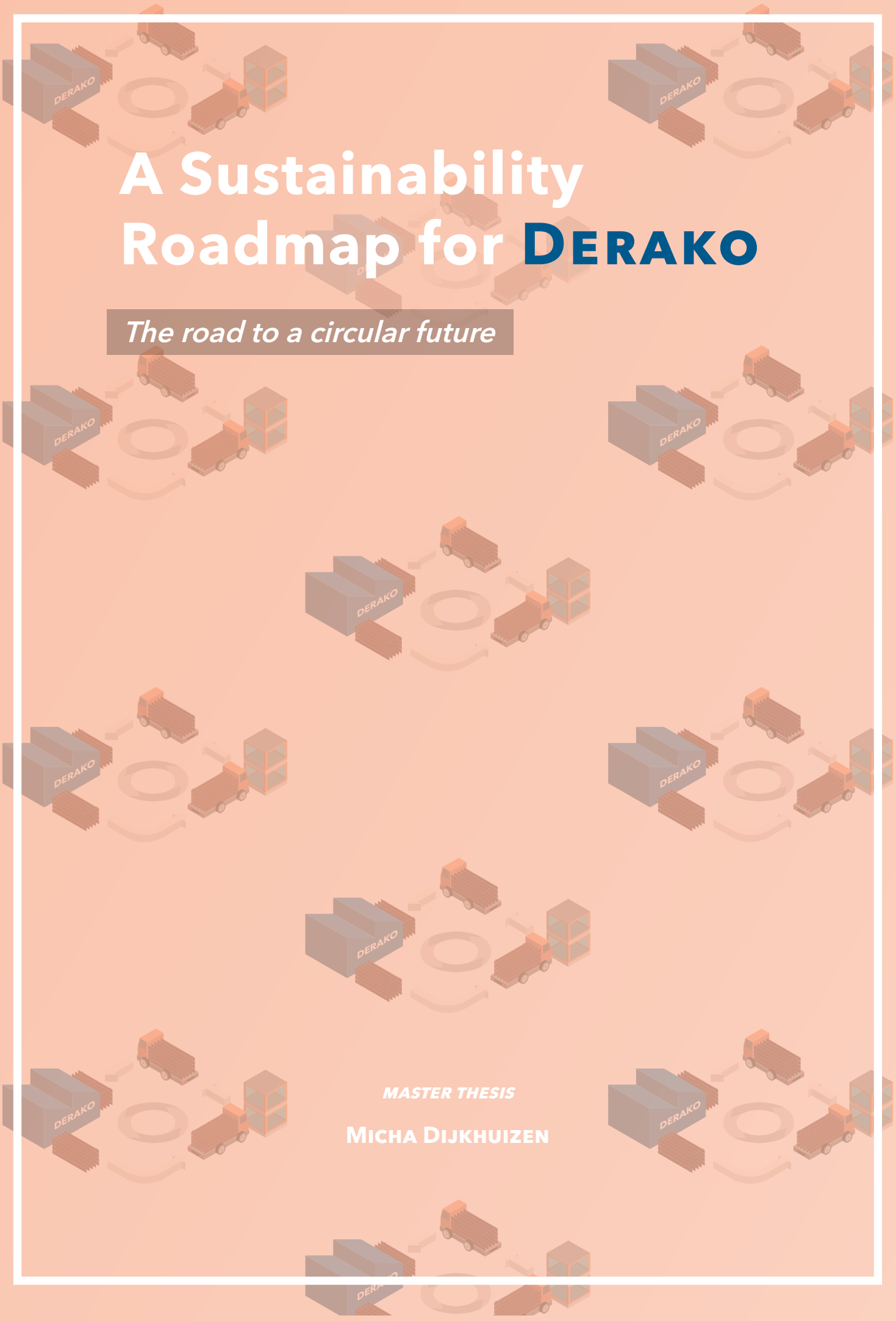
A Sustainability Roadmap for DERAKO

The road to a circular future



MASTER THESIS

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Master thesis
Delft, 2021

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PREFACE

Starting the journey of finding a graduation project, I never imagined ending up in the world of wood. Now the time has come to write this preface, I can say that these past months have opened my eyes for the opportunities and outstanding beauty this material is giving us day in, day out.

Wood is a precious material. Although it grows by itself, the value of wood should not be underestimated. Wood deserves to be cherished and nurtured, it should be handled with respect for the energy that went into it. Therefore I am proud to say that through this graduation, I am able to contribute to the preservation of this valuable material, being able to get the most out of this piece of nature.

The results of this graduation project can hopefully contribute to reducing the amount of wood that goes to waste. This result would not have been possible without the help of many.

