The Bin and Research Question

In this chapter, the query from The Bin is explained and their problem is described. This then forms the basis of the research question.

Clients of The Bin approach The Bin with a request to use their waste stream in a circular economy. These clients do not have the right tools and knowledge to work on the case by themselves, so they ask The Bin for help. An example of the question is: We have 20.000 old hospital gowns, what can we do with them? The question is broad and generic and the main thing that differs per client is the amount and the kind of waste stream. Although the questions they ask are broad and generic, the client is asking for a specific answer to the question. They expect answers where a physical product is the solution to their problem. The challenges they face are that they do not know how to find an answer to the question and want to become part of a circular economy. The clients do not know how to overcome both of these challenges and thus they approach The Bin.

The query and the problem from The Bin for this graduation project was as follows: How can they approach these requests from a client?
It was important that the result creates more value for the client and creates more value from the waste stream itself. Therefore, The Bin asked for a defined and structured design process, increasing their ability to communicate the value of the waste stream to their client. The result of this process should aim to get the maximum value out of a waste stream.

Based on the problem described above, the research question is defined. This research question forms the focus of this project and will be answered by literature and field research, and the final design of a design process.

To be able to answer this research question, two sub research questions were formed. The first question will help to understand and define the current situation and the second question will lead to a proposed direction to move towards.

How can a design process create more value for the clients of The Bin using their waste streams?

How can the potential of a waste stream be researched?
How can the value of waste streams be made visible?

1.4 Project approach

In this subchapter, the approach of this graduation project is discussed, which will help to answer the research questions and to work in a structured manner during the project. This project followed the design process according to Roozenburg & Eekels (1998). Hereafter, each phase is discussed on its relevance to the project.

The first phase of the project, the research phase, focused on understanding a circular economy and its frameworks, the current process of The Bin and the stakeholders involved in the process. In the second phase, ideation, the insights of the research part were brought together and set into a framework, which set the basis of the proposed design process. Ideas were tested by small case studies, allowing them to move towards concepts. The concept phase therefore elaborated further on the concepts, tested thoroughly with case studies, together with design students and potential clients of The Bin. In the final concept phase, the concept is further detailed and visualised. It was then put to the test with clients of The Bin. In the last phase, the evaluation phase, the final concept is evaluated and conclusions of this graduation project are drawn.

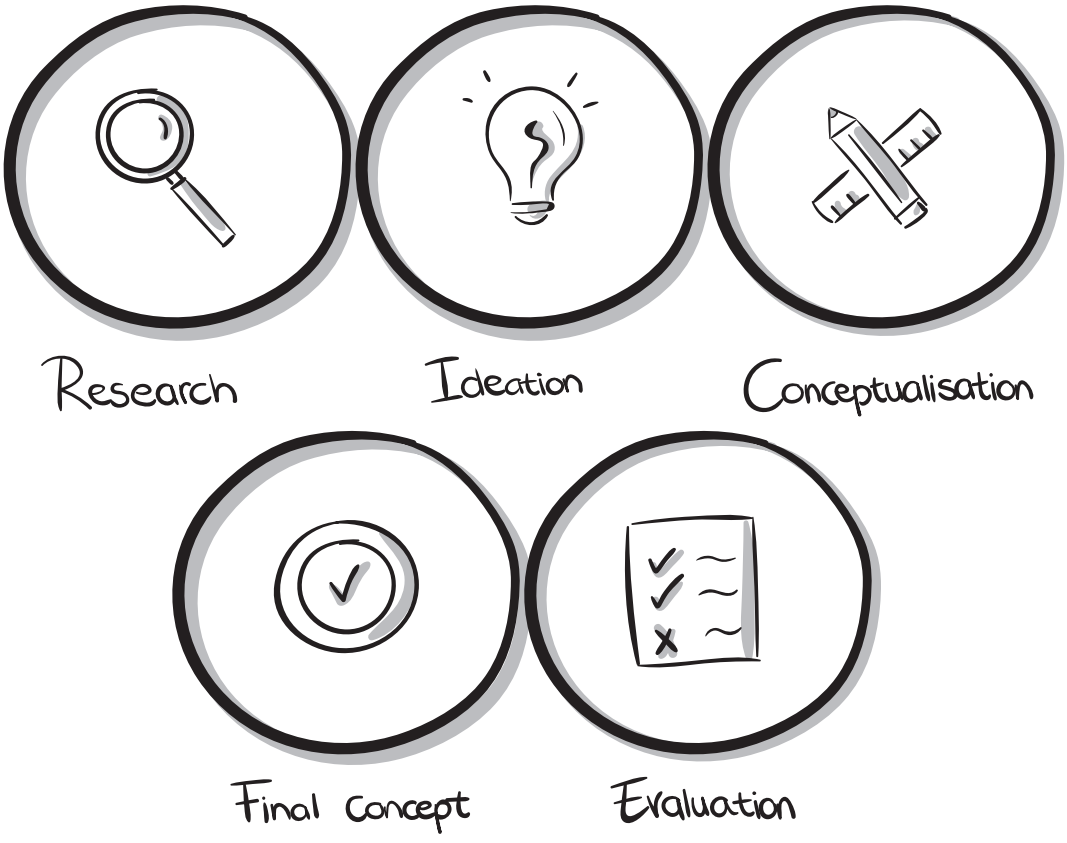


*Figure 4 - **Project approach***

Phase I - Analysis

2

Current situation

This project started with an analysis of the current situation around a circular economy and the process of the Bin. In this chapter, the ways of designing in a circular economy are described, together with how repurposing can function as an entry towards a circular economy. Besides that, the current process of the Bin is analysed. In this analysis, the clients of the Bin and the context around the waste stream are deeper discussed.

2.1 Designing for a circular economy

To start designing out waste streams and help companies shift to a circular economy, an understanding of the current practices of designing for circularity is needed. To create this understanding, a look is taken at the two different ways of designing circular products and the three different types of products they can result into.

Designing at the start-of-life involves practices where circularity is kept in mind during the design process of the product. Practices such as design for reuse and design for repair are taken. During this design process, there is an extra focus on the end-of-life of a product, with the goal of giving the product a second or even longer life in an easy manner.

A product example is deposit bottles, which you return in the supermarket, and are cleaned and filled again by the company. These products are used again multiple times (Figure 5 no. 1). Another approach is to design products that can easily be brought back to their material state, and processed again, for example, iron and paper (Figure 5 no. 2).

Designing at the end-of-life of a product involves practices where no thoughts are given about the end-of-life state during the design process of the product. Because the end-of-life state is neglected, it is often harder to give these products a second life. This results in the fact that products are thrown away, increasing the waste production and despite the fact of the problem of finite resources. A trend is seen in repurposing products, which is an approach more often taken by companies. They repurpose products at their end-of-life state, where the product is given a different purpose than it had before, instead of being thrown away (Figure 5 no.3). An example of this is a project of The Bin where old climbing shoes are now being repaired and the old rubber is used to create floor tiles for climbing halls.

The Bin focuses on clients with this approach. This project has therefore a focus on designing out waste streams. A waste stream in the context of The Bin is defined as the sum of particular products that are at their end-of-life state or by-products from a production line. The Bin focuses its services on

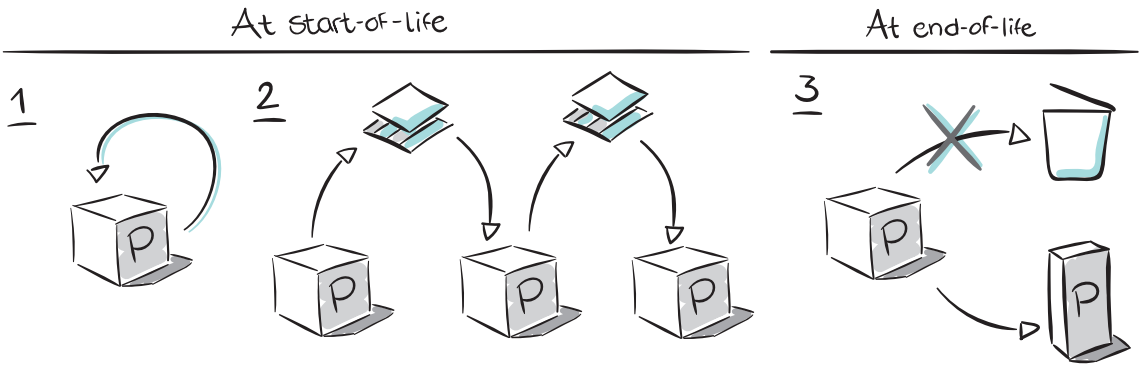


*Figure 5 - **Designing at the start- and end-of-life of a product***

large scale industrial waste streams of over 1.000 kg or pieces. Examples are old theatre curtains, old hospital gowns and old bicycle tires.

The waste streams The Bin works with, originated from companies that are mostly resellers of products. This means that they are dependent on other companies for the choice of material production and processing. This is also why it is hard for them to design at the start-of-life.

To understand this further, an overview of a typical chain in a linear economy can be found in Figure 6. This figure shows the way from a raw material to a product in usage. At the end of the chain, a consumer buys the product that later results in a waste stream. The product is damaged, no longer useful or rejected by the user.

To work from the linear chain (Figure 6) to a circular chain, many limitations are found. One of the main limitations is the problem that one actor in the chain is not able to change the entire chain. This asks for a shift at each actor in the chain. So only taking action at the client of The Bin will not create a circular chain in itself, but it does form the start of a circular movement in which other actors can become involved.

Conclusion

In conclusion, this subchapter distinguished two different approaches to designing in a circular economy: designing with circularity in mind and designing at the end-of-life state of a product. The Bin focuses on practices around designing out waste streams, where repurposing is taken as the main practice. By starting with repurposing at the client of The Bin the goal is to push the rest of the chain also towards a circular economy. The next subchapter discusses how repurposing can contribute as an entry towards a circular economy.

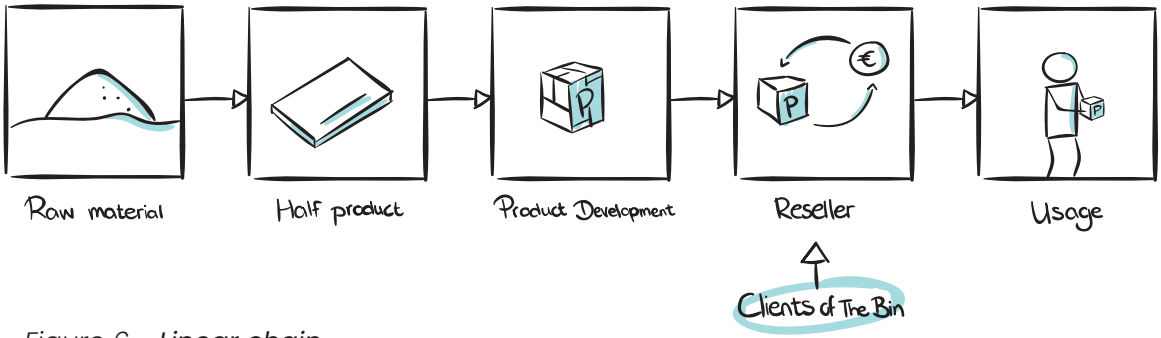


*Figure 6 - **Linear chain***

2.2 Repurposing as an entry towards a circular economy

As discussed in the previous subchapter, repurposing is the primary circular design activity of The Bin. To understand how repurposing can contribute as an entry towards a circular economy, this subchapter explores where repurposing has a place within a circular economy.

The Ministry of Infrastructure and the Environment has asked PBL Netherlands Environmental Assessment Agency to investigate how progress towards a circular economy can be measured (Potting et al., 2017). This conceptual framework called the R9-list (Figure 8) shows the position of repurposing in the transition from a linear economy to a circular economy. The higher the position on the R9-list, the higher the value and the fewer natural resources are needed and the less environmental pressure becomes.
When looking at the R9-list (Figure 8), it can be seen that repurposing has a relatively low position (no. 7). Since the waste stream is already present, higher steps such as reducing and reusing are not possible anymore. Besides that, the client does not have their own facilities to make structural changes on a production level. To be a valuable entry towards a circular economy, it is important that repurposing encourages a higher position on the R9-list. Therefore, it can be concluded that for creating circular concepts from waste streams, it is important that repurposing is also used as a starting point to climb higher in the R9-list (Figure 7).

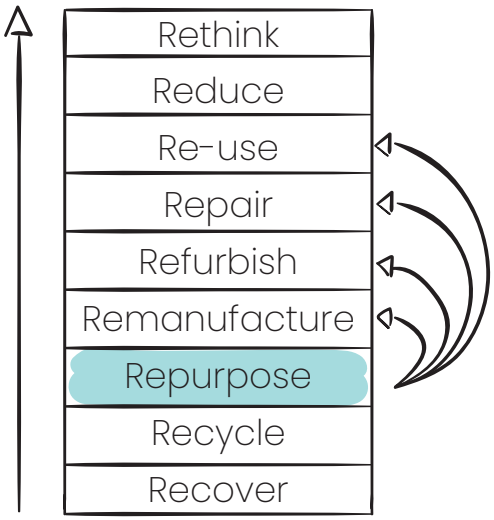


*Figure 7 - **Climbing up the R9-list***

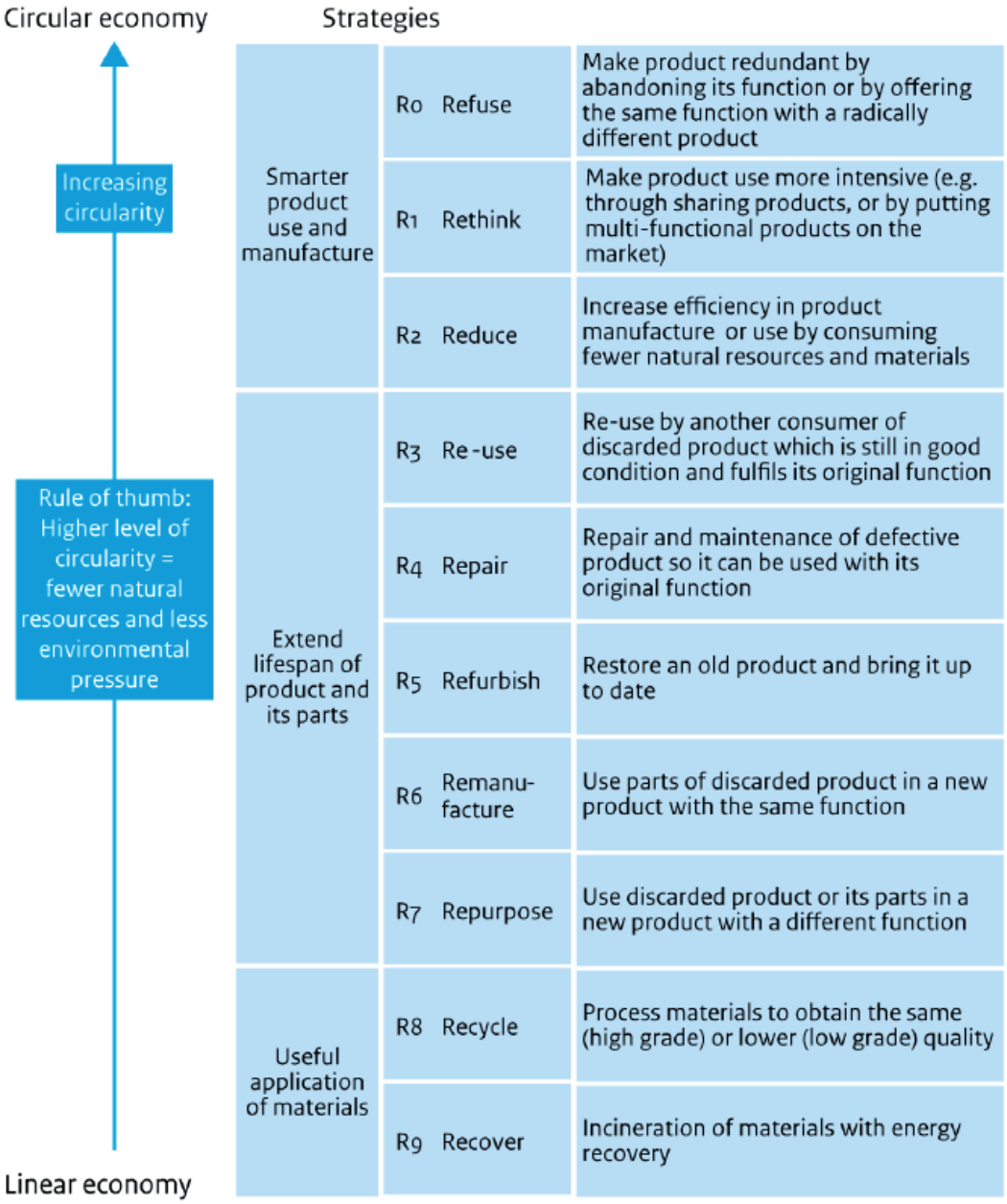


Figure 8 - R9-list (Potting et al. (2017))

In literature, more methods and processes on how to move from a linear to a circular economy can be found. Two of these are the frameworks Value Hill (Achterberg et al., 2016) and the Butterfly Diagram (EllenMacArthur Foundation, 2019). The Value Hill (Achterberg et al., 2016) shows how value is added and destroyed without taking action (Figure 9). It proposes how value can be retained and contribute to a position in a circular economy. The Butterfly Diagram (EllenMacArthur Foundation, 2019) illustrates the flow of goods and services in a circular economy (Figure 10). The diagram shows both technical and biological materials in cycles and how value is gained in the circular process.

However, the literature on specific design models for repurposing is limited (Lüdeke-Freund et al., 2018). Frameworks such as the Value Hill and the Butterfly diagram, do not position repurposing in their frameworks. In practice, different design studios practise Repurpose Driven Design which works with discarded products and materials (de Leede et al., 2021), but they focus exclusively on the material and thus do not investigate other opportunities to become more circular. The Bin currently uses the Value Hill, the Butterfly diagram and the R9-list as a basis of its design process. However, these frameworks do not position repurposing and do not explain how repurposing can be practised in a design process.

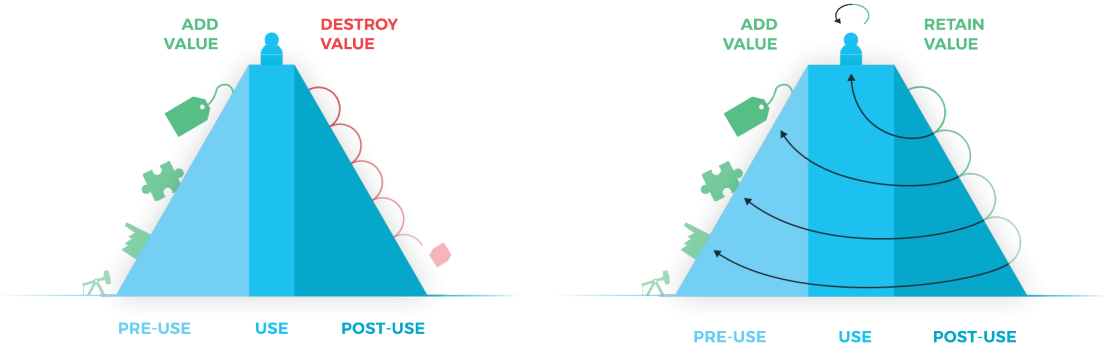


Figure 9 - The Value Hill (Achterberg et al. (2016))

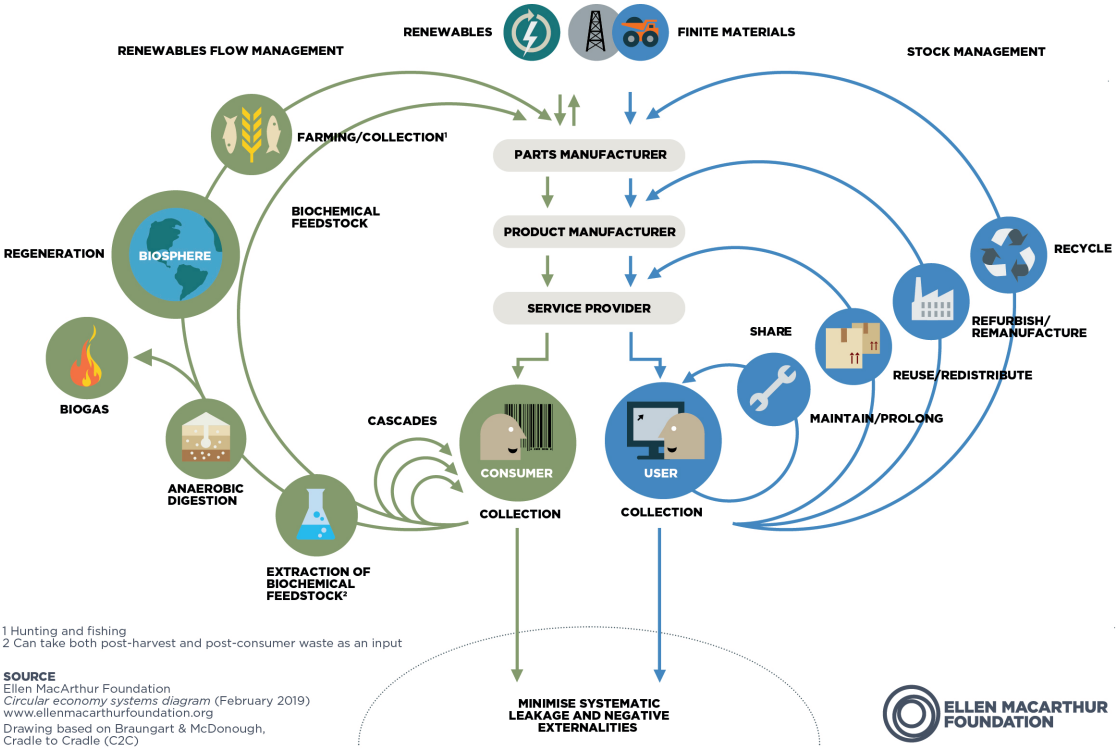


Figure 10 - Butterfly diagram (EllenMacArthur Foundation (2019))

Conclusion

To conclude there is a need from The Bin and an opportunity in the literature, for a design process that has a focus on repurposing but has a broader scope. This helps to not only find a solution for a waste stream but also helps to discover further opportunities to move towards a circular economy.

2.3 Current process of The Bin

To be able to design a new design process for The Bin, it is important to understand the current process of The Bin. This is done by discussing past projects of The Bin and field research around the waste streams, in which also the problem of the waste stream has been discussed with the client. This resulted in an overview of the current process as illustrated in Figure 11. In this chapter, the current process is discussed, resulting in an overview of the criteria for the new design process.

Explanation of the current process

The analysis of the current process is divided into three sections. In the first section, the request and the first conversation with the client are discussed. In the second section, the research around the waste stream and the concept development is discussed. In the last section, the realising part is shortly discussed. In the following paragraphs, each section is elaborated.

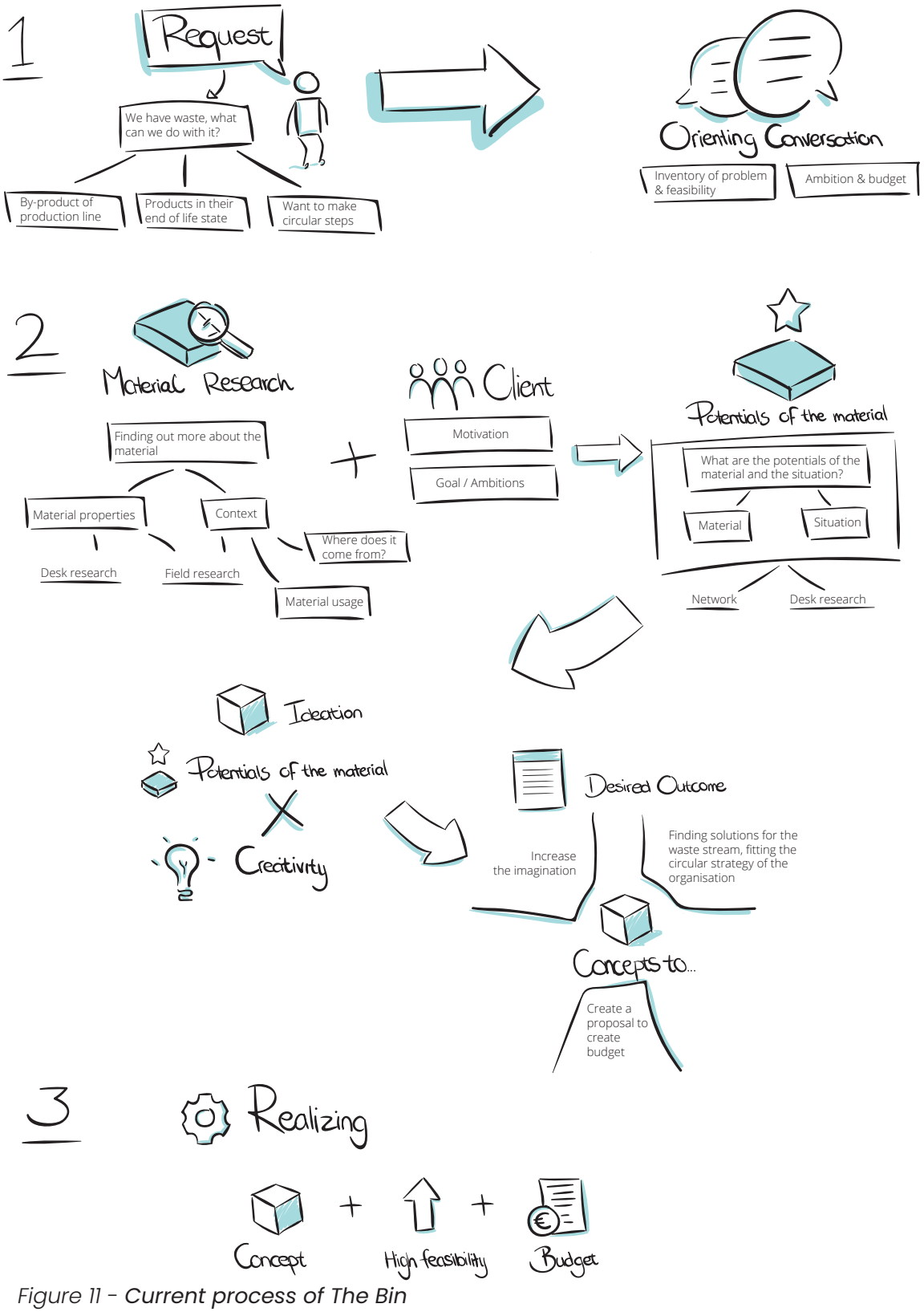


*Figure 11 - **Current process of The Bin***

1

Request of the client

In the first part of the process, the client contacts The Bin. The client has the question: We have waste, what can we do with it? These are products in their organisation that are at their end of life state or by-products of a production line, and they want to make circular steps within their organisation. After this request of the client, The Bin plans an orienting conversation with the client. In this conversation, the client tells about their organisation and why they are dealing with the waste stream. Later on, an inventory of the problem is made which includes looking at the feasibility and size of the waste stream and the rentability of the whole project. Also in this conversation, the ambition and budget of the company are checked. Each client of The Bin has their own specific kind of waste stream. These can be half-fabricates, products at their end-of-life time or by-products of production lines.

2

Waste stream research

When the orienting conversation was successful, the second part of the process starts. Here, material research on the waste stream is done and information around the client is gathered, resulting in potentials of the waste stream. These potentials highlight the opportunities of the waste stream into a useful product. These potentials are combined with a creative mindset, often in brainstorming about possible solutions with the waste stream. Here, the desired outcome is to find concepts that spark the imagination of the waste stream of the client. This helps them create a better proposal to get a budget in the organisation for the realisation of the project. These concepts also should fit the circular strategy of the organisation.
The concepts are discussed with the client and the most suitable is chosen. The realisation part of the process can start when there is a concept, high feasibility and a budget to start the project.

3

Realisation

When a budget is given the realisation process starts. Due to the different nature of each client and each waste stream, this process is unique for each project. But the goal is always to create a circular product and to build a system around it. The Bin aims to make sure the system can run on its own and tries to make itself obsolete.

This graduation project mainly focuses on the first and second parts of the process. This is because that is the part where the potential of the waste stream is found, setting the value for the rest of the project. Creating a structured way to research the potential of the waste stream will result in more valuable concepts that are more likely to create impact and actually be realised.

Problems in the current process

So far, the overall flow of the current process has been discussed. When looking more into detail to the process, there are some things that ask for attention. One of the main things that stand out is the lack of a model supporting the design process. This causes the following problems:

- The Bin experiences a difficulty in communicating the potential and value of the waste stream in clear ways to clients.
- For the project planning, it is hard to estimate which exact steps need to be taken and what time it will take when a client approaches The Bin.
- Following that, the amount of money that can be asked for a project is hard to predict (since steps and time are uncertain).
- It is hard to make a decision on which concept is the best solution for a waste stream since there are no set criteria to decide on and support it.
- The client asks for practical examples and first ideas of what can be done with the waste stream. The first reaction of The Bin is 'we can do a lot with it, but let us define specific concepts'. Right now, it is hard to quickly come up with concepts that fit the question of the client.
- It is not clear which elements are important to research as input for idea generation.

The Bin uses the Value Hill and the R9-list in their process as navigation frameworks to move companies towards a circular economy (Subchapter 2.2). As discussed in Subchapter 2.2, the R9-list ranks the position of repurposing and other circular strategies on value towards achieving circularity. These frameworks help to understand which transitions can be made towards a circular economy but do not help The Bin in the design process in terms of time division, concepts, design decisions and communicating potential.

Conclusion

To conclude, the following criteria for the design process are defined:

- It should be applicable to different kinds of waste streams.
- It should help to communicate the potential of the waste streams to the client.
- The elements that need to be investigated need to be made visible.
  Therefore, there is a need to find out which exact elements this involves for every situation and kind of waste stream.
- The design process helps to make decisions on which concept to choose.
  To do so it should be clear where the most value can be found for the waste stream and the client.
- To help communicate and make these decisions quickly the design process should be executable in one day.
- The design process should allow for an estimation of the amount of time and money that is needed for the rest of the project.
  To help with this the process should show which steps are needed for both the investigation and realisation part.

2.4 Clients of The Bin

The previous subchapter showed the criteria of the proposed design process for The Bin and its clients. To understand who these clients are and what their pains and gains are, previous projects of The Bin are discussed. In this subchapter, the client and their stakeholders are analysed, resulting in an overview of their activities and the problems they face.

Client

Currently, the client can be described as technical and visionary. They have certain technical knowledge and vision of what they want to achieve by moving towards a circular economy. For example, a client can say: "I saw the impact of plastic pollution during my trip in Asia and now I want to change the world". However they lack the ability to translate this to specific tasks and effects; "So I started a factory where we can recycle plastics, but I do not know where these recycled plastics can be applied". They are missing the link to look from a different perspective. This different perspective can result in new insights and opportunities, allowing the clients to think differently about waste and see solutions they did not see beforehand.

Adding this different perspective by design thinking, can create a collaboration between The Bin and the client. First, in a way where The Bin has the overhand and shows the client which steps to take and what different perspectives can be taken. Over time, this ratio shifts towards a situation where the client becomes more able to think with that different perspective and sees solutions for waste streams themselves. This will result in the ability of the client to move further towards a circular economy.

Adding this different perspective to the design process is not something new. The Bin already takes this approach by adding a creative mindset to their current process, but by laying more focus on the different perspective, the client becomes also able to see and understand this way of thinking and looking at the waste stream.

Client and The Bin

In this paragraph, the client of The Bin is discussed. A client profile is set together where the problems, pains and gains are discussed. In the next subchapter, the relation between the client and its stakeholders is discussed. Examples of clients are: hospitals, theatres, SwapFiets, Secrid, and municipalities. These are clients in different fields, but what they have in common is the fact that they are not design agencies or manufacturers of goods. Therefore, they are dealing with the waste stream, but are not in the position to create a change to the design of the product. This means design needs to happen at the end-of-life of the product (Figure 5 of subchapter 2.1).

By analysing the current process the following problems were found:

Problems

They approach The Bin and understand what The Bin can mean for their organisation, but they do not know not what the process of The Bin is.

They do not know which stakeholders to approach first when taking circular steps.

They experience a hard time translating their vision of circularity into specific steps and actions.

They often lack the understanding of a circular economy and which strategies can be taken.

They tend to exclusively focus on the material and its properties to find a solution for their waste stream.

Pains

The full ownership of the waste stream is not with the client, which causes a lack of responsibility. Despite this, they still approach The Bin with the question to help them with their waste stream.

They are not always familiar with the properties and specifications of the waste stream, which limits their view of possibilities/solutions.

They see something as waste when there is no longer value seen in the waste stream. It is a cost item and pain point in their business, causing the need to take action.

Gains

They want to make a change within their company. This arises from their own motivation (I want to leave a clean and healthy planet for my children), market demand, and they want to increase their business image. However, they do not know where to start.

The waste is often already at the company, so there is no need to focus on reverse logistics in the first steps of the process.

To conclude, there is a need for a design process. Including a method with techniques that allows The Bin to work structurally and enables them to communicate clearly with their client. The client has the motivation to make a change within their company, they only struggle with how to put their vision into a practical direction.

Clients think they need a product solution, but they actually need a concept direction to move towards.

A circular product then forms a part of the concept direction. This concept direction helps the client to create more of an understanding of a circular economy.

Stakeholder analysis

As discussed in Subchapter 2.1, circular supply chains form an important part of a circular economy, where each stakeholder fulfils their own position. The client is not able to make changes on its own, since they are dependent on the activities of their stakeholders. This means that the results of moving towards a circular economy will always have an influence on these stakeholders. Therefore, the role, interest, and power of each stakeholder are discussed in this paragraph.

Each stakeholder has its own activities and needs, which can be influenced by the actions of the client. Each client has different kinds of stakeholders, depending on the field they are active in, and the complexity of the product. Here, a general overview of stakeholders is made, with the type of stakeholders most clients are dealing with. This overview is generated by analysing past projects of The Bin, see for more information Appendix 12.5. How much stakeholders will influence the client, is also dependent on the interest and power of each stakeholder. This is illustrated with the stakeholder analysis approach of Ashby (2016), Figure 12.

Conclusion

It can be concluded that knowing which stakeholder has what interest and power, helps to make decisions on which stakeholder is relevant for the client to involve in the transition to a circular economy. By mapping out the activities and needs of stakeholders, a decision can be made on which solution will positively influence a stakeholder the most. Since the problem is always approached from the waste stream, it is useful to involve an expert on the material as early as possible. These stakeholders have their practices in a certain field, therefore the context of the client and its stakeholders can also provide new insights around the waste stream. The next subchapter discusses this context.

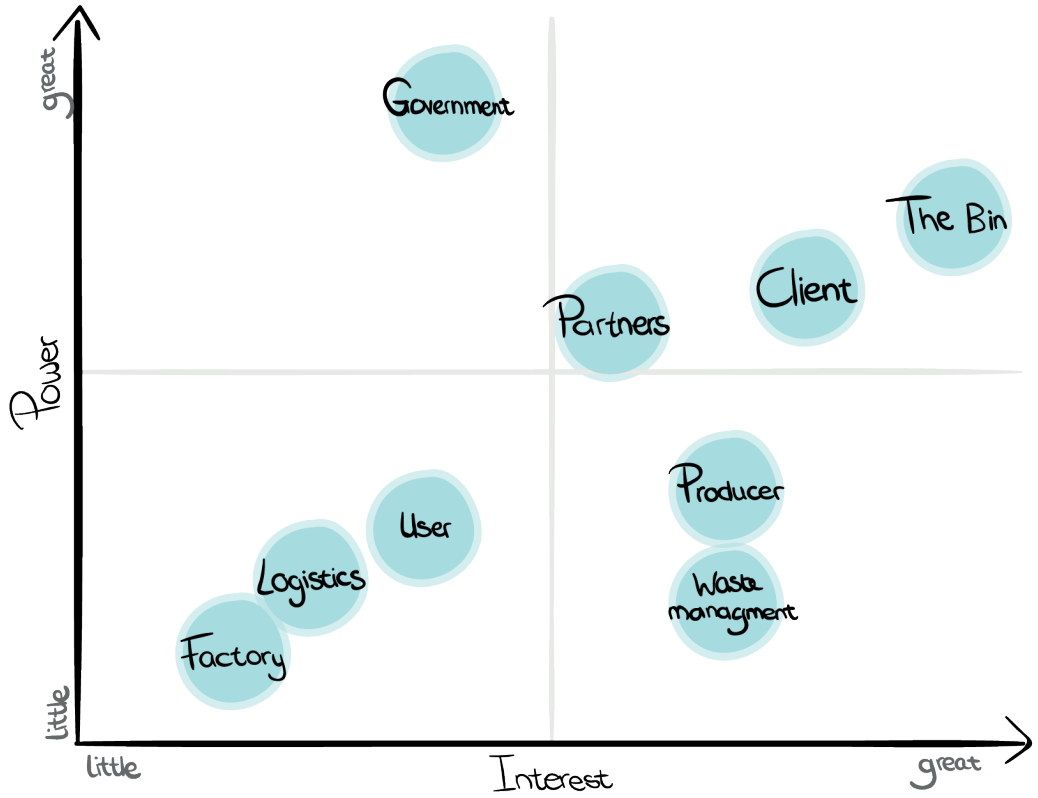


Figure 12 - Stakeholder analysis

The Bin: The client of this graduation project. They are a start up working in the circular economy.