Therefore I want to express my immense gratitude towards my supervisory board. Lianne who has helped me greatly in navigating my way through the process of building the project and the roadmap. Thank you for all your support, motivational words and valuable insights. Renske, thank you for your fresh vision on going through this process and sharing your knowledge on the topic of sustainability and being able to motivate me to continue at every step of the way.

Furthermore a special thanks to Derako, for literally opening their doors for me, welcoming me into the company. I truly felt part of Derako for these past six months. Working at Derako taught me the importance of being connected with the people behind the company. It gave me the opportunity of seeing all the loving work that goes into making a high quality product and experiencing the complex operations behind it.

When it comes to the people behind the company, I would like to take this opportunity to thank Margot for her close involvement with the project. I am very grateful for all your time and effort and the fact that no question was left unanswered. Thank you for all the fun and serious conversations. Furthermore I have to say a big thank you to Peter van Laar, for sharing all your knowledge and letting me in on the important details of the business you are operating. And of course thank you for giving me the opportunity for trying to help Derako become a better version of itself.

For everyone who made time to talk about the project, all the experts involved, thank you. Your great knowledge gave me highly valuable insights.

A big thanks to my family and friends who supported me on this amazing journey. KT, thank you for being my unreserved support, guiding me and supporting me whenever I needed it most. Thank you for making the working from home bearable and inspiring.

And finally, thank you as a reader, for having the interesting and taking the time to read this report. I hope you will join me and Derako into a better, sustainable, and most of all, circular future!

EXECUTIVE SUMMARY

Derako is a company specialized in designing and manufacturing wooden suspended ceilings, wall panels and façade panels. Derako faces the challenge of high production of waste, over 50% of their bought wood ends up as waste, additionally over 6500 kilograms of plastic waste is being produced.

In their industry, Derako is not alone. The construction industry is considered a highly polluting industry, responsible for 50% of all raw material usage and 35% of the CO_2 generated in the Netherlands. The industry is reacting by slowly adopting ways to improve their sustainable performace. One of the main topics is the Circular Economy.

This thesis will provide an answer to the research question at hand, namely, how can Derako become a more sustainable business in the future? It will aim to do so by closely collaborating with Derako employees, to ensure a good fit.

In order to fully understand the industry Derako is operating in, a thorough analysis has been conducted. Several stakeholders in their process, such as architects, contractors and installers have been interviewed, alongside several employees of Derako. The sales process of Derako proves to be complex, several of the aforementioned stakeholders influence the decision making, while their interests vary greatly.

As the construction industry is developing, several trends are showing. An analysis of these trends has uncovered potentially interesting directions for Derako to pursue. The Circular Economy would be the foundation of this development, as it shows to be a highly relevant and promising topic in the industry, providing many options for product development.

Together with Derako, through the means of co-creations session, the trend directions were discussed. The direction of flexible and modular buildings was deemed most relevant to develop into a vision. During this co-creation, participants set out to develop a vision which would be guiding for the strategy and roadmap.

During the development of the strategy, the vision would be split in two parts. One part focussing on waste reduction, the other focussing on a circular product line.

The waste reduction plan has been developed as a method to provide tangible handles for waste reduction. The current waste streams, mainly wood and plastic waste have been mapped roughly. Tests have been designed to collect more detailed information on those waste streams. The waste reduction plan sets specific goals in three horizons with the final horizon ending in 2030. For the non-renewable waste, a reduction of 50% has been set, as for wood waste a reduction of 90% has been set. In these goals, finding high value applications for the wood waste is also considered a reduction.

The circular product roadmap describes the development of a circular product line, in which a standardized product is central. This product minimizes variation on materials, sizes and finished, therefore creating a product that facilitates easy reuse. Alongside the circular product line, a return shipping method has been developed. This has been treated facilitate wasteless shipping of Derako product, drastically reducing the amount of plastic and wood waste.

Combined, the waste reduction plan and circular product roadmap provide Derako with practical handles to drastically increase sustainable performance.

GLOSSARY

Circular business model (CBM) Business models designed to operate in a Circular Economy, often based on service or pay-per-use models.

Circular economy (CE) An economy where products and services are designed to facilitate the reuse of materials, components and products as long as possible while producing with renewable energy sources.

Co-creation Collaborative innovation, using the expertise of others to gather ideas and push development

Corporate social responsibility (CSR) A CSR is a way for companies to monitor and control the environmental and social concerns their operations might cause.

Cradle to cradle (C2C) A design philosophy, closely related to Circular Economy, where material is not seen as waste, but food for a different product or process. C2C has a strong focus towards materials and material loops.

Environmental Management System (EMS) System to track environmental data, for example data related to the operations

Grill product line Slats are mounted vertically connected by a dowel, making the side grain of the material visable.

Lineair product line Slats are mounted horizontally on a railing system, making the front grain of the material visable. `

Panel The Grill product line is delivered in panels, made of multiple slats connected by a dowel

Wood

Raw wood Wood as it arrives from the sawmill

Gross size wood Wood after first planing, before getting fire retarding treatment

Net size wood Wood that has been planed to its final size, ready for further processing

Treated wood Wood that has been treated with a fire retardant coating

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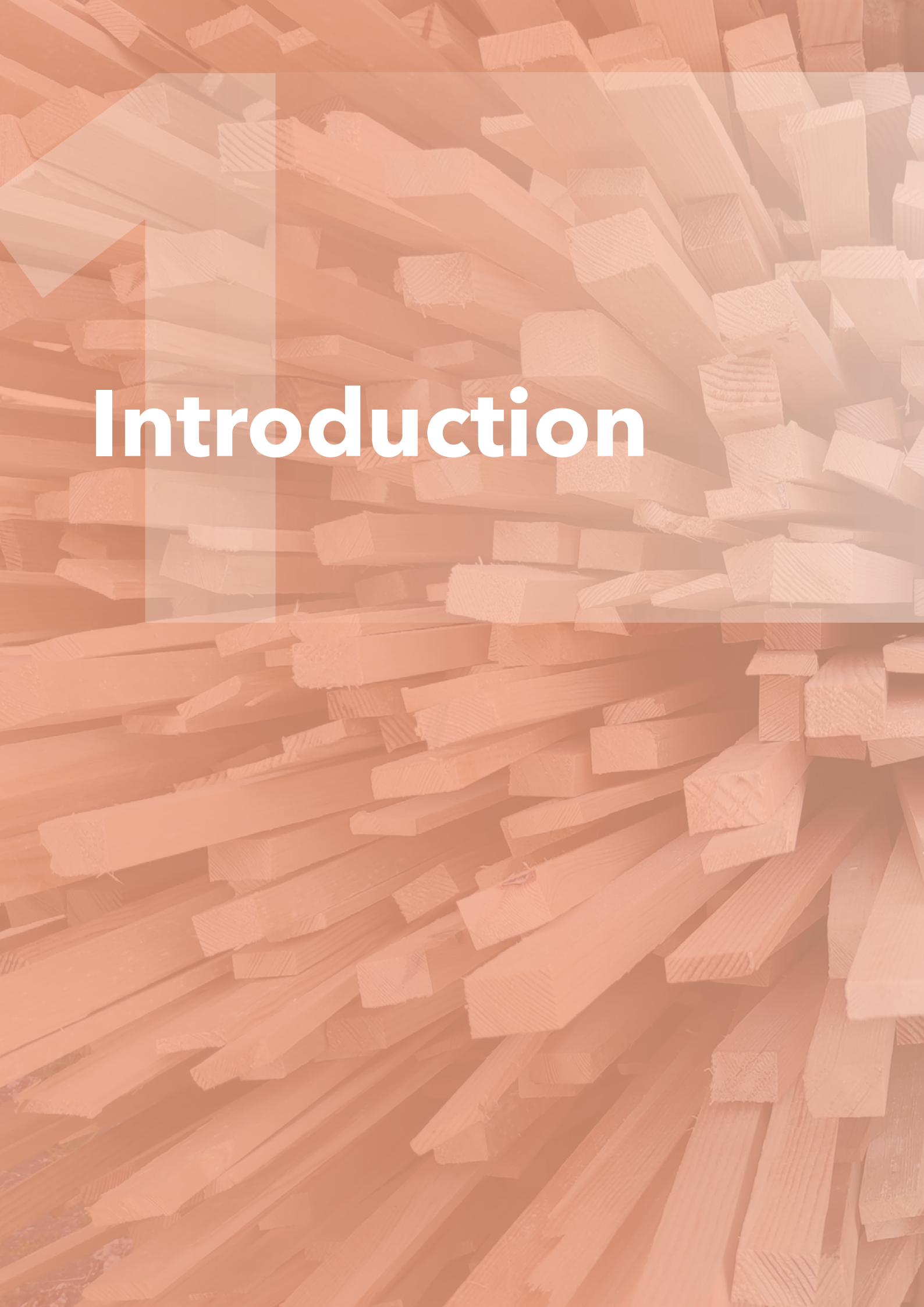


Introduction

In this introduction the focus will be on getting to know Derako, what they do and how they currently operate. Furthermore the project brief will be described, including the main research question and two sub-questions. Additionally the goals, approach and boundaries of this thesis will be elaborated on.

DERAKO AND THEIR PRODUCT

COMPANY

Derako is a company located in 't Zand (Noord-Holland, The Netherlands) and specializes in designing and manufacturing suspended ceilings, wall panels and façade panels. These products are all made of wood. Derako has over 30 years of experience in processing wood and is considered a well known company in the market. They operate in a business to business market, where most products will be sold to construction projects or renovation of existing buildings. With around 35-40 employees, Derako is classified as a SME (in Dutch: MKB).