Client: The client of The Bin, explained in the previous paragraph.

Partners: Companies the client of The Bin has an active working relation with and that are not directly related to the waste stream.

Producer: The producer of the product, often has technical knowledge about the product and its materials.

Waste management: The stakeholder that is processing the waste stream. Often the waste stream is burned at the waste processing.

Logistics: The party that moves the products from A to B.

Factory: The party where the raw materials and half-products are made.

Consumer: The person that buys the product from the client.

Government: The government has to abide by the goal of reducing the use of primary raw materials with 50% by 2030 to become part of a circular economy in 2050 (Rijksoverheid, 2022). They provide subsidies to stimulate companies and entrepreneurs to help achieve this goal.

2.5 Context

As discussed in Subchapter 2.4, there are multiple kinds of clients, but are all in the same position: they are not the producer of the material that has resulted in the waste stream. This results in the fact that the clients are always dependent on their stakeholders to make a change, but also dependent on the context the product has been used. To find out what factors of the context have an influence on the waste stream and the solution space, field research is done by visiting two clients of The Bin, a sail factory and the Amsterdam UMC. In this subchapter, the main findings of these visits are discussed, together with the relevance of visiting the context in terms of the design process of The Bin.

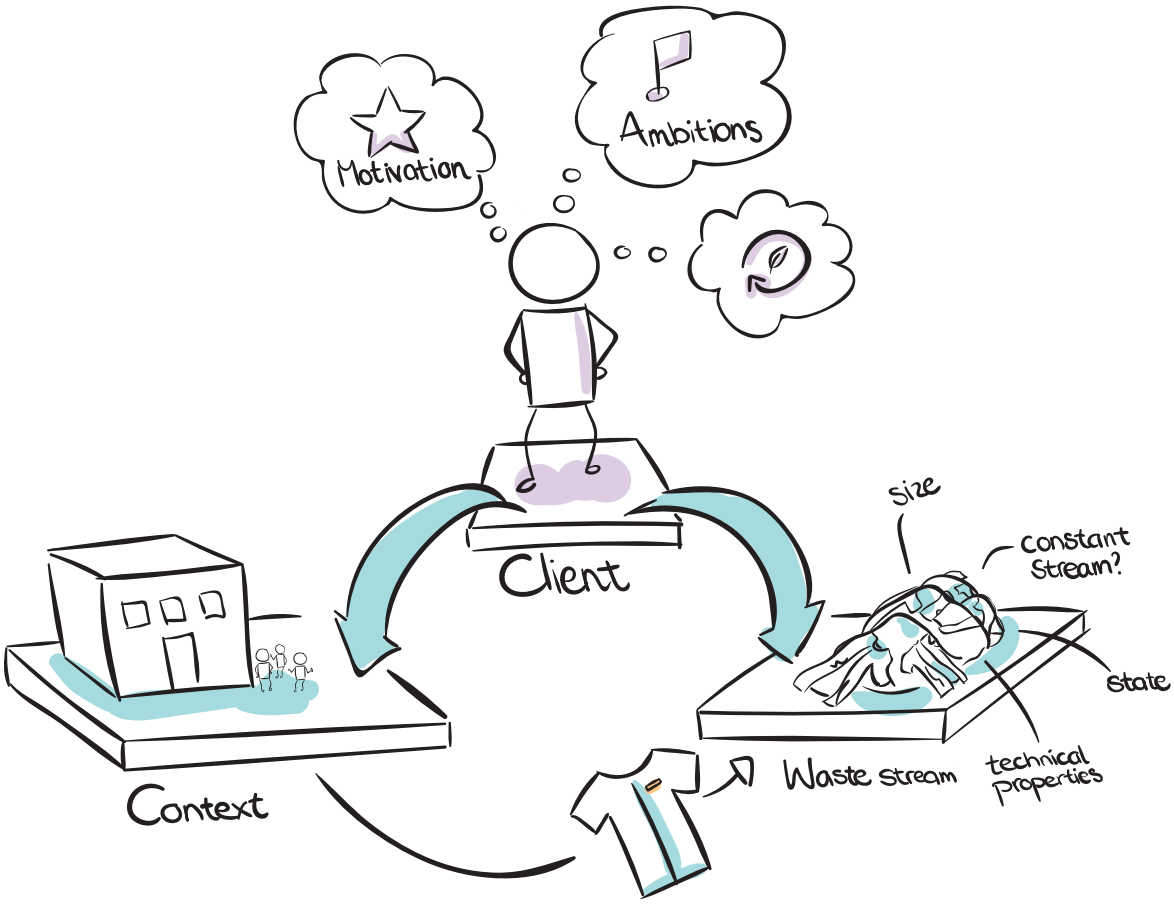


Figure 13 - The context and the client

The approach of the field research was to see what the relation between the client and the waste stream is and which other factors are influenced by the context. In the list below, an overview of the factors relevant in the context related to the waste stream is made. In Appendix 12.6, more information about the context visits can be found.

- Usage of the product/waste stream
- Facts about the waste stream as the size of the waste stream, size of the product, constant stream or not, state of the waste stream (Damaged or not, colour difference)
- Problem through the eyes of the client
- Strategy and culture in the context and organisation
- Ambition and motivation of the client

Conclusion

To conclude, the proposed design process should investigate the factors mentioned above. The importance of each factor cannot be generalised and should be determined for each client individually. The field research also showed that, next to talking to the client, visiting the context is needed to properly investigate these factors and to determine the influence of each factor.

3

Potential of waste streams

Two of the most important concepts mentioned in the research question is the value and potential of the waste streams. To see the hidden potential of waste streams and to create it, it is necessary to understand what potential is and how it can be seen. In this chapter, the transition from potential to value is discussed.

First, it is defined how potential is seen right now by the clients of The Bin. Second, the different kinds of potentials are defined and how the potentials can be positively influenced. In the end, it is defined how the potential of the waste streams can be translated to the value of the waste streams.

3.1 Current vision on waste stream potential

This subchapter explains what potential is, and how it is currently seen by the clients of The Bin. The potential is taken into relation to the potential of a waste stream. This is found by looking at its definition and what potential can mean for the proposed design process.

The Cambridge Dictionary (2022) defines potential as

> "the possibility of something developing or happening in a particular way".

Potential is in this project related to the potential of a waste stream. When we combine the definition of potential with waste streams, it translates to the possibility of the waste streams to develop or happen in a particular way.

The client defines something as waste when the quality is decreased in ways that are not useful for them anymore. The value is decreased and the waste stream no longer fulfils its original usage. If the value was still seen, they would not define it as waste in the first place. However, the client has a feeling there is a potential of the waste stream since they connect with The Bin and ask for opportunities. What is missing here at the client, is that they are not able to exactly define what the potential of the waste stream is. The reason for this is that they are unaware of the different areas they can look into to find the potential. To help create an awareness of these areas a shared vocabulary has to be created.

Conclusion

Therefore, the design process needs to have a vocabulary, which can be used to discuss the potential of a waste stream with the client. The vocabulary should be understandable for both The Bin and the client. To be able to find this vocabulary, we first need to understand how the potential of a waste stream can be found. One of the ways potential can be found is by looking at the waste stream as a material. This is further explained in the next subchapter.

3.2 Material Driven Design Method

When we look at the waste stream as a material, the potential of the material can be seen as, a part of, the potential of the waste stream. The waste streams of the clients are often simple products. This allows for it to be seen as just a single material and not a product consisting of multiple parts. Oskam et al. (2019) show in their Recurf-Up! research project that the Material Driven Design (MDD) method can be used to research the abstract experience value of materials to achieve an increase in value of waste streams. Therefore this method is further explained in this subchapter and used as a basis for part of the proposed design process.

The MDD method has a holistic approach to looking at materials in design, looking at both technical and experiential qualities of a material. Understanding materials in also its experience value, provides new avenues to design products and new materials. Bringing materials at the early stage of the design process makes it possible to review a bigger variety of materials and explore their qualities. They can be used as a start of idea generation and to explore the possible applications of the material.

The experiential qualities of a material as described in the MDD method exist in researching on four different levels: sensorial, interpretive (meanings), affective (emotions) and performative (actions, performances) (Karana et al., 2015).

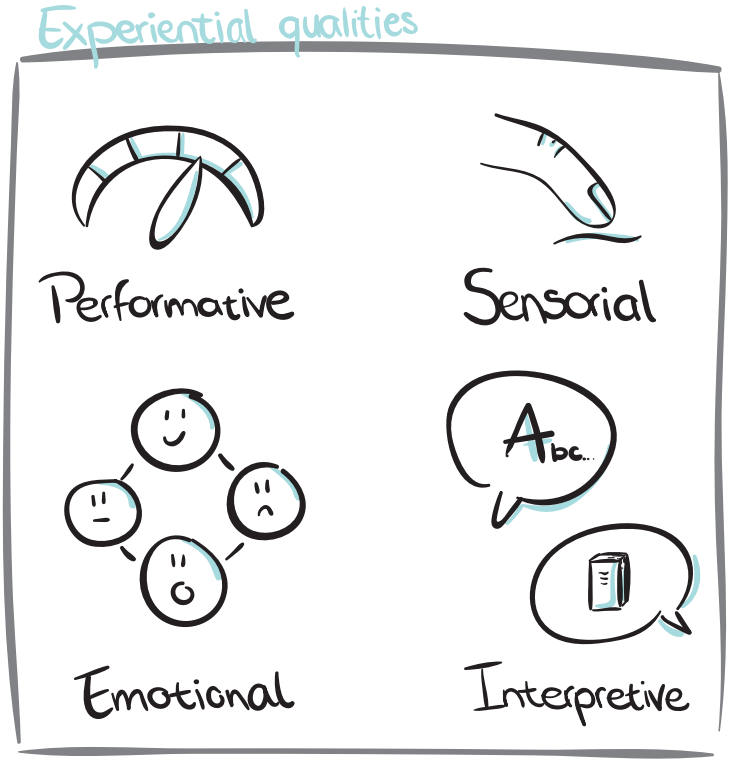


*Figure 14 - **Experiential qualities***

Karana et al. (2015) formulate the following questions that can be answered in the experiential studies:

- What are the unique sensorial qualities of the material?
- What are the most and the least pleasing sensorial qualities of the material (according to users)?
- Is the material associated with any other material due to its similar aesthetics?
- How do people describe the material? What kind of meanings does it evoke?
- Does it elicit any particular emotions - such as surprise, love, hate, fear, relaxation, etc.?
- How do people interact and behave with the material?

Researching the experiential qualities next to the technical qualities, Wiberg (2014) describes that material character defines the potential of the material. So, defining the material character of waste streams by approaching the waste stream as a material, defines the potential of the waste stream.

Conclusion

To conclude, by defining the material characteristics of a waste stream, defines the potential of a waste stream. So, when the potential is defined, it allows The Bin to communicate the potential of a waste stream to the client. The MDD method also provides a vocabulary to define the potential. These factors make MDD a solid base and source of inspiration for the proposed design process for The Bin.

3.3 Circular design guidelines

In addition to the MDD, literature around circular design practices is explored. This chapter shows the relevant guidelines found in that literature. The relevance is determined by looking at if they are suited for repurpose drive design and their ability to create a higher value out of the waste streams.

The following guidelines were found:

- Design with different participants in the value chain. (Moreno et al., 2016)
- Design by considering value in a broader view, not as a price tag on a shop shelf but as an asset. (Moreno et al., 2016)
- Design knowing where each material and part comes from and where each material and part goes to. (Moreno et al., 2016)
- Design with hands-on experience that foster a call of action. (Moreno et al., 2016)
- Design a product that is functional and beautiful next to sustainable. (Martina & Oskam, 2021)
- Use the waste of a client directly in the product for that respective client (Martina & Oskam, 2021)
- Do not rely only on collecting waste materials from your prospective client, but work with partners who can provide high volumes of waste material so to provide a predictable and consistent inflow of materials. (Martina & Oskam, 2021)
- Make use of your waste in your products made from recycled materials. (Martina & Oskam, 2021)

Conclusion

These design guidelines can contribute to defining where potential can be found and which prerequisites there are for the proposed design process. We have now defined how the potential of a waste stream can be defined. The next subchapter discusses how the potential can be translated to value.

3.4 Potential to Value

In the end, the question remains how the potential of a waste stream can be translated to the value of a waste stream. Therefore, the definition of value is laid next to the definition of potential. Besides, a proposal from literature is given on how this translation can be made.

To see how the potential can be translated to the value of a waste stream, the definition of value is looked at as well. The Oxford Dictionary (2021) gives five definitions of value, where the first two are about value in means of money and the third the most relevant is in terms of use value:

> "the quality of being useful or important"

The definition of potential is as follows:

> "the possibility of something developing or happening in a particular way"

When this definition is compared to the definition of potential, a transition can be made. When the possibility of something is brought into actuality, it is able to develop into quality and usage. So when able to bring the defined potentials as discussed in subchapters 3.2 and 3.3 into actuality, there can be worked on the value of a waste stream.

Now value is defined in general sentences, which raises the question of how the client looks at the value right now. The client looks at value related to circularity in different ways: working on a healthy and long term company, market demand for circularity, use value in products and services they currently have and the function of those.

The client is prepared to pay for elements that contribute to increasing the value in one of these aspects. If it does not contribute or it is not visible that it will contribute, the client is not willing to pay for taking steps with their waste stream. This exchange value is the amount paid for the perceived use value (Bowman et al., 2000).

Currently, the clients pay money to discharge their waste for waste processing at an external party. However, they seem to have the feeling that there is a potential for the waste stream and want to use it as a step to move towards a circular economy.

Having looked at the potential, the value and how the client views value it is important to look at what approach to take to translate potential into value in a design process. An example of a systematic design approach is given by Tung (2012). They suggest to first understand the situation around the material, then define the opportunities and after that, make decisions on what design is taken. The MDD method also successfully followed this approach (Karana et al., 2015) and therefore this approach will also be taken in this project, allowing to facilitate designing out waste stream with the waste stream as the starting point of the process.

Conclusion

To conclude, the potential of a waste stream can be translated to value by understanding the potentials of the waste stream, finding opportunities and making decisions. This is also where new circular solutions arise, and higher value for both the waste stream and the client is achieved. The question that remains is how this theory can be put into practice and set into a design process for The Bin. The next chapter discusses the key findings of chapters 2 and 3. After this, the proposed design process is presented.

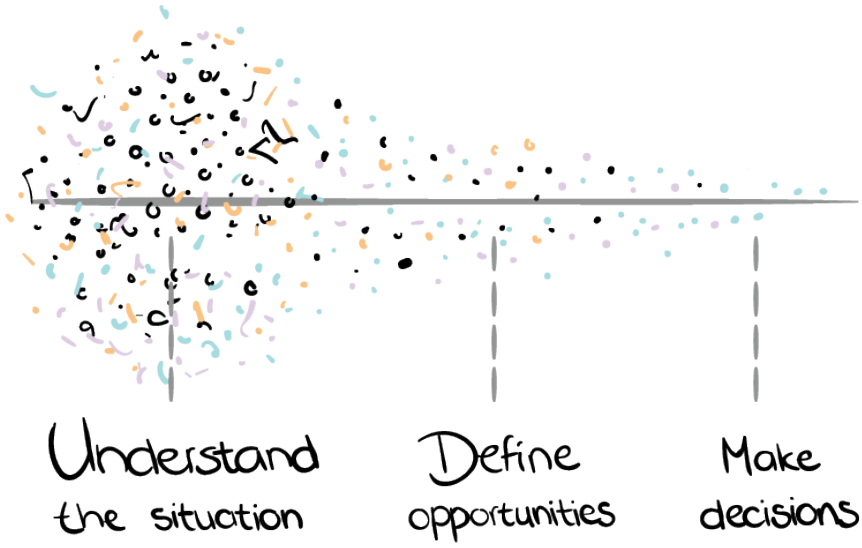


Figure 15 - Framework according to Tung (2012)

4

Key insights

To conclude the research part of this graduation project the key findings from the previous chapters are gathered and summarised. These findings are divided into four individual topics. Each topic is discussed individually and then an overall conclusion is drawn.

Designing for a circular economy

This project has the designing at the end-of-life of products approach. This is done by starting with repurposing and with these activities achieving reaching higher on the R9-list (Subchapter 2.2). Higher on the R9-list means a higher value for a circular economy.
A circular economy is a gathering of factors and not only based on material or technical properties alone (Subchapter 1.2). Approaching circularity from different levels with social, economic, and environmental perspectives, results in successful development of becoming a part of a circular economy.

Design process prerequisites

From the conclusions from the previous chapter, design process prerequisites are lined up. These prerequisites form the criteria before starting a project with a potential client.

- The client thinks they need a product solution, but they actually need a concept direction to move towards (Subchapter 2.4).
- Involve stakeholders in the value chain and know which stakeholder to involve first. A stakeholder with expertise in the waste stream is highly recommended (Subchapter 2.4).
- Know where each material and part comes from and goes to (Subchapter 3.3).
- Feel the material you are designing with, hands on experience enable room for new insights (Subchapters 3.2 and 3.3).
- Keep the waste stream in the loop of the client by using the product again for the respective client (Subchapter 3.3).
- Gather partners around the waste stream who can provide high volumes of waste materials (Subchapter 3.3).

Client

It is found important that the design process allows the client and The Bin to structurally work together. In addition to structure, the process should also include different perspectives on the problem in this process the client gets a better understanding of the way of working and looking at waste streams. Additionally, it is important to not only look at the clients themselves but also at the stakeholders surrounding them. This gives a more complete image of the waste stream.

Design process criteria

Creating structure in a design process can be done in different ways. Together with the criteria from the previous paragraph and conclusions from chapters 1 to 3, the following criteria for a structured design process are formulated.