Derako has shown a strong urge to practice what they preach. Their claim to be a sustainable business is backed up by a silver Cradle to Cradle (C2C) certification (see *Sustainability (page 22))* on all of their products and ISO 14001 certification, which relates to the Environmental Management System (EMS) in the organization.

PRODUCT

Derako offers two types of products, both fitting for wall and ceiling.

The first product line is their 'Lineair' product line (see *figure 1*), constructed wooden slat mounted to steel railings with patented metal clips (see *figure 2*). The Lineair product line creates a smooth finish and can be applied with the slats mounted open, which means a gap between the slats, or closed, where the slats are placed close to each other. The aforementioned gap can be closed of using a fabric (see *figure 1*).

The second product line is called 'Grill', it uses a different principle where the wooden slats are connected by a dowel (see *figure 3*), which is mounted to the steel railing. The dowel is fastened with a nail on each slat (see *figure 4*). The distance in between the slats can be varied as desired. As Derako says, their products are solely used to create a visually pleasing environment and do not in any way add to structural integrity of the building.

Most products created by Derako are bespoke, which has a big impact on their operation. The products have been engineered to fit the desires of developers or architects. This means, for a big part, scale and size can be decided by the client.

Recently, Derako introduced their Base-Line, which is available in fifteen predetermined sizes and four types of wood. With the Base-Line Derako offers a cheaper option while aiming to optimize processes and reduce woodwaste. Derako is able to reduce waste, as these predetermined sizes are optimized to the sizes Derako is able to purchase from their suppliers.

Waste

For their Lineair and Grill products, Derako makes the wooden slats from various types of raw wood, ranging from pine to cedar and cherry. The customer decides on the kind of wood, treatment of the wood, the size of slats, the overall size of the project and so on.

Derako purchases the raw wood project specific. This means for each project they will decide how much wood they need of a specific type and size, while taking into account dropout of raw wood due to low quality, losses in processing and accounting for a small amount of remnant slats.

This method prevents keeping large amounts of woods in storage, which reduces costs and prevents wood laying around for a long period

FIGURE 1 Lineair product line

of time. However, as the wood is purchased project specific, it is difficult to reuse any leftover wood for a different project due to the differences in type and size of the raw wood. This often results in batches of raw wood, smaller pieces of partly processed wood or finished products that remain unused or are being thrown away. In the end, less than 50% of the volume of raw wood Derako buys, ends up in the end product.

Selling It On

Currently, Derako already makes an effort trying to maintain the value of the wood by selling it on to other industrial uses, such as carpenters or cabinetmakers, sheltered workshops and so on. To satisfy the needs of these parties, the wood needs to be sorted on size, quality and will often sell in small amounts. Meeting these constraints require intensive manual labour while the financial gains are limited for the quantities involved.

Currently, it has proven to be difficult to find enough parties to sell the large amount of redundant wood Derako has. However, if Derako can successfully sell or repurpose a significant part of their current wood waste, large costs savings can be made.

FIGURE 2 Lineair product line backside with the metal clips and rails

FIGURE 3 Grill product line

FIGURE 4 Grill product line with the aluminum dowel fastened by a nail

PROJECT BRIEF

The initial brief by Derako focussed specifically on minimizing the waste of wood during the production process. In doing so, Derako hopes to reduce the volume of wood that becomes waste while bringing down production costs.

This thesis will approach that challenge in a broader sense. By zooming out and focussing on a more holistic approach, a vision on sustainability will be created. This vision will guide Derako towards a more sustainable future in multiple parts of their operation. In doing so, sustainability can become a more integrated part of the organization, thus have a bigger impact.

As Derako was looking for quite a practical solution on waste reduction, solely creating a vision would find little traction within the company. Therefore the vision will be supported by a strategy on how to achieve the vision. On its turn, the strategy will be supported by a roadmap, which will help concretize the strategy by plotting it on a timeline and linking it to certain external factors such as trends, partners and technologies. The roadmap will aim to offer solutions to the earlier identified issue with waste.

Therefore, the project is split in three main parts. *Sustainability* is the main topic of this thesis, more precisely a sustainability vision. In order to create such a vision, more than just the sustainability aspects have to be taken into account. A thorough analysis will be conducted on general and market specific trends, technological developments, regulations and so on. The results of this analysis will be used to create a coherent and holistic vision.

Building on this vision, a *strategy* will be created. The aim of this strategy is to define how the vision will be achieved. This strategy should give guidance and help Derako reason their decision making concerning sustainability in the future.