- The design process should turn potential into value
- The design process should follow the process framework of Tung (2012). 1) create an understanding, 2) define opportunities and 3) make decisions
- The design process should be applicable for different kinds of waste streams.
- The design process tells which elements are needed to be researched. These elements include but are not limited to the factors found in chapter 2.5.
- The design process should help to communicate the potential and value of the waste streams, with a vocabulary.
- The design process should support making decisions for the best concept of the waste stream.
- The design process should be executable in one day, but can also be used as a project structure.
- The design process should help to estimate the time needed for the process, by a structural overview of which steps are needed to be taken. And the amount of money that can be asked for.
- The client lacks the understanding of a circular economy and which strategies can be taken, so the design process should help to create an understanding of a circular economy and its strategies.
- The design process should help to translate the circular vision of the client into practical steps.
- The design process should define the material characteristics of a waste stream.
- The design process should use the vocabulary from MMD.
- The design process should include a visit to the context.

Conclusion

To conclude, a design only can become circular if different perspectives are taken into account. These perspectives include but are not limited to social, economic and environmental.
For a project to succeed within the context of The Bin, several prerequisites are formed. Additionally, it was also found that it is important that the client of The Bin also sees the different perspectives one can take on a waste stream.
Finally, a framework was chosen to base the design process on and criteria for this process were formed to ensure the gaps found in the research were filled.
These findings form the basis for the second phase of this project, Synthesis.

Phase II - Synthesis

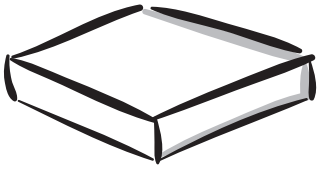
5

Framework

From the key findings of the previous chapter, a framework is set up as a first step to create the structure that The Bin required. This chapter presents the framework where it is looked further than the material of the waste stream, namely exploring how other problems can be solved with the waste stream.

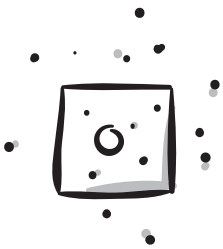
5.1 Three pillars

The framework is built up out of three pillars: material, stakeholders and context. These three create the space to think further than only the technical properties of a waste stream. Adding different perspectives to the waste stream, helps in understanding the waste stream before making decisions on its further application. The following paragraphs explain what each perspective is and how this is related to earlier defined insights.



Material

Stakeholders



Context

*Figure 16 - **The three pillars of the framework***

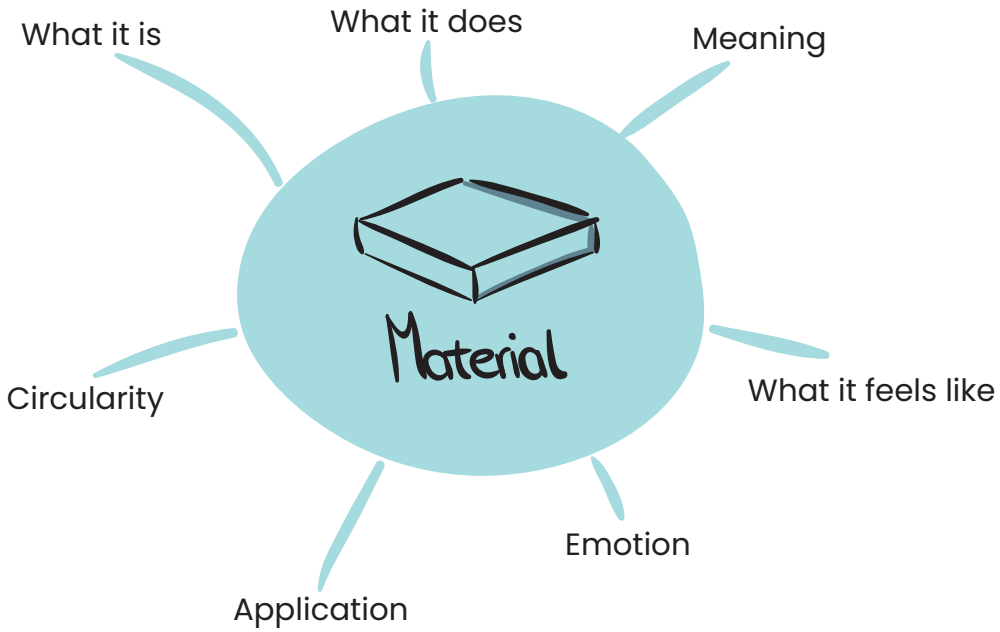


*Figure 17 - **Material***

Material

The waste stream is approached as a material. A waste stream is often a single material or a combination of a few materials. Therefore, approaching the waste stream as a material allows understanding the individual characteristics of each material of the waste stream. But also looking at the waste stream as a whole, for example, the combination of materials made or when the materials are attached in a way it is hard to separate, can define new opportunities. Figure 17 shows which elements can be questioned when looking at the material of the waste stream. This is set up from subchapters 2.5 and 3.2. In the material pillar, the focus lies on its technical and experiential characteristics, together with circular applications. Having the waste stream physically at hand when exploring, enables touching the material and finding its opportunities and limitations by stretching and cutting the material.

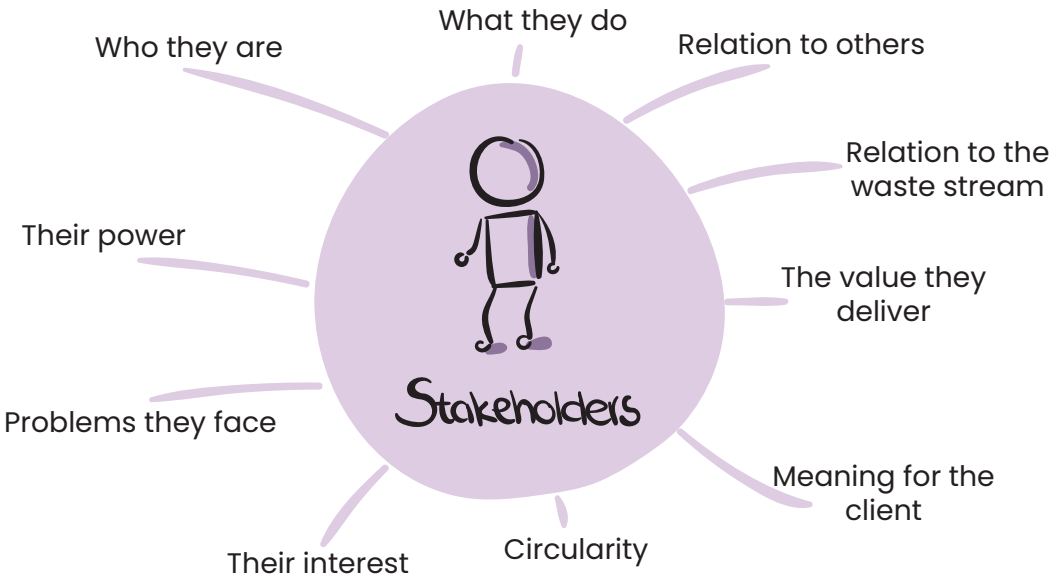


*Figure 18 - **Stakeholders***

Stakeholders

Around the waste stream, many stakeholders are present. Stakeholders are the people and organisations involved around the waste stream. The stakeholders are each dealing with their own activities and problems, related to the waste stream. But it is also important to look at the activities and problems that are not related to the waste stream. Additionally, circularity means something different for each stakeholder. They have a different vision or are not working around circularity yet. Each stakeholder around the waste stream is identified and analysed on elements. Figure 18 shows which elements can be questioned when looking at the stakeholders around a waste stream. These insights are based on the findings from subchapters 2.4 and 2.5. Finding the information about the stakeholders can be supported by observations, interviews and sessions with stakeholders.

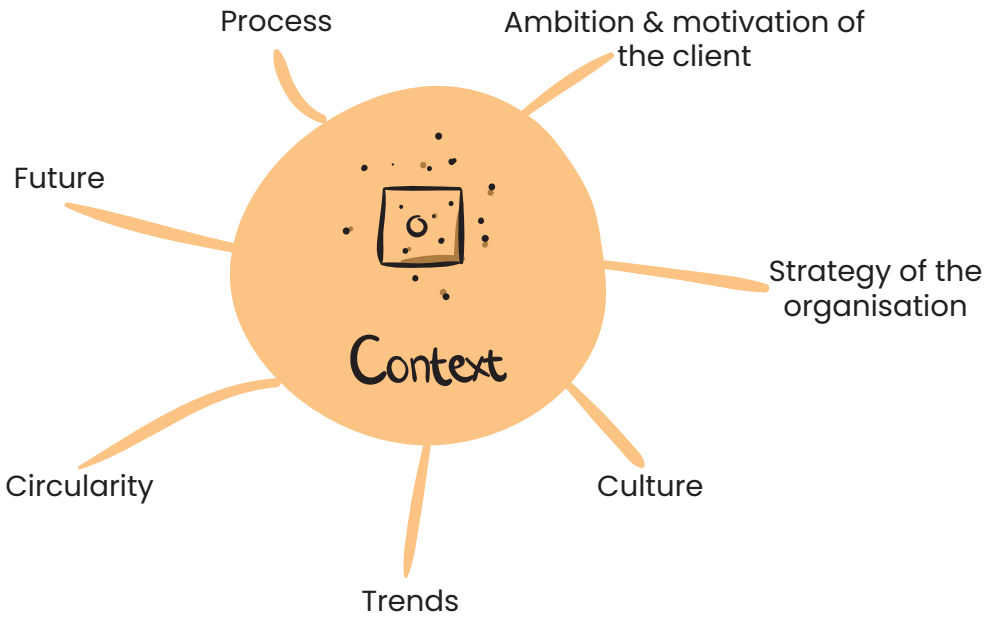


*Figure 19 - **Context***

Context

At last, the context around the waste stream is seen. The context is the place where the waste stream is used, produced and/or collected. This can be multiple places, but the most relevant is taken, which is directly influenced by the waste stream. The context tells more about the culture and trends in the area around the waste stream. These are elements that directly influence the waste stream. The context also shows the culture and trends that are not related to the waste stream. This includes the strategy of the company or behaviour of the stakeholder within context. Figure 19 shows the elements that can be questioned in the context around the waste stream. These insights are based on the findings from subchapters 2.4 and 2.5. Finding information about the context is done by visiting the context.

5.2 Combining the pillars

As can be seen, the framework is built up in material, stakeholders and context. Each of these pillars is a different perspective one can take on the waste stream. They are always present around the waste stream. Analysing these pillars defines characteristics that can be found around the waste stream. Defining these characteristics defines the potential of the waste stream (Chapter 3.2, Wiberg (2014)).

Taking different perspectives into account is one of the key insights mentioned in chapter 4. Chapter 1.2 also shows the importance of operating on different dimensions and levels. This framework proposes to go further than taking different perspectives into account or operating on different levels. It proposes to combine the three pillars by actively seeking out connections between each pillar. This can be seen in Figure 20, where the connections between the three pillars are described as: interaction, behaviour and product.

Interaction
At interaction, the combination between material and stakeholders is made. What can a material mean for a specific stakeholder?

Behaviour
At behaviour, the combination between context and stakeholders is made. What kind of behaviour is desired for the stakeholders to have in the context?

Product
At the product level, the combination between material and context is made. How could the material characteristics of the waste stream be used to positively influence trends from the context?

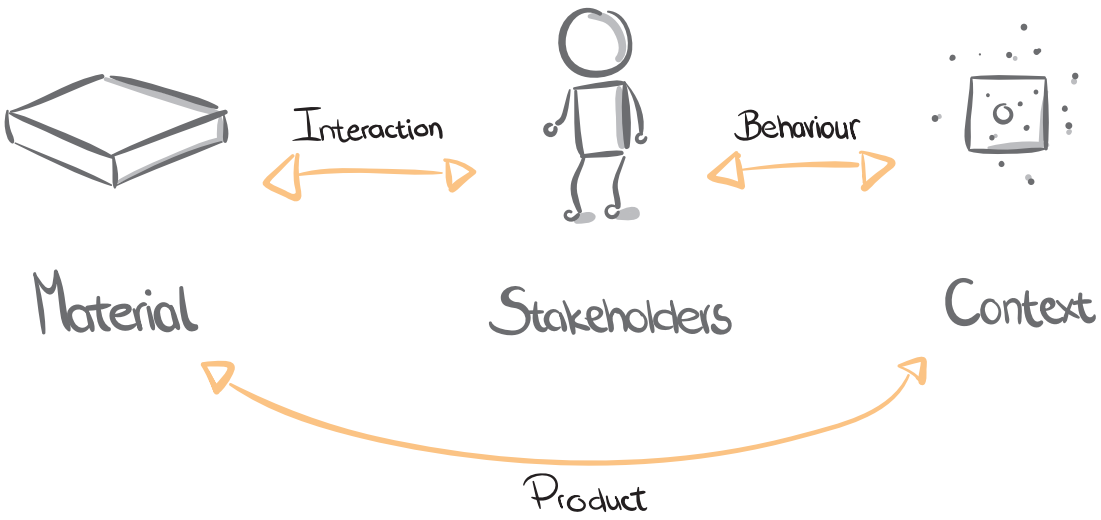


Figure 20 - The three pillars combined

Conclusion

To summarise, the framework consists of three pillars: material, stakeholder & context. Each pillar has a different perspective on where to find potential for a waste stream. By combining each pillar, connections are found. These connections are described as interaction, product & behaviour. Combining these pillars is hypothesised to be an important part of creating value out of the potential found in each pillar. In the next chapter, the design process that was made using this framework is presented in detail.

6

The proposed design process The Potential to Value Circle

The framework presented in chapter 5 shows how the potential of a waste stream can be found and translated into value. This framework forms the basis of the proposed design process. This chapter gives an overview of the proposed design process and explains the definition of each part of the design process. In the subchapters, the individual levels are elaborated.

To turn the framework into a design process that increases the value of waste streams a look is taken at the literature on design processes. In particular, the work of Burnham (1999), the conceptual framework of approach, method and technique, provided a clear framework on which the proposed design process is based. Figure 21 shows the overview of the conceptual framework placed in the proposed design process, later called the Potential to Value Circle.

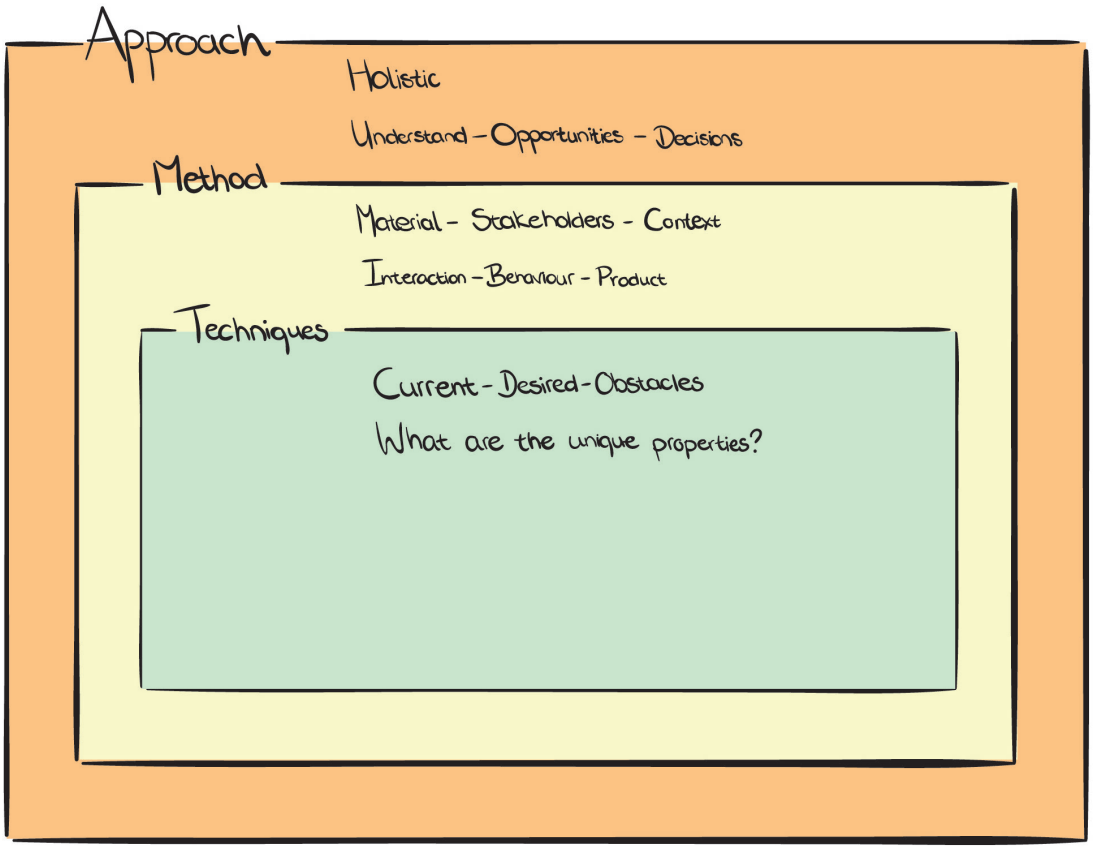


Figure 21 - Framework to support the proposed design process

Approach
An approach can be defined as the direction that is used to address a problem. It contributes to determining the way a problem would be solved (Andiapann & Wan, 2020). The Potential to Value Circle has a holistic approach, where a look is taken at the wholeness around a waste stream. The goal is to achieve high value for the waste stream, as well for the clients of The Bin and The Bin itself. The approach of the Potential to Value Circle follows the framework from Tung (2012) (Chapter 3.4). First, the situation is understood, after which opportunities are defined and decisions are made.

Method
A method is the way in which the problem will be solved. Something can be defined as a method when it has a specific and rational working principle. This includes being applicable to multiple problems and the use of the method is visible. A method is supported by a model, which is a graphical representation of the method (Roozenburg & Eekels, 1998) The use of a method can help design waste streams by working in a specific manner. Here the framework defined in Chapter 5 is put into practice. The method is built up into three phases. Phase 1: Analyse, Phase 2: Combine, Phase 3: Formulate.

Technique
A technique is a specific activity performed by users that can be observed and measured. It is a specific task with an immediate result. (Andiappan & Wan, 2020). Specific tasks support the way to work towards the goal of the method and make the method applicable. This increases its accessibility for designers of different fields and makes the steps in the design process clear and negotiable with clients of The Bin. The technique will allow for a vocabulary to communicate with, resulting in consistent communication internally at The Bin, as well as externally to clients.

As discussed in chapter 4, there is a need for a design process to work structurally and to be able to communicate clearly all time with the client. Therefore, it is important to know which elements need to be discussed to make waste negotiable and to solve the pain point of waste within their company (Subchapter 2.4). Having a design process that works from understanding, towards defining opportunities and making decisions, gives structure to which elements need to be discussed and where the client should be involved in the process. By using this structure, the elements lead to solutions for the waste stream, allowing clear communication with the client.
The upcoming subchapters will discuss the approach, method and techniques of the Potential to Value Circle more in detail.

6.1 Approach

This subchapter describes the approach of the Potential to Value Circle. For this approach, the systematic approach for design phases described by Tung (2012), understand, define & decide, is followed and combined with a holistic approach. First, the material, stakeholders and context are analysed to understand which elements can contribute to a circular transition. By connecting the results of this analysis opportunities are then defined. Ending with decisions that are made, formulated in a circular design goal, which will show in which way the highest value can be achieved.

Understanding which elements can contribute to a circular transition by looking at the three pillars material, stakeholders and context. By defining their characteristics the potential of the waste stream is defined. Here, the current situation, the desired situation and the obstacles between those two situations for each pillar are analysed. Analysing this reveals the potential around the waste stream, driven by the iconic elements and findings.

Defining opportunities by laying relations between potentials after analysing the three pillars and interpreting the findings. The potentials are brought together into interaction (material & stakeholders), behaviour (stakeholders & context) and product (material & context). These results show the translation from potential to value of a waste stream.

Making decisions formulated in a circular design goal, resulting in the highest value for the client and the waste stream. Here, a sentence is formulated where interaction, behaviour and product come together, causing an actionable concept direction to take with the waste stream.

Now it is defined what the approach of the Potential to Value Circle is, the next subchapter will explain the next part of the framework of Burnham (1999), the method of the Potential to Value Circle.

6.2 Method

The method of the Potential to Value Circle consists of three phases, each with its own subgoal, steps and results. In this subchapter, each phase is explained. The method is applicable to all waste streams, by its open and holistic approach. The method has a visual representation, the model, as a guide to executing the method and communicating with clients, visualised in Figure 22. This supports showing where value can be found and created. The next subchapter explains the techniques that support these steps of the method.

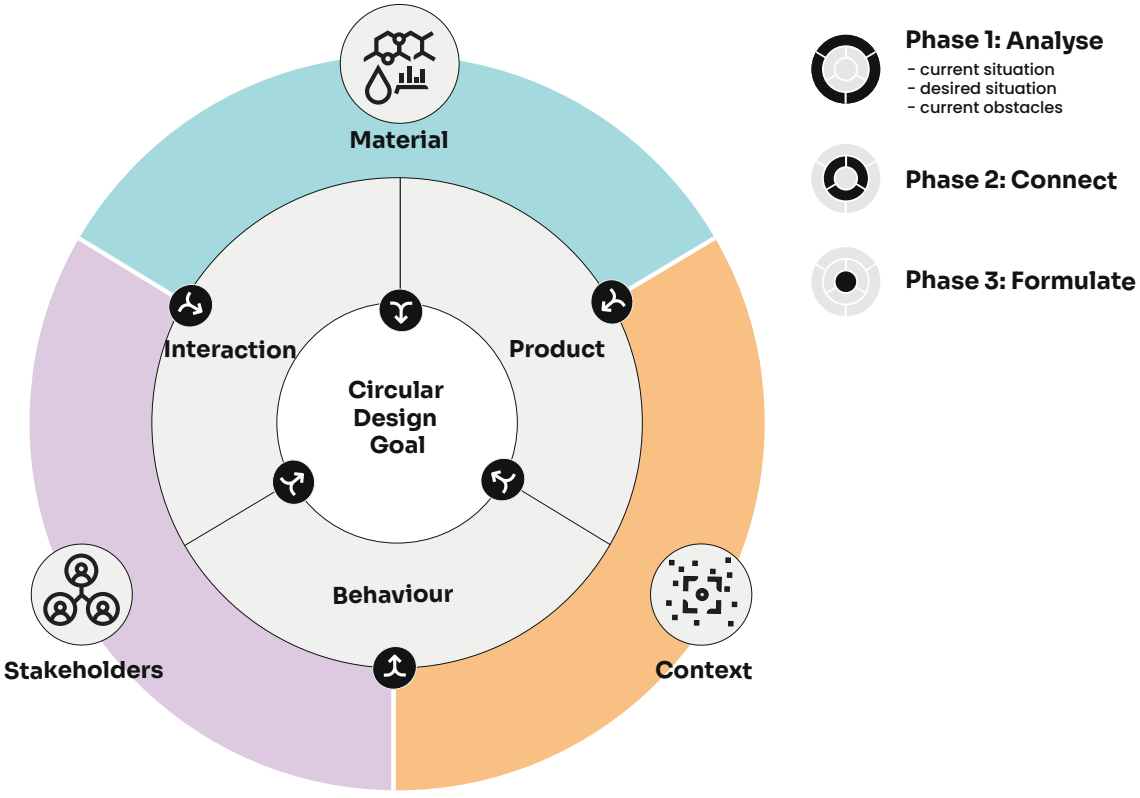


Figure 22 - The model of the Potential to Value Circle

Phase 1 Analyse

Understand which elements can contribute to a circular transition

Here the framework presented in chapter 5 is put into practice. By analysing material, the stakeholders and the context around the waste stream, the potentials are defined. This is done by looking at the current situation, desired situation and the obstacles between those two situations of each pillar. Translating from the research part (Phase I), results in the following topics for each pillar:

Material

When the material is analysed, it is important to create an awareness of the material and its characteristics. During this analysis, known facts about the material need to be collected, but it's even more important to find new characteristics of the material. This is done by having the waste stream physically present at the analysis, so the material can be seen, touched and explored. To get a complete image of the material three aspects of the material in particular are important. 1) Technical & Experiential characteristics, 2) Possible product areas and 3) Obstacles to overcome

Technical & Experiential characteristics

First, the technical characteristics are analysed to create a clear understanding of the unique properties and their limitations. The following technical characteristics are considered: size, colour, weight, and strength. Besides this, convenient manufacturing processes are collected here. This information can be found in technical datasheets, provided by manufacturers of the material and by looking and tinkering with the material itself. The last step allows the designer/researcher to understand its technical qualities, constraints and opportunities when the technical characteristics are unknown or different when dealing with a used or damaged material.

Under experiential characteristics, the experiential qualities of the MDD method defined are used (Subchapter 3.2). The experiential characteristics can be analysed on four levels: performative (touching, moving and holding the material), sensorial (how does it feel), emotional (emotions) and interpretive (associative) (Karana et al. 2015). Each can be worked through. Analysing the experiential characteristics besides the technical characteristics, broadens the insights and opportunities of the material. It helps to approach the waste stream from a new point of view.

Possible product areas

A question often asked when designing out waste streams is which other products could be made from the material. Especially when it is desired that the waste stream is deployed in the same context to keep control over the material. Mapping this out, creates an overview of possible application areas of the waste stream. Questions related from the R9 list that can be asked can be found in Appendix 12.1. Additionally, an overview of products that are made from the same material, creates opportunities. In this way, easy processing and manufacturing can be achieved by contacting manufacturers or companies already working and designing with the material.

In this topic, the possibilities to repurpose the waste stream in a technical way are explored. This can be done by looking at possible manufacturing processes with the waste stream. Can it be easily cut, how can the material be attached and shaped?

Obstacles to overcome

In the end of the material pillar, the obstacles to overcome are analysed. Here, questions such as "what is withholding the material to be processed in a circular way" and "what factors are characteristics of the material need to be changed to be able to apply in a circular product" can be asked. Examples that can be kept in mind are: rules around the material, hygiene aspects, not recyclable yet because of a mix of materials, hard to separate the different materials, no recyclers available, missing machines or facilities needed to repair or recycle.

Stakeholders

When analysing the stakeholders, you want to empathise with the stakeholders around the waste stream. These stakeholders are analysed on first assumptions. When there is a bigger time frame available, the stakeholders are interviewed. Start with making an overview of the relevant stakeholders. Then investigate the following three topics, 1) Their activities, 2) Their problems and 3) Obstacles to overcome.

Activities

Here the activities of stakeholders with the waste stream are collected, but also other activities, not related to the waste stream. This is done to create a complete overview of the activities the stakeholders are doing, with and without the waste stream. Things such as what are their main activities, what is their occupation, how does a normal day look like, what is their relation to the waste stream, can be analysed.

Problems

The problems of the stakeholders are analysed. Which problems are they facing? What is keeping them up at night? What is obstructing their daily activities? These problems are related to the waste stream, but also without the waste stream.

Obstacles to overcome

Here, the obstacles from the stakeholders are analysed. Why are certain problems bothering the stakeholders? Why do they have these problems and what is withholding them to change something? This is related to circularity topics but also obstacles not related to the waste stream are relevant.

Context

At last, the context around the waste stream is analysed. The context is the place where the waste stream is used, produced and/or collected. During this analysis, it is important to get an impression of what motivates them. It is advised to do a context visit before executing the method. Start with describing the context around the waste stream. The context can be divided into three separate subtopics, 1) Strategy & culture, 2) Trends, and 3) Obstacles to overcome.

Strategy & Culture

The strategy and the culture of the context are analysed. This is done by analysing how the organisation behaves in the context. What are their current undertakings? Look at the motivation and ambition of the organisation, related to circularity but also non-related to circularity. Additionally, analyse the culture of the context. Which kind of habits, norms and values are seen in the context. This shows how people interact and highlight the limitations of the solution space.

Trends

The context around a waste stream is always developing. Societal themes and trends are where a context is moving towards, desired or not. Therefore, those themes and trends are analysed in this step. What kind of problems are faced in the context, desired and unwanted.

Obstacles to overcome

The obstacles to overcome can be analysed in two different ways. On the one side, the obstacles to move towards a circular economy in the context. On the other hand, obstacles not related to the waste stream are interesting, because this allows looking into new solution areas. What are trends in the context that can be tackled? Examples here are laws, unmotivated organisations, no power to make big changes, and negative trends.

The order in which the pillars are presented is also the prefered order to go through them. Starting with material, followed by stakeholders and finally context. By doing this you start with the waste stream and then zoom out with each following pillar. This broadens the perspective of the analysis with every step.

When the pillars are analysed, the potentials are defined. These are defined by selecting the most unique aspects from the waste stream because that is where the potential is the highest. More than one finding can be selected as potential. Phase 1 ends with an overview of the potentials, these will be used in phase 2 to define the opportunities with the waste stream.

Phase 2 Combine

Formulate valuable opportunities for a circular solution

The opportunities are formulated by the potentials found in the previous phase. By combining the potentials, value is created.

Between each pillar, connections are made as presented in the framework in chapter 5 (Figure 20).

Interaction (material & stakeholders) - The way products obtain their meaning for a stakeholder.

Behaviour (stakeholders & context) - A change that is created by/for a stakeholder in the context.

Product (material & context) - The physical product in the context.

In this phase, the opportunities are formulated on the described three levels. When this is done, phase three starts, where the three levels are brought together.

Phase 3 Formulate

Inspire and encourage an actionable circular project

In the last phase, a circular design goal is formulated, which forms the call of action with the waste stream. It encourages The Bin and the client to take action with the waste stream and elaborate on the concept direction. In this phase, the opportunities defined in phase 2 are brought together, resulting in the concept direction for the waste stream with which a high amount of value will be achieved. The circular design goal should have the following points:

Actionable

The circular design goal asks for immediate action from the designer. This allows taking steps towards the goal within two weeks. These actions include validating made assumptions, involving stakeholders and collecting the waste stream.

Contains the three levels: interaction, behaviour, product

Each level should be represented in the circular design goal. When this is not the case, potential value gets lost and the value created with the waste stream is lower.

Answers the starting question

The circular design goal is an answer to the starting question: ''What can we do with the waste stream?'' If it does not answer that question, it can lead to a project, not solving the actual problem of the waste stream from the client.

Conclusion

It can be concluded that the three phases form the method of the Potential to Value Circle. To support the execution of the method, each phase asks for specific techniques. In the next subchapter, the specific questions and steps of each phase are further explained.

6.3 Technique

As described in subchapter 2.4, the client is lacking a different perspective on the problem around the waste stream. The method helps the client to get a first understanding of the process The Bin is taking with the waste stream. To ensure a deeper understanding, more guiding steps with specific questions are needed, for both The Bin and the client. Therefore, specific questions are set up for each phase to support the execution of the method. This will also increase the communicability with the clients and other stakeholders.

Phase 1 Analyse

For each pillar, questions are formulated that support the analysis. These questions form the start of researching the pillars. From these questions, more questions can be formulated during the process, depending on the factors unknown.

Material

Start with formulating the waste stream.
Technical & Experiential characteristics: What are the technical characteristics of the waste stream? And what are the experiential characteristics of the waste stream?
Possible product areas: What are possible applications of the material?
Obstacles to overcome: What is withholding change?

Stakeholders

Start with writing down the different stakeholders.
Activities: What are the activities of each stakeholder? What is their drive?
Problems: What are they up against? What irritates them?
Obstacles to overcome: What is withholding change?

Context

Start with writing down the context you see around the waste stream.
Strategy & Culture: What are habits, norms and values in the context?
Trends: What is going on? What are trends in the context?
Obstacles to overcome: What is withholding change?

A lot of information is collected in the first phase. To choose the **potentials** in each pillar, the following questions are asked:

Material:
What are the most unique characteristics of the material?
Example: "The material looks futuristic"

Stakeholders:
What are the most unique abilities of a stakeholder?
Example: "The user of the sailcloths has emotional value for the material."

Context:
What are the most unique aspects in context?
Example: "The people in the sailing world feel connected with the water and nature."

Phase 2 Combine

In phase 2, potentials from phase 1 are brought together. This is done between each pillar, resulting in: interaction, behaviour and product. For each connection the following questions can be asked to support this process:

Interaction

How can the unique characteristics of the material help a stakeholder?

Behaviour

How can the unique abilities of a stakeholder help the context to change?

Product

How can the unique characteristics of the material result in a product that helps a trend in the context?

Phase 3 Formulate

In phase 3, the results from phase 2 are combined into a circular design goal. This design goal will form the outcome of the method and therefore tell the direction of what to do with the waste stream. Important here is that the circular design goal is actionable, represents the three levels (Product, interaction and behaviour) and gives an answer to the problem statement. To check if the formulated goal is suited and workable, the following questions are asked.

- Is the formulated goal actionable?
- Does it contain the three levels: interaction, behaviour and product?
- Does it answer the beginning question: what can we do with the waste stream?

Conclusion

With the techniques described, the Potential to Value Circle is presented. The design process was developed by doing research and multiple tests with case studies. The next subchapter explains the validation of the Potential to Value Circle is done.

6.4 Validation of the Potential to Value Circle

To design the Potential to Value Circle, an iterative approach with multiple user tests was taken. This helped to give direction to the design and validated the method along the way. Within this subchapter three of these user tests and their results are discussed.

Hospital gowns

During this first test in the development of the Potential to Value Circle, the waste stream consisting of hospital gowns was taken. These hospital gowns are the white uniforms of doctors and nurses in hospitals. These hospital gowns are disapproved after approximately four years due to runout or pen spots that could not be removed anymore. Because of this, the Amsterdam UMC has 20.000 hospital gowns waiting for a circular application.
For this test, the framework was written down on a whiteboard (see Figure 23), and the test was executed internally at The Bin. The goal of the test was to find out how the framework can be used as a design method. The test plan and more results can be found in Appendix 12.7.

Key insights from the test

- It was found that it was effective for phase 1 and phase 2 to be distinct steps.
- It was found that most of the value was created during phase 2, connecting the different potentials found in phase 1.
- It was found that during phase 1 it was effective to look at the current situation, the desired situation and the obstacles between these situations.
- The method helps the user to build argumentation for moving in a specific direction which in turn helps the user convince other stakeholders to free up more resources.

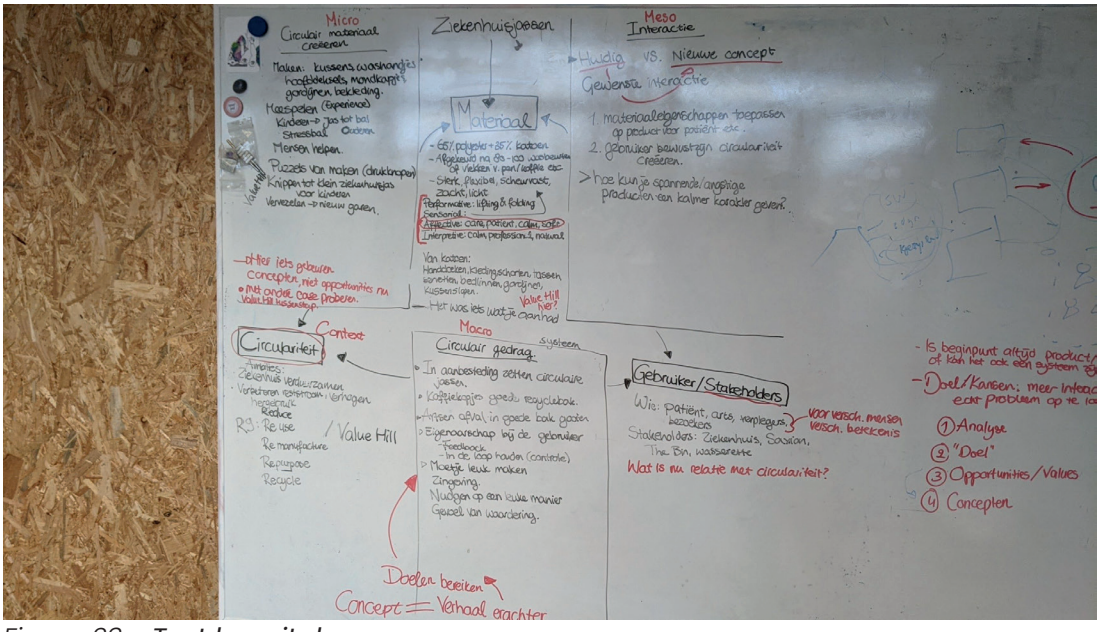


Figure 23 - Test hospital gowns

Sailcloths

During the second test, the waste stream consisting of sailcloths was used. This was a request from a sail factory. These sailcloths are clothes of sailboats damaged during their use. However, most of the time the sailcloths are only damaged on the edges, so the rest of the sailcloths still have the potential to be used for something else. Again, this test was executed on a whiteboard (see Figure 24) internally at The Bin. The goal of the test was to find out how the method formed in the previous test could end with a concept for a product.

Key insights from the test

- The step by step nature of the method was found to be a good way to create structure.
- It was found that this method is not suitable for creating a concept for a product and worked better to create a circular design goal.