Finally, in order to make the strategy tangible and actionable, a *roadmap* will lay out and plan the strategy over a fixed time frame. The roadmap will include horizons to step by step work towards the future vision.

GOAL OF THESIS

Provide Derako with a coherent, holistic and implementable strategic sustainability roadmap based on a vision that aligns with Derako

Therefore a main research question is formulated. This thesis aims to answer this question and all related sub-questions.

Research Question
How can Derako become a more sustainable business in the future?

Sub-Questions
1. What products or services could Derako introduce to reduce or re-use their waste streams to reduce their impact on the environment?

2. What process-oriented changes could Derako introduce to reduce their impact on the environment?

AIM

Derako is a down-to-earth and hands-on kind of company. In order for the roadmap to align with this and be successfully implemented, some important factors have to be taken into account.

First of all, the aim is to create a strategy and roadmap that will be successfully used for further sustainable development at Derako. Therefore the following goal has been formulated:

Keep it tangible and approachable. Derako is looking for implementable sustainability solutions on a realistic timescale.

For the strategy and roadmap to find traction within the company, it is important to work with the employees of Derako. The following goal has been set:

Make sure to create a clear vision with Derako that aligns with the values and way of working Derako is known for. Create ownership during the process.

These aims will be the backbone of this thesis. They will help with good implementation and good alignment with Derako.

PROJECT APPROACH

This thesis will focus on delivering a strategic design for Derako, through the means of a roadmap. The roadmap will be created using the design roadmapping methodology by Lianne Simonse (2017), as will be elaborated on in the chapter on roadmapping. For the basic structure of the project, the Framework for Innovation will be used (Design Council, 2015).

The model is based on four phases: discover, define, develop and deliver. In *figure 5* the activities of each phase are described. In both the discover and develop phase, the process will be divergent, searching in and outside the current context of Derako, finding new information and creating new ideas. The define and deliver phase will be convergent, focusing on collecting the most valuable and relevant information and ideas out of the bigger context. This process enables creative, out-of-the-box thinking while aiming to create relevant and practical ideas.