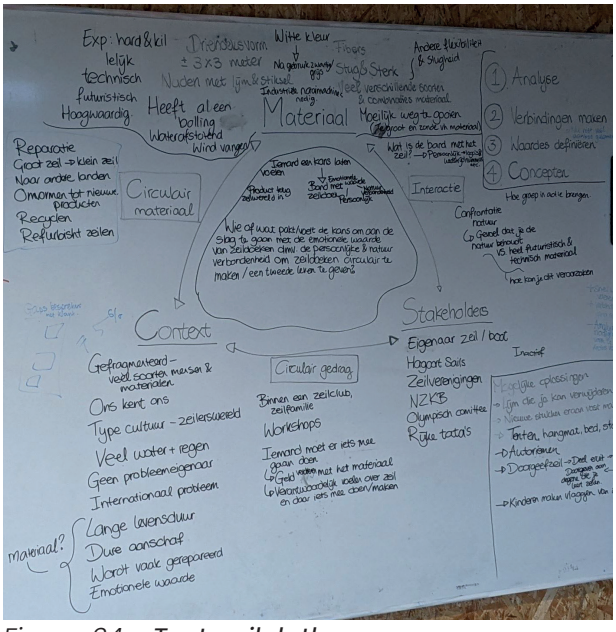


Figure 24 - Test sailcloths

Smarthouse

The third test was conducted together with a potential client of The Bin, Smarthouse. The focus of the test lay on the collaboration with the potential client during the session, and the flow of the method. The test plan and more results can be found in Appendix 12.8.

Key insights from the test

- Applying the method together with the client sparked more discussion which generated more potential.
- Working with the client brought expertise which reduced the need for assumptions and thus increased the chance of success.
- By executing the method together with the client the involvement of the client was increased, which also increased the chance of success.
- Participants found it hard to brainstorm without being triggered by specific questions. Based on this finding the specific questions from subchapter 6.3 were added to the method.

Conclusion

These test results have shown that the method gives The Bin the structure they desire for a design process. It also shows that value was created through this process especially when it was done together with the client while connecting the individual pillars. The outcome of the method improves the chance that the project will be realised by increasing the involvement, reducing the amount of assumptions and helping to build the argumentation behind the chosen concept direction. Since tests are done with several different kinds of waste streams, the design method gives the room to be executable with different kinds of waste streams.

The question that remains is how The Bin can apply this Potential to Value Circle in their own process flow. The next chapter explains how the Potential to Value Circle can be applied in the process flow of The Bin.

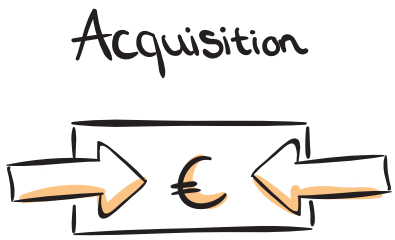
7

How can The Bin apply the Potential to Value Circle?

In this chapter, it is explained in what ways The Bin can apply the Potential to Value Circle in their own process flow. This design process is the same for each client but has enough freedom to be applicable for each waste stream. Depending on the question of the client and the amount of time available for the project, it can be used in three different ways. These three ways of applying are explained in this chapter, showing the variety of the usage of the design process. After that, the best way of applying for The Bin is given.

7.1 Three ways of applying

In the following paragraphs, the three ways of applying the design process are illustrated. These are: acquisition, project structure and a workshop. These three ways of application followed out of iterative tests with small case studies during the project, as described in subchapter 6.4. This chapter explains how each way of applying works, why it can be used, and its result.

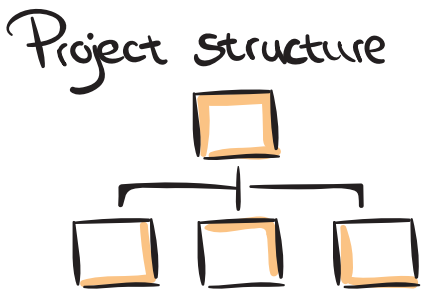


Acquisition

In the acquisition form, the Potential to Value Circle is used as a quick run-through in one hour. During this quick run-through, the potentials and the limitations around the waste stream are mapped out. This is done quite simplistic and on the surface, resulting in exploring the first boundaries. This way of applying can be used when a potential client asks: "What can we do with this waste stream X?" and has the desire to hear some first concept directions. It enables the user of the design process to quickly explore the waste stream and come up with some first concepts.

Since in one hour there is not enough time to dive into the deep, the acquisition form of the Potential to Value Circle is filled in with assumptions. However, it also allows the user of the Potential to Value Circle to see what needs to be researched further, in order to find out the feasibility of the concept directions. The result of this way of applying is finding out if the waste stream of the potential client is worth putting time in, and what needs to be further researched during the project, but also on beforehand the project.

The test with the waste stream sailcloths (see subchapter 6.4) showed that while working through the Potential to Value Circle in one hour there was enough room to explore the opportunities and limitations around the waste stream. The focus during this test was executing the Potential to Value Circle in one hour, resulting in this acquisition way of applying. This allowed quick insights around the waste stream and the ability to quickly contact the client with some first concept directions.



Project structure

In the project structure, the Potential to Value Circle is used to plan a project with the waste stream in one hour and then is used throughout the project afterwards. This is used when the project has the intention to become a long term project and many stakeholders are already involved. During this project structure form, the Potential to Value Circle and its questions are used to find which research activities are useful. These can be for example interviews with certain stakeholders or technical material research on its strength or performance. During this planning, it is mapped out how the material, stakeholders and context analysis are going to be researched in a project occupying multiple weeks. At the end of the hour, there is an overview of the elements that need to be researched, including who needs to be contacted and how it is going to be researched.

In the test with the waste stream containing hospital gowns, the basis of the project was already set with stakeholders, only a project structure was missing. Using this way of applying in the test, showed that the Potential to Value Circle works efficiently and clearly. This allows an overview of the project, also able to be used in communication with the stakeholders in the project.

Workshop

In the workshop form, two and a half hours are taken to run through the Potential to Value Circle together with the client. During the workshop, the expertise of the client and other stakeholders is used to go through the Potential to Value Circle with less assumptions compared to the acquisition form. Involving the client in the design process in a workshop, shows the client that the waste stream can be approached from different perspectives. It also allows the client to learn more about a circular economy, and what complexities can occur during a potential project around the waste stream. The result of the workshop is a concept direction formulated together with the client. From this concept direction, actions are formulated to put the concept direction into practice.

Subchapter 2.4 explained the need to involve the client more in the design process, so the possibilities around a workshop were explored in multiple tests. First, a workshop about old tennis balls with IDE students was conducted, which set the basis for the workshop (see Appendix 12.9 for the test results). After this, the workshop was put into practice with actual clients of The Bin. First in a small form (see subchapter 8.4) and later in workshops of 2,5 hours at the location of the client (see subchapter 8.4).

7.2 The best way of applying for The Bin

The previous subchapter described three ways of applying the Potential to Value Circle. These ways of applying can each individually be used, depending on the desired result. However, the ways of applying can also be combined to create a stronger execution of a project. Combining acquisition and project structure allows to first work with assumptions, quickly go back to the client and after that make a plan for the project. This allows asking questions about the assumptions and researching them.

While the combination is promising, it still misses the involvement of the clients which was shown to provide value. Involving the client creates space to increase their knowledge of a circular economy. Increasing their knowledge around a circular economy helps to move them in the long term towards their wish to become part of a circular economy.

Additionally, there were opportunities for testing the workshop with the clients. Whereas testing the combination between the acquisition and the project structure would not be possible within the scope and time of this graduation project.

Therefore, the workshop is picked to elaborate on in this project, as can be read in the next chapter.

8

Workshop

This chapter explains the third way of applying, the workshop. The workshop is elaborated further in steps that need to be taken in preparation of the workshop, the workshop itself and the steps afterwards. The Potential to Value Circle is the basis of the workshop and is elaborated on in a more simplified manner and with specific exercises. The flow of the workshop is visualised in Figure 25. In Appendix 12.3, a booklet for the facilitator of the workshop can be found. This booklet contains the exact script of the workshop, together with supporting questions and examples of cases.

8.1 Preparation of the workshop

Before the actual workshop can start, it is important that several preparing activities are done. This consists of a preliminary conversation with the client, pre-research on the waste stream, defining a problem statement and gathering the needed materials. This subchapter explains the preparing activities.

Preliminary conversation

In advance of the workshop, a preliminary conversation is needed to discuss the waste stream and expectations. The following topics need to be discussed in the conversation, the full list including questions can be found in Appendix 12.2:

- Introduction of the contact person & other present persons at the workshop
- Information about the waste stream
- Currently involved stakeholders
- Motivation and ambitions of the organisation
- The ideal outcome of the workshop
- Expectations
- Experiences with creative sessions

During this conversation, an open but critical attitude is needed to be able to get to the core of the problem. This is needed to formulate a problem statement.

Problem statement

From the information gathered during the preliminary conversation, a problem statement is formulated. This problem statement explains in one sentence the problem that is going to be tackled during the workshop. The circular design goal formulated at the end of the workshop should answer this problem statement.
Together with this problem statement, already known facts such as size, amounts and material properties of the waste stream or involved stakeholders, are gathered and formulated for the introduction of the workshop. By doing this, everyone present at the workshop will be on the same page with the problem at the start of the workshop.

Gathering the needed materials

In order to be properly prepared for the workshop the following materials need to be gathered in advance:
A printed workshop canvas
Post-its
Pens and markers

Conclusion

To conclude, the preparing activities are essential for a successful progress of the workshop. Missing one of these activities will result in an unstructured workshop, or an end result that does not answer the question the workshop started with.

8.2 Execution of the workshop

When the preparing activities of the workshop are completed, the actual execution of the workshop can start. This subchapter explains the progress of the workshop, including the goal of each phase, the steps required and the time needed for each step. In Appendix 12.3, a booklet with instructions for during the workshop can be found.

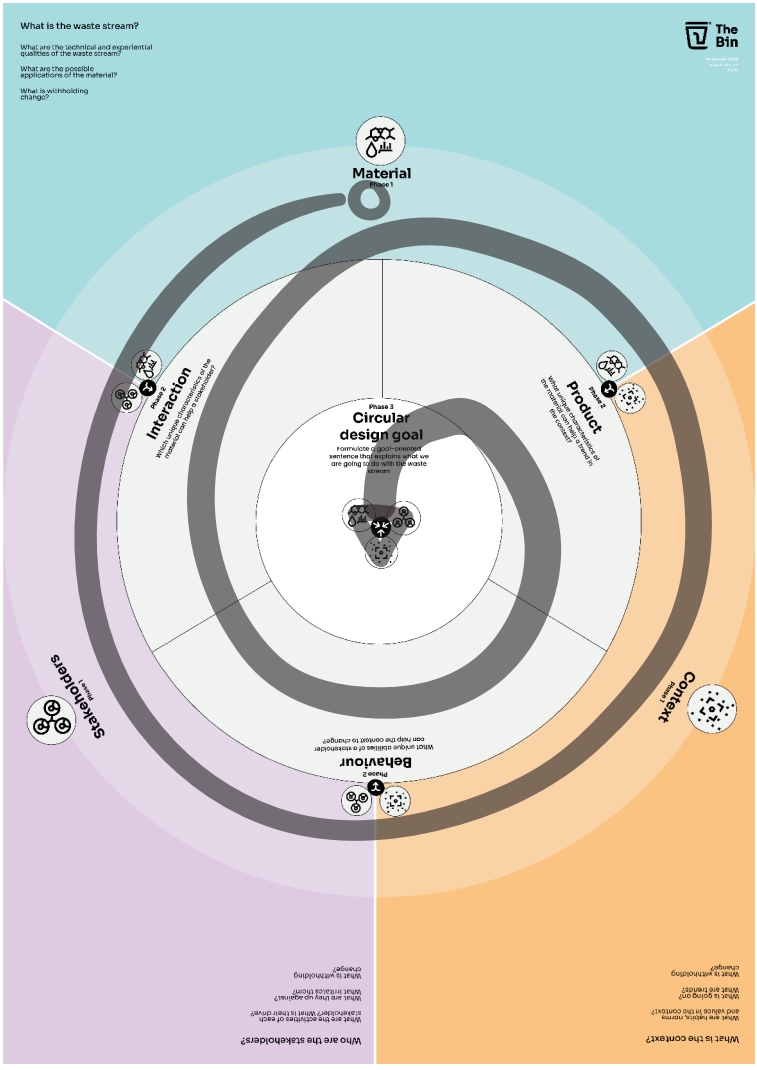


Figure 25 - The flow of the workshop on the workshop canvas

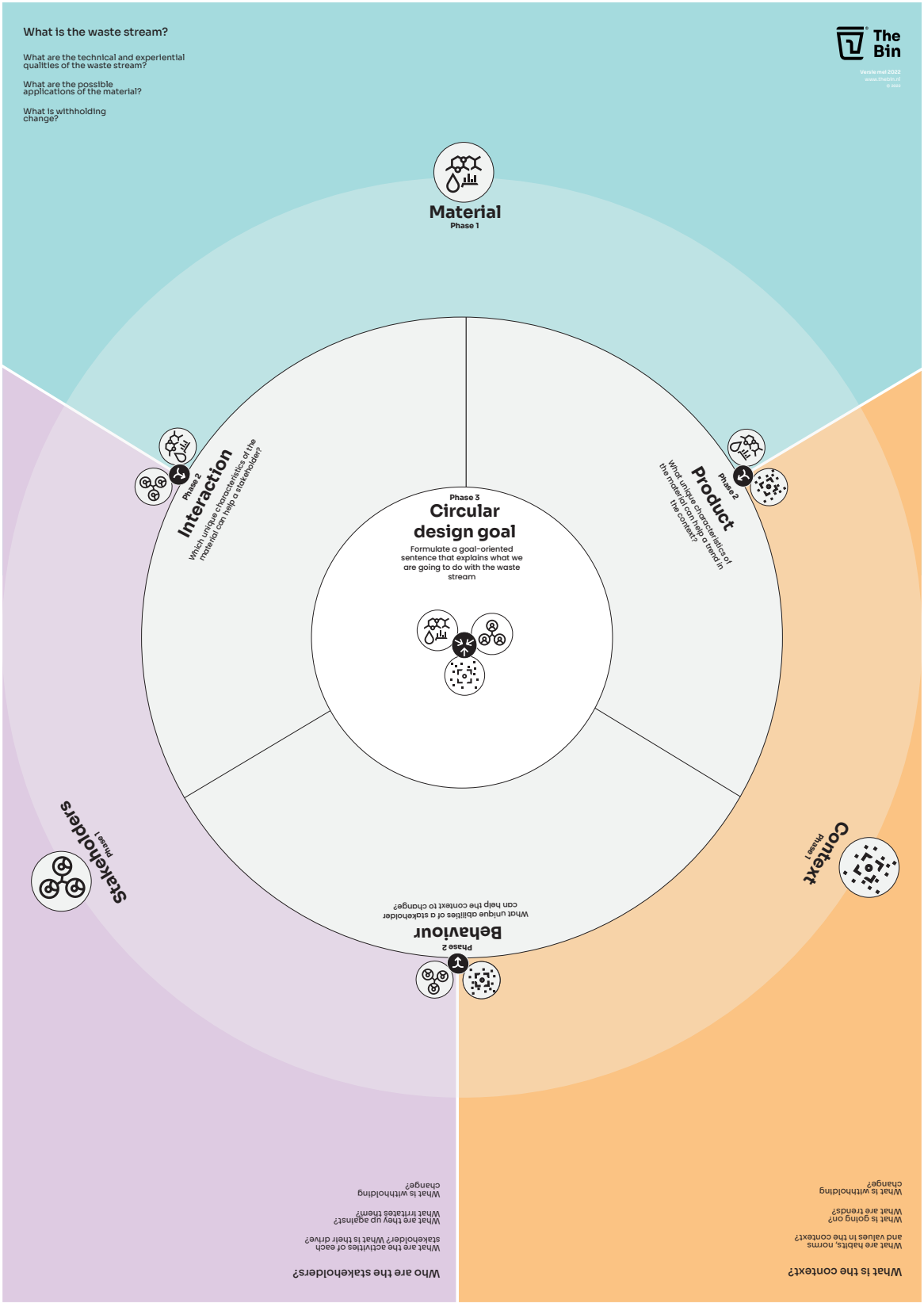


Figure 26 - The workshop canvas

Total time needed: 3 hours
(2,5 hours workshop and 0,5 hours break)

15 min.

Introduction

Before the actual start of the workshop, some session duties are needed for a successful workshop (Heijne & Van der Meer, 2019). Therefore, the workshop starts with a welcome and introduction, followed by an explanation of the set up, time schedule and the session rules of the workshop (see the workshop booklet in Appendix 12.3).

60 min.

Phase 1 Analyse

Understanding which elements can contribute to a circular solution

For each question, the answers are written down on post-its by the participants and stuck on the canvas. These questions are given as exercises: take three minutes to write the answers to the question down.

15 min. The workshop starts with **material**. Here the following questions are asked:

- What are the technical characteristics of the waste stream?
- And what are the experiential characteristics of the material? What do you feel when you touch the material?
- What are the possible applications of the material?
- What is withholding change?

15 min. Then move on to the **stakeholders**. Start with writing down the different stakeholders around the waste stream.

- What are the activities of each stakeholder? What is their drive?
- What are they up against? What irritates them?
- What is withholding change?

15 min. And at last, the **context**. Start with writing down the context you see around the waste stream.

- What are habits, norms and values in the context?
- What is going on? What are trends?
- What is withholding change?

When the information is collected, the potentials are defined. These are the findings that are the most unique aspects of the waste stream. The potentials are defined by asking the questions:

5 min. **Material**:
What is unique about the material?

5 min. **Stakeholders**:
What is the unique ability of a stakeholder?

5 min. **Context**:
What are unique aspects in the context?

From each pillar, multiple findings should be selected as potentials. Phase 1 ends with an overview of the potentials, these will be used in phase 2 to define the opportunities with the waste stream.

15 min. **Break**
A break of 15 minutes is needed after the first phase, to refresh and re-energize.

25 min. **Phase 2 Combine**
Formulate valuable opportunities for a circular solution
In the second phase, the potentials of phase 1 are brought together. This results in defined opportunities. Multiple opportunities for each connection should be made. You start with interaction (material & stakeholders):
Here, the following question should be asked:
- Which unique characteristics of the material can help a stakeholder?

For the behaviour (stakeholders & context) the following should be asked:
- What unique abilities of a stakeholder can help the context to change?

For the product (material & context) the following should be asked:
- What unique characteristics of the material can help a trend in the context?

At the end of this phase, sentences are formulated that form opportunities for the waste stream on different levels. These are collected on post-its in phase 2 on the canvas.

15 min.

Break

A break of 15 minutes is needed after the second phase, to refresh and re-energize.

20 min.