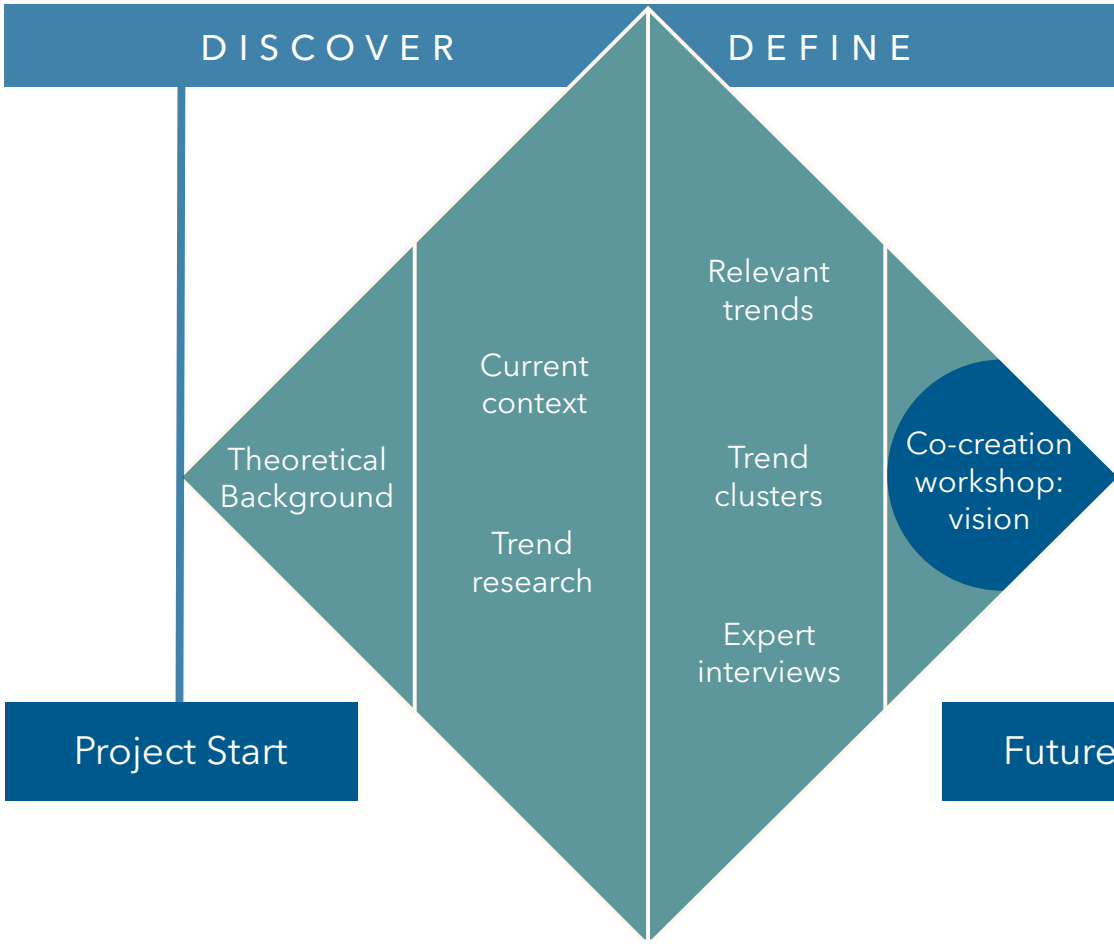


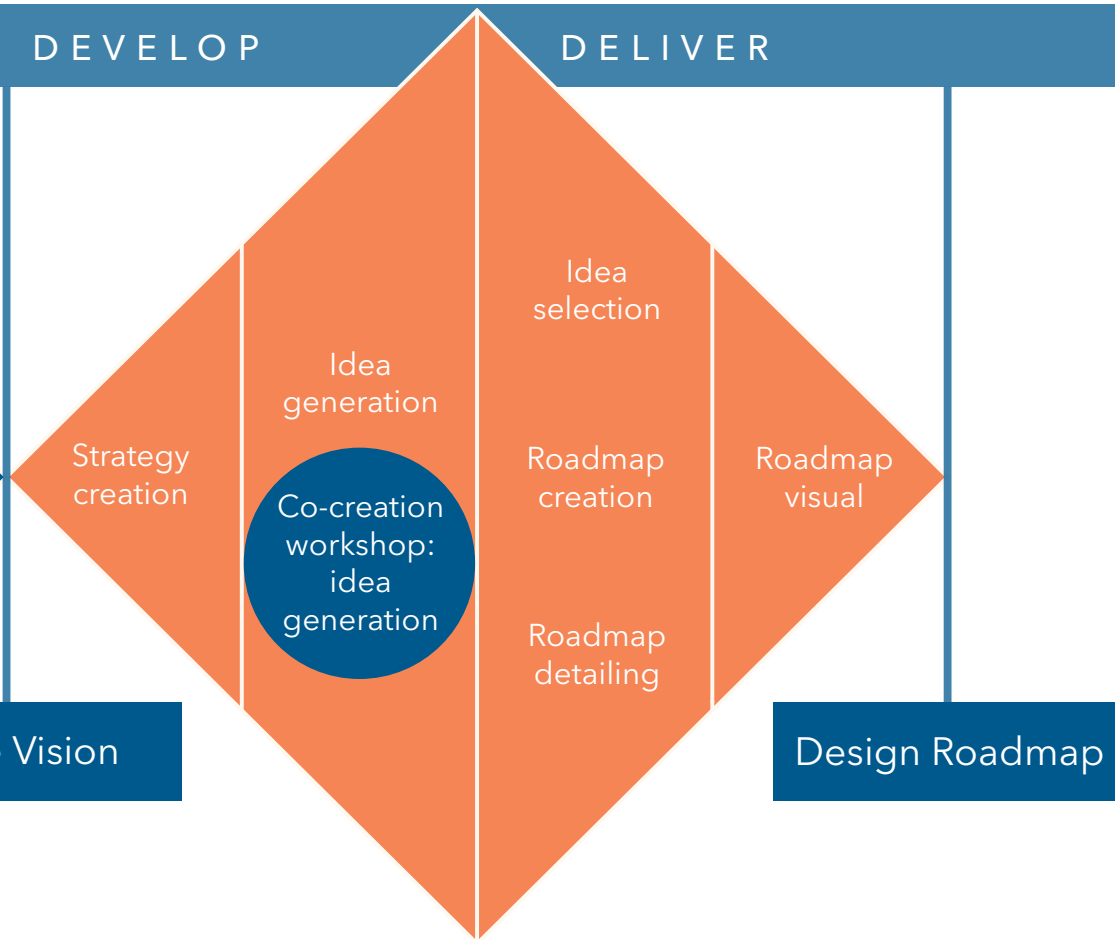
FIGURE 5 Project process based on the Framework for Innovation

In *figure 5* the process has been visualized.

The project will start with the discover phase, which will consist of extensive research on Derako and the context. This information will be the input of the define phase, which will focus on creating a more concise image of the context and trends. At the end of the define phase a future vision will be delivered, based on the first co-creation workshop with Derako employees.

This vision will be used to create a strategy and roadmap in the develop and deliver phase.

The first step will be divergent, creating numerous ideas and solutions. These ideas will be converged to a selection of most promising ideas in the deliver phase, which will be the basis of the roadmap.



BOUNDARIES OF THIS THESIS

This thesis aims to cover as many aspects of creating a sustainability roadmap for Derako. However, due to the constraints of time, in the thesis some boundaries have to be set.

TIMELINE OF ROADMAP

Together with Derako a timeline has been set. The duration of this timeframe is of utmost importance as it defines how far in the future the future vision will look. In order to ensure a realistic and viable roadmap, while still being able to be ambitious, a timeline of 10 years has been decided upon. Based on this timeline the trend and developments will be researched.

FOUR LEVELS OF DESIGN

The four levels of design described by Baldassarre et al. (2019), as explained in the chapter *sustainability in strategy (page 31)*, have been considered, namely product design, product service system design, business model design and ecosystem design. Taking into account the size and resources of Derako, aiming for innovation on an ecosystem design level would be unrealistic. Moving into this direction would mean Derako is pushing multiple organizations towards a more sustainable future. These kinds of partnerships require enormous amounts of time and money, which Derako does not have. Therefore the ecosystem will be left out of the project scope.

More information on ecosystem design can be found in subchapter *sustainability in strategy (page 31).*

PATHWAY MAPPING

Additionally, concerning the roadmapping process, during the pathway mapping the focus will be on the resource constraints and possible partners of Derako. If possible, one solution will be further elaborated on in sense of lead times, manpower and/or investments.

More information on pathway mapping can be found in subchapter *the process of roadmapping (page 32).*

BACK END STAKEHOLDERS

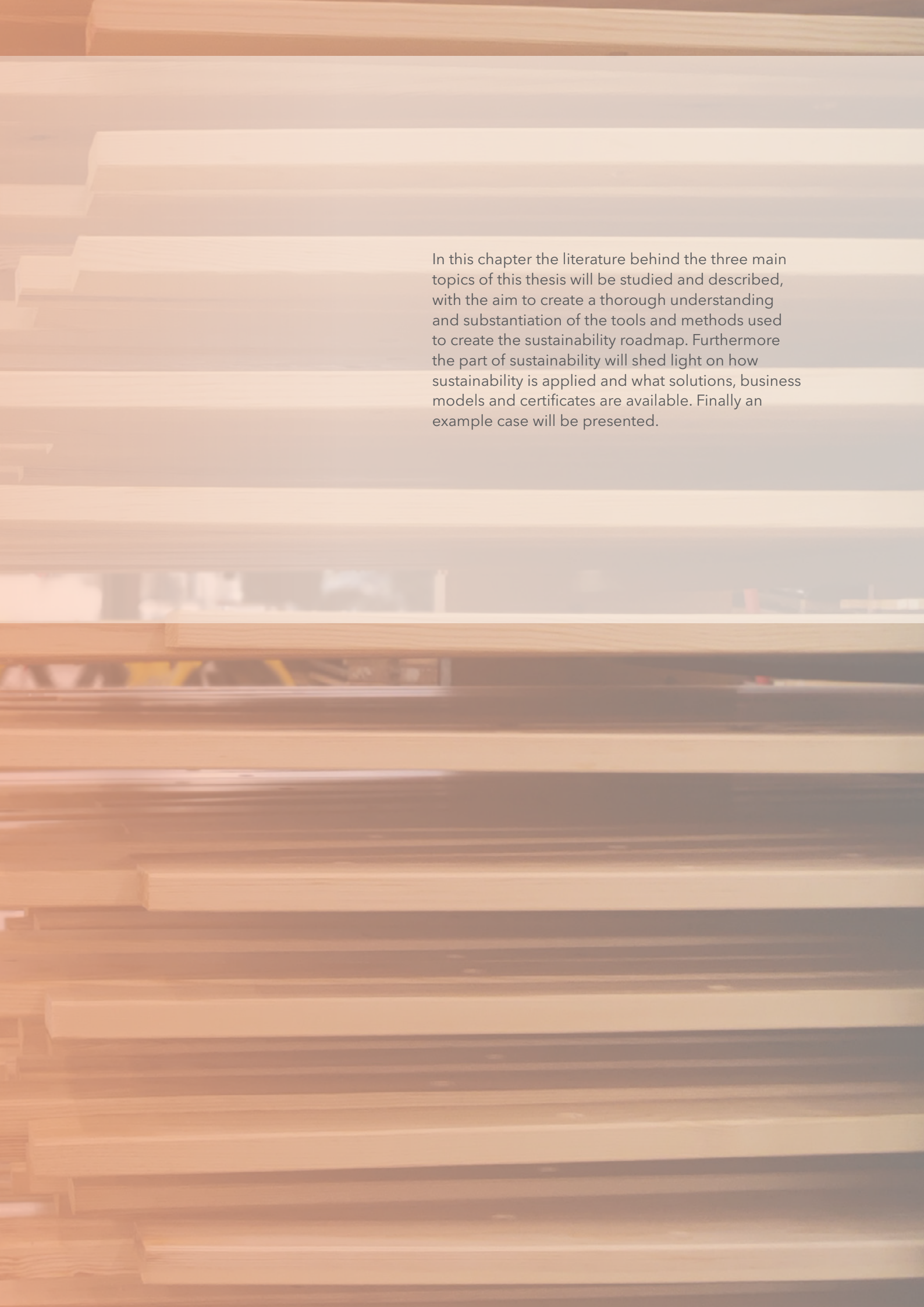
It is evident that the stakeholders of Derako have a major influence on their processes, both on the front end as well as on the back end. This thesis will leave the front end of the process out of the scope, meaning all suppliers such as wholesalers of wood and manufacturers of additional supplies will be left out of the project. The main focus will be on the processes within Derako and their interaction with the customers, such as architects, contractors and sub-contractors.