Phase 3 Formulate

Inspire and encourage an actionable circular project

In the last phase, a circular design goal is formulated from the results of phase 2. The results are brought together in one sentence that inspires and encourages the client to move with this solution towards a circular economy. Combining the most valuable outcomes of phase 2 can be a bit puzzling, so one should be flexible in order to create a realistic and complete goal. What helps is to formulate the sentence as: We want to... .

To check if the formulated goal is suited and workable, the following questions are asked.

- Is the formulated goal actionable?
- Does it contain the three connections between the pillars: interaction, behaviour and product?
- Does it answer the problem statement that was formulated before the workshop?

When the answer to all these questions is yes, the actions that arise from the goal are formulated.

- What are the actions?
- What is the deadline for the actions?
- Who is responsible for what?

15 min.

Wrap up

At the wrap up, it is important to check if everyone agrees upon the circular design goal. During the wrap up, tasks that are needed to be done are divided and set with a deadline, so everyone knows their responsibility. These tasks consist of things that need to be researched further, for example interviewing stakeholders or validating technical properties, or discussing the goal within the rest of the company. During the wrap up, pictures are made of the results.

After the workshop, the facilitator writes a small recap of the workshop. This recap contains the results of the workshop and the actions described at the end of the workshop.

Following these steps will result in a successful execution of the workshop. In order to also have a successful project, the steps following the workshops are also important. The next subchapter expands on the steps that are needed after the workshop.

8.3 Steps after the workshop

The workshop ends with specific actions and deadlines. To make sure the envisioned goal is set into practice, it is important to check up with the actions and deadlines two weeks after the workshop. The client has to execute the tasks set before the deadline. The Bin looks back at the formulated design goal when back at the office to see if the core and the highest value are found or if any changes should be made for a better result.

The check up after two weeks can be a quick heads up when the actions were easy and clear, or a second workshop can be organised. A second workshop is organised when the outcome of the first workshop was that certain areas should first be researched to come to a valuable circular design goal. A second workshop has the same setup as the first one, only this one will go more into depth of the research results. This will result in a more specific design goal with an actual circular product concept in it, whereas in the first workshop that could have been more of a broad product concept direction.

8.4 Validation of the workshop

To design the workshop, an iterative approach with multiple user tests was taken. This helped to give direction to the design of the workshop and validated the workshop along the way. Within this subchapter three of these user tests and their results are discussed.

Tennis balls & design students

The waste stream taken during the first test workshop was old tennis balls. The waste stream was a made-up case study, so not related to future projects of The Bin. This test was conducted with five IDE students. The goal of the test was to find out how the design method can be used as a workshop with design students and which materials are needed to support the workshop. One of which was the material of the waste stream itself. In Figure 27, a photo of the set up of the workshop can be found. The duration of the workshop was two hours: one and a half hours for the execution of the test, and half an hour for evaluation and co-creation. The test plan and more results can be found in Appendix 12.9.

Key insights from the test

- It was confirmed that having the material of the waste stream physically present led to a better understanding of the material which in turn led to more potential being found.
- It was found that 4 people is a suitable amount for the workshop.
- It was found that the prepared questions were too complex which inhibited them in their creative process.
- It was found that a base level of knowledge about the waste stream is required.
- It was found that in order to have a complete result it is important for all three connections to be present in the design direction.

Figure 27 - Test tennis balls & design students

Mini-workshop in the week of the circular economy

In the second test, an online mini-workshop in the Week of the Circular Economy was given. The Week of the Circular Economy is a nationally organised week with webinars, tours and workshops. Martijn from The Bin facilitated the session and explained how the design process would work in a workshop. The goal of the test was to find out how the method is explained by others and how potential clients of The Bin react to the idea of the workshop. The duration of the test was one hour. The test plan and more results can be found in Appendix 12.10.

Key insights from the test

- It was that the workshop helped the participants go beyond the obvious and discover unique directions.
- It was found that people were inspired by the workshop itself

"The model will help us to take a broader scope"

"Circularity is more than just the material, very insightful"

"I would use it as soon as it is available"

Workshop with potential clients of The Bin

The third test was a workshop with potential clients of The Bin. These potential clients indicated at the mini-workshop that they wanted to participate in a workshop with their own waste stream. This test was conducted in three sessions with different companies. The first session was done with the company TwenteMilieu, the second session with the company FlorisGifts, and the third session with the initiative NDSM-Wharf Cleans Up. The duration of the workshops was approx. three hours. The test plan and more results can be found in Appendix 12.11.

Key insights from the test

- It was found that all the materials that were prepared (Intake conversation, problem statement, script & template) increased the overall effectiveness of the workshop.
- It was found that asking critical questions generated a deeper understanding of the potential
- It was found that proper time management is required to ensure the last phase gets the level of attention that it needs.

"I would have liked to apply this way of thinking to our previous project"

"I would like to use this way of thinking for my next projects"

Conclusion

Overall it was found that the workshop was an effective form for the participants to apply the method and with that translate potential into value. They were able to get a thorough understanding of the potential of a waste stream, partially by having the material present and the facilitator asking critical questions. The critical questions were also found to be helpful in generating innovative connections. By combining value from all three connections a complete design direction was formulated.
Although these insights are promising, they were found using previous iterations of the workshop. Therefore a final evaluation with the final form of the workshop, as can be read in this chapter, is done in chapter 9.

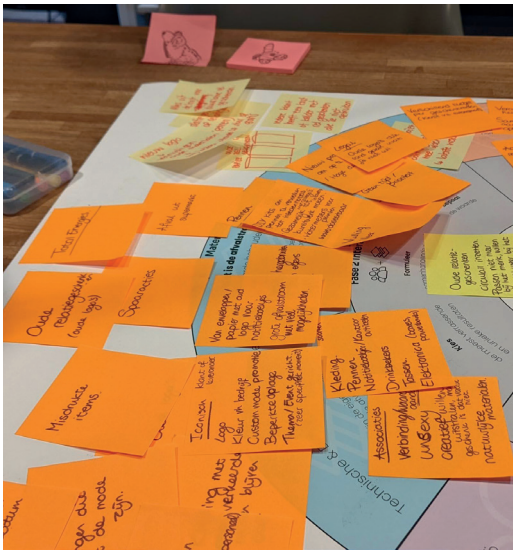


Figure 28 - Test potential clients 1

"This method helps you make decisions and to think about particular subjects"

"The method is a good way to get organised"

Figure 29 - Test potential clients 2

PHASE III - Evaluation

9

Evaluation

Once the design was finished, a final evaluation of the workshop was conducted. The workshop was evaluated in a session with the company Arion. The Bin met Arion during the test ''the mini-workshop'' (Subchapter 8.4). Arion was impressed with the design process of The Bin and wanted to do a workshop with their own waste stream. This chapter shows the test setup, and results. Ending with recommendations and next steps.

Setup

For this evaluation, the workshop schedule as proposed in chapter 8 is used. This means that the evaluation started with a preparing conversation with the client in which the waste stream was discussed. Later, a physical workshop took place which I facilitated, with Martijn from The Bin and the client (sustainability manager) with a colleague (Research & Development team) as participants. During the workshop, the workshop canvas (Figure 26), booklet (Appendix 12.3), post-its and markers were used.

The main focus of the test was to find out how a potential client of The Bin could see the strength of the design process, Potential to Value circle, by participating in the workshop. The main strength of the process is to approach the waste stream from different perspectives, understand each perspective and connect them. The participants did not have a creative background and thus were not familiar with design processes. Which made it particularly interesting to see if they could see its strength. Additionally, the workshop is evaluated on the needed materials, time and structure of the workshop.

Results

The waste stream of Arion was cutting waste from the production line of disposable washing clothes. The preparing conversation beforehand (Appendix 12.2) helped to understand the first opportunities and limitations around the waste stream. However, planning the workshop was hard, since Arion is based in Heerlen (Limburg) and both participants had busy schedules, resulting in executing the workshop one month after the preliminary conversation.

The workshop was executed with exercises of three minutes about the questions in each phase. This creates

*Figure 30 - **Test workshop Arion 1***

space for every participant to think individually about the question and to write their thoughts down. After each exercise, there was room to share the results in the group and discuss a bit further. This gave everyone a voice and helped to stick to the time schedule.

The waste stream was present during the workshop, so the participants were able to touch, feel, and test the waste stream on its properties. However, the client and their colleague had much material knowledge about the waste stream. This caused a high information load in the first phase, resulting in much time spent in the first phase of the workshop, despite the time scheduled exercises. Due to the time left for the last phases, the second and third phases were merged together. So instead of first making the individual connections between the pillars, an exercise was given to make combinations between the chosen unique characteristics of the waste stream, resulting in ideas of how the waste stream could be used. However, some participants were struggling with thinking of ideas, because the step was too big and they did not have a feeling of which way to think towards.

When was asked what the client thought of the workshop, he said the following:

Quote Arion:

> "The workshop has its strength to approach the waste stream from different perspectives and bring those together."

(The main focus of the workshop was not communicated to the participants)

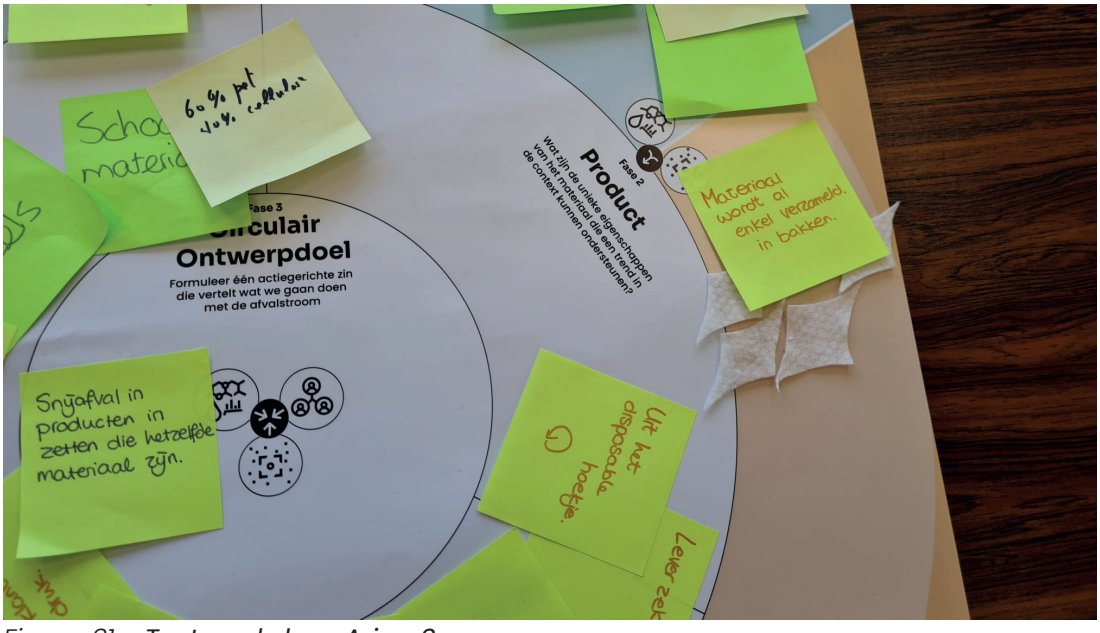


*Figure 31 - **Test workshop Arion 2***

Recommendations and limitations

From the quote from the client, it can be concluded that the workshop is able to communicate the strength of the Potential to Value Circle successfully. However, there is still an opportunity to improve the workshop by changing and adding some things to the materials needed for the workshop.

The used size of the workshop canvas was A1 size. However, increasing the size of the canvas to A0 size creates more space to order the post-its to the questions and makes every post-it readable.

Right now, the questions of the first phase were placed in the left corner of each pillar. This was just as a reminder of the questions for the participants since the facilitator was explaining the question to the participants. However, the questions were experienced as vague, since the questions allowed for many answers. Therefore, placing guidance on the workshop canvas will trigger answers to the questions. Especially when referring back to the experiential characteristics described in subchapter 3.2. The first proposal for this guidance can be found in Figure 32. These guidelines are based on the results of the workshop and earlier described insights in the report. These adjustments will help find the unique aspects around the waste stream, resulting in finding the new potentials of the waste stream.

At last, more examples can be added to the workshop booklet. This allows the facilitator to give the participants examples and guidance when they are stuck or do not know in which direction to think.

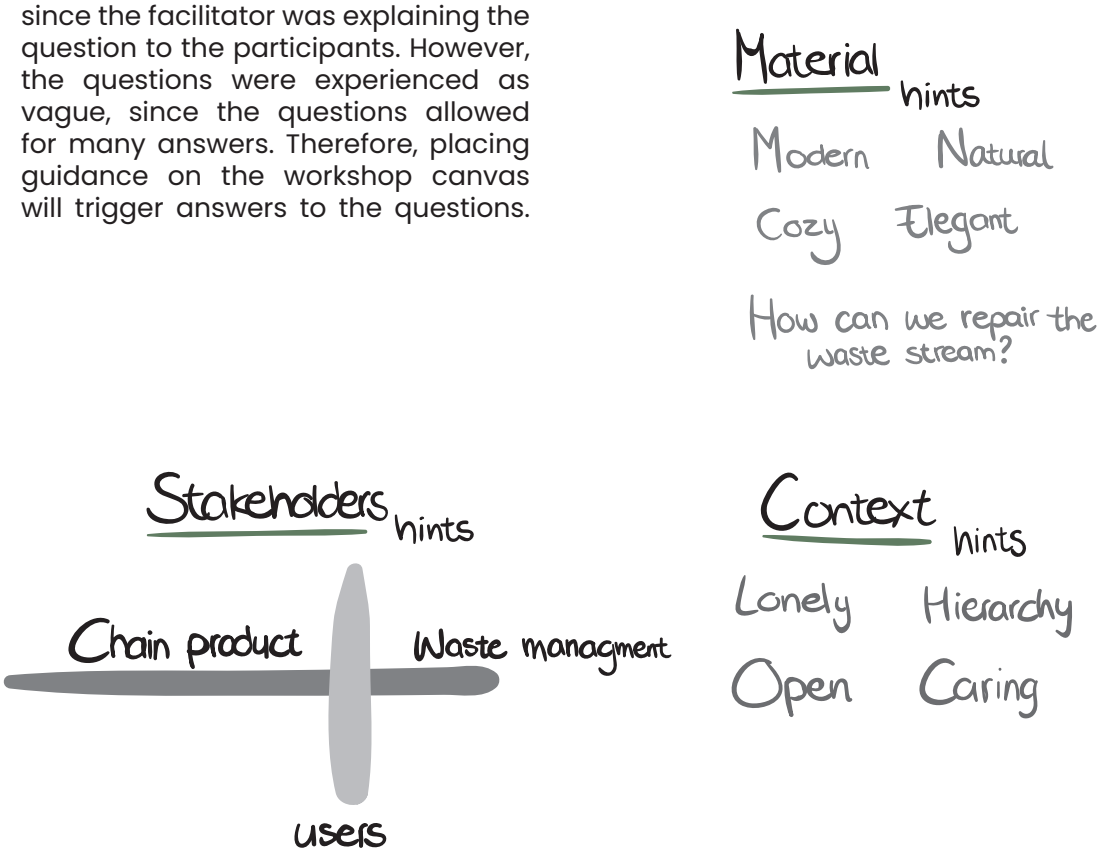


Figure 32 - Recommendations for the workshop canvas

Next steps

In addition to the recommendations, the workshop still could use further refinement to be easily implementable for The Bin. Testing the workshop further will result in further development of the canvas and content of the workshop. Right now, the workshop is mainly tested on the short term practice of a waste stream and done at the start of the project. Therefore it is important for further testing to be done. The workshop should be tested with more companies and at different parts of the process. Based on those tests a reflection should be made focussing on a few topics in particular. The influence of the workshop at the start of the project with a lot of unknowns versus first doing some research. The influence of the workshop on the project as a whole and its completion. And on how well tasks given at the end of the workshop were picked up.

10

Conclusion

This report aimed to discover how value can be added to designing out waste streams and how a design process can support this. This chapter concludes this graduation project with an answer to the research question. After this, a discussion and recommendations are given regarding the proposed design process for The Bin. The chapter ends with a personal reflection on the graduation project.

10.1 Answer to the Research Question

The following research question was formulated in chapter 1:

How can a design process create more value for the clients of The Bin using their waste streams?

More value was created by mapping out opportunities around a waste stream. By approaching the waste stream with a holistic view, the waste stream was seen as more than just the material alone. Approaching the waste stream through the three pillars, material, stakeholders, and context create a complete view of the opportunities of a waste stream. Dividing each pillar into smaller sections helps to explore each pillar to its fullest. Based on this the potential of the waste stream could be defined. Combining these defined potentials, creates opportunities for the waste stream, resulting in concepts for the waste stream with added value.

This is valuable for the clients of The Bin in multiple ways. It sparks the imagination of the clients and allows them to so see more possibilities of what they can do with their waste stream. They experience these possibilities as tangible solutions which helps them to free up resources within their company to create a solution to their waste stream. Hereby, the first steps are taken for the company to become part of a circular economy. The Potential to Value Circle gives structure and guidance to work towards a circular concept direction for the waste stream. It is effective in its way to envision which elements need to be researched in order to find the potential of the waste stream and combine them into opportunities.
As chapter 2 explained, waste streams are in the starting position for companies to move towards a circular economy. This allows the creation of circular supply chains of stakeholders and broadens the knowledge about what involves to become part of a circular economy. By helping companies to take this first step towards a circular economy, the opportunity opens up to also start doing activities that are higher on the R9 list (Subchapter 2.2) and to start designing more at the start-of-life of a product instead of the end-of-life (Subchapter 2.1). This helps the company to move even further towards a circular economy.

Conclusion

As a final conclusion, it can be said that by creating a structured way of working, whereby value is generated for a waste stream, The Bin can add value for their clients. This value is generated by combining the perspectives material, stakeholders and context around a waste stream into a concept direction. Through this process, The Bin guides their clients to take the next steps in becoming part of a circular economy.

10.2 Discussion

The goal of the proposed design process, Potential to Value Circle, is to create new opportunities by combining the potentials of the waste streams. By doing this, it shows that circularity goes further than only CO2 reduction or waste avoided. However, CO2 reduction and waste avoidance are still important topics and questions on these topics still could be included in the proposed design process. Adding such questions and information to the design process creates space to make the concepts with waste streams even more circular. This however asks for more research and further development of the Potential to Value Circle, together with tests in the field with clients.

As for each design process, the result depends on the information that is gathered in the process. This is especially the case in phase 1 of the Potential to Value Circle. But also the combinations that are made with the defined potentials can result in different concept directions. During the evaluation workshop (Chapter 9), this was also a topic of discussion. Involving different colleagues of the client could have resulted in different outcomes of the workshop. Therefore, it is important to think and discuss beforehand which kind of knowledge is relevant for the waste stream and the workshop.

10.3 Recommendations

This report showed how a design process for The Bin can achieve more value for their clients by using their waste streams. This subchapter shows some additional recommendations for people who are interested in applying the Potential to Value Circle themselves.

It is advised to use the Potential to Value Circle for communicating and working with clients. It is helpful to involve them in the process by telling them transparently which steps you will take in the process and where opportunities and limitations are located.

This report provided the visualisations of the Potential to Value Circle and the workshop. These visualisations are recommended to be used to structure the work and to communicate effectively.

Work together when working towards a circular economy and open up the discussion with stakeholders and go into the field. Circularity does not happen on its own, many factors and parties are involved to create change. Approach the waste stream always from different perspectives. The Potential to Value Circle provides the three perspectives that are always applicable to different kinds of waste streams. However, do not close your eyes and look further, depending on the situation around the waste stream and the client.

Start with working with the Potential to Value Circle with the described execution and steps. Over time, applying its way of working and thinking becomes natural and one can also apply it to design other circular products than those that are created using waste streams.

Keep the different pillars in mind through the project and be willing to iterate on them when new information is found. For example, months after the hospital gown test of chapter 6.4 was done a new stakeholder was found, CleanLease (Appendix 12.13). By finding this stakeholder new criteria were found which makes the design created out of the waste stream ever more sustainable.

10.4 Personal reflection

This graduation project has been one big journey. I enjoyed it, loved it and sometimes I hated it. I look back at this graduation project as an adventure and an amazing end to my Master's education. During this graduation project, I learned a lot of new things about circularity and design processes, but also about myself and who I am as a designer.
First of all, I learned a lot about a circular economy and its transition from a linear economy to a circular economy. This is not an easy transition and asks more of a company than just using their waste streams to set the first step.

I started this graduation project from my point of interest in design methods and experience as a teaching assistant. I had the experience of explaining and teaching design processes to students, but designing a design process involves a lot more. I am extremely proud of the impact and contribution to the design process of The Bin that I created during my project. It was not only creating the design process on paper, but it was also directly put into practice. Both in this graduation project and in other projects of The Bin outside of my graduation project.

An idea can sound simple at the beginning. However, developing an idea further can increase the complexity fast. Complexity is something I should be aware of, especially when you are on a project on your own and for a long time. I found out that explaining to others helped to keep it simple, but I should have done this more frequently.

During the project, I learned to explicitly define the goal of an activity I do and what the conclusion is. Only having the feeling that something is necessary to execute or something is good to move towards, does not help you to communicate your direction well. Making it more explicit what I exactly want to say, helps to make my work stronger. During the project, I only got the first taste of this, and it is definitely something I will focus on in the upcoming years.

The balance between study and spare time has always been a challenge for me. Designing is something that makes me very enthusiastic and I love creating things, as well for study as in my spare time. It was sometimes challenging to leave my thoughts about the project behind at the office or at the IDE Faculty. Especially during the COVID lockdowns, where there are a lot of social activities not naturally anymore and you are dependent on online meetings. I have found a balance in my graduation project in what works for me and what not, related to my energy, working hours and performance. However, this balance will not stay like this, it will always keep changing. I will take what I learned with me, and adjust my balance each time on my next adventure.

This project showed me who I am as a designer and what I found important in design. I want to create an impact with my projects and share creativity and perspectives with other people. In my graduation project, I saw this coming forward by the workshop I designed. I like to bring elements around a problem together by

looking for different perspectives and paradoxes that create unexpected insights resulting in beautiful and innovative end products.

In the future, I will focus on speaking up and formulating my opinion strongly. It is okay to not know everything before I can formulate an opinion on a certain topic. However, staying critical is something I value highly. And at last, I want to be proud of what I do and not try to work towards perfection, but embrace the imperfections as well and make the best out of it.

11

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12

Appendix 12.1-12.3

Appendix 12.4-12.13 can be found in the appendix document.

Appendix 12.1 R9-list questions

For session:

How can we use the product more intensively? How can we encourage people to use the product more intensively?
How can we use less natural resources and materials?
How can the product be used by someone else?
How can the product be repaired?
How can the old product be refurbished?
How can parts of the product be used in a new product with the same function?
How can a product or parts of it be used in a new product with a different function?
How can the material be processed/recycled and at the same time create as high as possible quality?

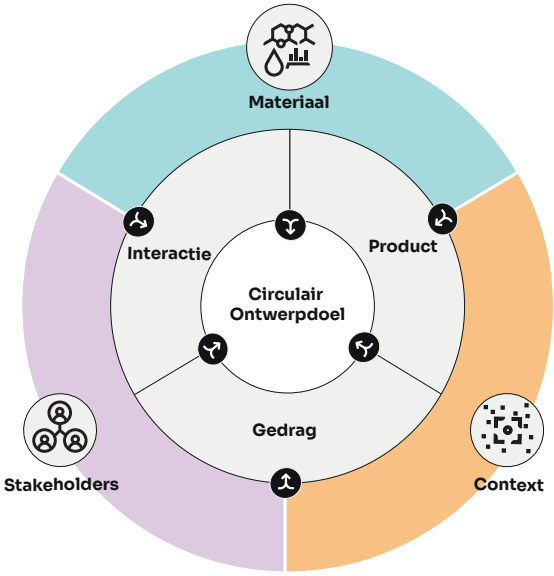
Appendix 12.2 Preliminary questions

- Wie is de persoon die je voor je hebt?
- Welke mensen zullen aanwezig zijn bij de workshop?
- Wat is de afvalstroom? En wat zijn de technische eigenschappen?
- Waar komt de afvalstroom vandaan? (geschiedenis)
- Hoe wordt de afvalstroom verzameld?
- Is er een verantwoordelijke voor de afvalstroom?
- Wanneer is het een afvalstroom?
- Waarom moet er iets met deze afvalstroom gedaan worden?
- Welke mensen zijn bij de afvalstroom betrokken?
- Hoe groot is de afvalstroom?
- Is het een constante stroom of niet?
- Wat is de motivatie?
- Wat zijn de ambities?
- Wat zijn oplossingen die al geprobeerd of overwogen zijn?
- Naar wat voor soort oplossingen/ doel gaan we naar opzoek? (Eenmalig, structureel, grote/kleine schaal)
- Wat zou de ideale uitkomst zijn van de workshop?
- Hoe ziet de ruimte eruit?
- Wat zijn de verwachtingen?
- Wat is de ervaringen met creatieve sessies?

Appendix 12.3 Workshop booklet (NL)

The Potential to Value Circle

Connecting potential to create value in a circular economy



Workshop boekje

Mei 2022

The Bin

Wat is de afvalstroom?

Wat zijn de eigenschappen van de afvalstroom?

Waar kan het materiaal toegepast worden?

Wat weerhoudt verandering?

The Bin

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www.thebin.nl
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Materiaal
Fase 1

Product
Fase 2

Wat zijn de unieke eigenschappen van het materiaal die een trend in de content kunnen ondersteunen?

Interactie
Fase 2

Wat zijn de unieke eigenschappen van het materiaal die een stakeholder kunnen helpen?

Fase 3
Circulair Ontwerpdoel

Formuleer één actiegerichte zin die vertelt wat we gaan doen met de afvalstroom

Gedrag
Fase 2

Wat zijn de unieke eigenschappen van een stakeholder die het gedrag binnen de context kunnen veranderen?

Context
Fase 1

Wat is de context?

Wat is de cultuur in de context?

Wat zijn de trends in de context?

Wat weerhoudt verandering?

Stakeholders
Fase 1

Wie zijn de stakeholders?

Wat zijn de activiteiten van de stakeholders?

Waar lopen stakeholders tegen aan?

Wat weerhoudt verandering?

Introductie

Doel
Het doel van een workshop is het helpen vinden van een oplossing voor de afvalstroom van de klant. Dit boekje is bedoeld voor de facilitator van de workshop. Hiermee zou iedereen in staat moeten zijn om met de workshop aan de slag te gaan.

Oorsprong
De workshop is een pressure cooker versie van de methode. De workshop biedt de hand om het proces in 2 uur te doorlopen, gezamenlijk met de klant.

Hoe gebruik je dit boekje?
Dit boekje is opgebouwd in drie delen. Het eerste deel betreft de voorbereidende activiteiten. Het tweede deel gaat over de daadwerkelijke uitvoering van de workshop. Het laatste deel vertelt meer over de vervolgstappen die gezet moeten worden na de workshop. Elke stap heeft een benodigde tijd, doel, stappen en voorbeelden die door de facilitator gebruikt kunnen worden.

Beginpunt
Een klant met de vraag wat ze met hun afvalstroom kunnen.

Benodigde materialen
Voor de workshop zijn een aantal materialen nodig om het succesvol te laten zijn. Verzamel deze vooraf aan de workshop.

- Workshop canvas
- Post its
- Pennen en stiften

De uitvoering

Introductie - 15 min

Welkom - 5 min
Aan het begin van de workshop heet de facilitator iedereen welkom en introduceert zichzelf. Hierna hebben de deelnemers van de workshop de ruimte om zichzelf voor te stellen. Tijdens deze introductie worden naam, achtergrond, functie en rol in het bedrijf, en ervaringen met de afvalstroom besproken. Hierdoor voelt iedereen zich gehoord voor de workshop en kunnen we gezamenlijk aan de slag gaan.

Uitleg workshop - 5 min
Na het welkom en de introductie wordt de opbouw van de workshop uitgelegd. Deze uitleg is een globale uitleg, met daarin het doel, de structuur en tijdsindeling van de workshop. Een voorbeeld hiervan is als volgt:
Het doel van de workshop is om een actiegerichte circulaire design goal te vinden die antwoordt geeft op onze problem statement. De workshop is opgebouwd uit drie fases, en we lopen elke fase gezamenlijk door. Tussen de fases hebben we pauzes van 15 minuten. We starten in de eerste fase met het verzamelen van de informatie rondom de afvalstroom, stakeholders en de context. Hierna worden kansen gedefiniëerd en waarde punten, wat uiteindelijk samen komt in een circulair design goal.

Uitleg sessie regels - 2 min
Om de workshop in goede banen te leiden, is het belangrijk dat iedereen een open houding heeft. Daarom zijn de volgende regels belangrijk om aan het begin van de workshop te vertellen.
- Alles is toegestaan
- Niets is goed of fout, vooral tijdens de eerste fase
- Oordeel niet
- Schrijf alles op wat in je opkomt
- Luister naar elkaar

Uitleg problem statement - 3 min
Als laatste deel van de introductie wordt de problem statement geïntroduceerd. Deze is opgesteld vooraf aan de workshop en wordt opgeschreven op een post it. Hierdoor is hij altijd zichtbaar tijdens de workshop.

Doel: begrijpen welke elementen kunnen bijdragen aan een circulaire oplossing

Fase 1 Analyse - 60 min

Materiaal - 15 min

De deelnemers schrijven alles op post its, en plakken die bij het bijbehorende vlak. Elke vraag neemt 3 minuten in.
15 min Materiaal
0 Beschrijf eenvoudig de afvalstroom. Wat hebben we voor ons liggen?
1 Wat zijn de technische eigenschappen van het materiaal? Waar associeer je het materiaal mee? Daarnaast: wat voor emoties geeft het materiaal je? Hoe raak je het aan en hoe voelt het? Neem 3 minuten hiervoor.
2 Wat zijn andere toepassingen van het materiaal? Welk product zou het kunnen vervangen? Als we de afvalstroom in delen zouden kunnen gebruiken voor een ander product, hoe bewerk je deze delen van de afvalstroom? Neem 3 minuten hiervoor.
3 Wat beperkt de verandering? Waarom is er nog niets gedaan met de afvalstroom? Neem 3 minuten hiervoor.

Stakeholders - 15 min

0 Denk aan gebruikers, verwerkers, verschillende mensen in de organisatie. Wie gebruikt het niet direct maar ziet het bijvoorbeeld wel voorbij komen?
1 Hoe ziet een standaard dag van een stakeholder eruit? Wat houdt hen bezig? Neem 3 minuten hiervoor.
2 Welke problemen hebben ze? Waar lopen ze tegenaan? Waarom irriteren zij zich aan deze afvalstroom? Waar lopen ze tegenaan in hun activiteiten? Neem 3 minuten hiervoor.
3 Wat weerhoudt een verandering? Waarom zijn problemen van stakeholders nog niet opgelost? Neem 3 minuten hiervoor.

Context - 15 min

0 Schets een beeld van de context, schrijf alles op rondom de plek van gebruik/inzameling etc.
1 Wat zijn activiteiten in de context? Wat zijn gewoonten/normen/waarden in de context? Hoe ziet de strategie eruit? Hoe is de cultuur? Neem 3 minuten hiervoor.
2 Wat speelt er in de context? Wat zijn trends (zowel positief als negatief) die spelen? Neem 3 minuten hiervoor.
3 Wat beperkt er om een verandering te maken? Wat zijn regels of dingen waar aan voldaan moet worden? Neem 3 minuten hiervoor.

Potentie definiëren - 15 min

Hier wordt de potentie gedefiniëerd van de afvalstroom. Er is veel informatie verzameld en nu wordt er gekeken hoe hier de meest unieke elementen uitgehaald kunnen worden. Dat wordt gedaan door bij de informatie de volgende vragen te stellen:
Material:
Wat is uniek aan het materiaal?
Stakeholders:
Wat is uniek aan de stakeholders?
Context:
Wat voor unieke aspecten zijn er in de context?

Verzamel deze door een sticker op de post its te plakken en ze bij elkaar te halen.

Fase 2 Verbinden- 25 min

Interactie - 6 min
Bekijk de gekozen potenties van materiaal en stakeholders. Stel de volgende vraag: Wat zijn unieke eigenschappen van het materiaal die een stakeholder kunnen helpen? Formuleer meerdere antwoorden op deze vraag. Neem 3 minuten hiervoor.

Gedrag - 6 min
Bekijk de gekozen potenties van stakeholders en context. Stel de volgende vraag: Wat zijn unieke eigenschappen van een stakeholder die het gedrag binnen de context zou kunnen veranderen? Formuleer meerdere antwoorden op deze vraag. Neem 3 minuten hiervoor.

Product - 6 min
Bekijk de gekozen potenties van het materiaal en de context. Stel de volgende vraag: Wat zijn de unieke eigenschappen van het materiaal die een trend in de context zouden kunnen helpen? Formuleer meerdere antwoorden op deze vraag. Neem 3 minuten hiervoor.

Waarde definiëren - 6 min
Welke gedefinieerde kansen dragen het meeste bij op circular gebied en voor de organisatie? Kies de meest interessante zinnen en plak hier een sticker op.

Doel: het samenbrengen van kansen tot een inspirerende en actiegerichte circulair ontwerp doel

Fase 3 Formuleren- 20 min

Kiezen - 5 min
Het samenbrengen van de zinnen naar 1 zin. Kies drie waardevolle zinnen en zet die bij elkaar. Schuif totdat er iets is gevonden wat realistisch klinkt. Er mogen in dit stadium nog aanpassingen gemaakt worden om het realistischer te maken.
Wat willen we realiseren?
Wat zien we voor ons?
Als iets niet mogelijk klinkt, wat kunnen we veranderen waardoor het wel mogelijk wordt?

Formuleren - 10 min
Zorgen dat dit samenkomt in een ontwerpdoel. Formuleer 1 circulaire ontwerpdoel, waarin product, interactie en gedrag naar voren komen. De ontwerpdoel moet een antwoord op de beginvraag zijn; wat kunnen we met de afvalstroom?
Hoe kunnen we dit formuleren tot een ontwerpdoel? Wij willen dat... kan helpen. Zorg dat iedereen zich er in kan vinden.
Checklist:
- Actiegericht
- Product, interactie en gedrag zitten erin
- Beantwoordt de vraag; wat kunnen we met de afvalstroom?

Acties - 5 min
Zorgen dat de ontwerpdoel duidelijk geformuleerd is en er taken opvolgen. Wat wordt het actieplan adhv de workshop?
Welke taken volgen uit de ontwerpdoel?
Wie is voor wat verantwoordelijk en wat is de deadline?

Wrap up - 15 min

Afsluiten - 10 min
Check of iedereen zich kan vinden in de geformuleerde ontwerpdoel. Daarnaast wat mensen vonden van de workshop en de uitkomst. Tijdens de wrap up, de acties worden verdeeld onder de aanwezigen en deadlines worden gezet. Deze taken kunnen dingen zijn die onderzocht moeten worden, zoals interviews of het valideren van technische eigenschappen van het materiaal. Ook het voorleggen binnen het bedrijf is een onderdeel hiervan. Tijdens de wrap up worden ook foto's gemaakt van de resultaten.

Foto's maken - 5 min
Tijdens de wrap up worden ook foto's gemaakt van de resultaten.

Vervolgstappen

Acties
Om aan de slag te gaan met het geformuleerde ontwerpdoel, zijn er aan het einde van de workshop acties opgesteld. Die acties dragen bij aan het daadwerkelijk tot uitvoering zetten van het ontwerpdoel. Het is hierbij belangrijk dat de acties deadlines hebben, over een maximale tijd van twee weken. Hierdoor kan er na twee weken na de workshop teruggekoppeld worden om te kijken of er doorgegaan wordt met het project.

Van workshop naar project
Doordat er acties opgesteld zijn na de workshop, wordt er al een opzet gemaakt naar een project. Deze acties bedragen vaak het uitzoeken van aannames en eerste stappen zetten om te kijken of een project rondom de afvalstroom haalbaar is. Wanneer er teruggekoppeld wordt na twee weken, is daarom ook een van de belangrijkste punten om te kijken hoe de ontwerpdoel tot een project ontwikkeld kan worden. Hierbij kan gebruik gemaakt worden van de methode in projectstructuur planning. In deze planning kan ook opgenomen worden om een eventuele tweede workshop te doen.

Eventuele tweede workshop
Tijdens een eventuele tweede workshop wordt er een stap dieper gekeken naar het probleem rondom de afvalstroom. Soms kom je er tijdens de eerste workshop achter dat er teveel aspecten o nbekend zijn, waardoor het niet lukt om tot een concreet product binnen het ontwerpdoel te komen. Als dit het geval is, wordt er aangeraden om een tweede workshop te doen. Na de eerste workshop wordt er dan kort onderzoek gedaan naar de onbekenden factoren, die dan gebruikt worden als input voor de tweede workshop. Na deze tweede workshop zal er dan een concreet ontwerp doel geformuleerd worden, waarna er vervolgens gekeken kan worden hoe dit project tot stand kan komen

Graduation project
Elina Eikelenboom
May 2022

Company: The Bin