More information on the stakeholders can be found in chapter *Stakeholders (page 44).*

TARGET MARKET

Based on the sales numbers over three years (2017, 2018 and 2019), it is evident the Netherlands is the biggest market for Derako. Therefore the decision has been made to work with a focus on the Netherlands, while including the western European market (Belgium, France, Germany and Switzerland), which represents another big part of this market of the total sales of Derako. See *appendix 11 - Confidential (page 154).*

2 Theoretical Background



In this chapter the literature behind the three main topics of this thesis will be studied and described, with the aim to create a thorough understanding and substantiation of the tools and methods used to create the sustainability roadmap. Furthermore the part of sustainability will shed light on how sustainability is applied and what solutions, business models and certificates are available. Finally an example case will be presented.

SUSTAINABILITY

ABOUT SUSTAINABILITY

Sustainability is a topic high on the agenda of many, it has been an increasing point of interest among consumers, companies and governments for a number of years (Nielsen, 2018). Sustainability is an incredibly wide topic, ranging across all industries, embedded in policy making from municipality all the way into Europe. Together with customer demands for more sustainable alternative products and services, governments are prone to take action by implementation of legislation concerning sustainability or awarding subsidies to stimulate the sustainable choices of consumers and companies (Business.gov.nl, n.d.).

Not only do consumers desire more sustainable products and services, they also feel companies are responsible to take care of the world around them as much as consumers are. A survey conducted by The Conference Board® in collaboration with Nielsen (2018) shows that 81% of global respondents feel companies should take responsibility to improve the environment. Research in the Netherlands shows 70% of the consumers feel the same (MarketingTribune, 2020).

Many companies feel the urge to become more sustainable, either as they feel pressure from the consumer, they are forced by law or are steered by intrinsic motivation. In some cases, becoming more sustainable can feel like a burden, something which puts pressure on the day to day operations and requires a substantial investment.

However, sustainability is an opportunity to thrive as well. In this thesis, sustainability will be defined as "a dynamic state of development in which a complex system can thrive without collapsing" (Baldassarre et al., 2019; Meadows et al., 1972). This definition underlines a system must be able to sustain for a longer period of time without causing decay or even collapse due to the harmful activities inherent to the specific development.

This definition is specifically true for Derako. Their operations are depending on a source of material which is finite if not properly sourced.

MARKETING

To facilitate a positive side effect to becoming more sustainable, many companies integrate sustainability in their branding and communication, with which they aim to improve their existing brand image. Derako does this by marketing their product as a CO_2 storage, which is sustainable and visually creates a look which is close to nature.

Integrating sustainability into marketing does not go without controversy, many companies have been accused of greenwashing (Delmas, 2011). Greenwashing is the communication by a company sending a positive message about their environmental performance, while the performance itself is poor. This can have a profound effect on consumers and investors, harming the overall credibility of sustainable products or services.

CORPORATE SOCIAL RESPONSIBILITY

The steps a company takes to improve their sustainable performance can be part of a bigger Corporate Social Responsibility (CSR) (in Dutch: MVO) strategy. A CSR is a way for companies to monitor and control the environmental and social concerns their operations might cause.

It goes further than just looking at their energy consumption or waste streams, but also takes into account what kind of impact their operations have on communities (Edmondson, 2020). One way of monitoring a CSR is the ISO 26000 norm (NEN, n.d. b).

A way to create a CSR strategy is based on sustainable growth. Sustainable growth is a term which describes growth based on three principles: repeatable, ethical and responsible (Miller, 2018). In this sense of the word, 'sustainable' is not only about being 'green'. Sustainable growth focuses on being able to sustain for a longer period of time (repeatable) while taking care of communities and people (ethical), and indeed also taking care of the world (responsible). Sustainable growth for a big part aligns with the Triple Bottom Line that focuses on people, planet and profit. In focusing on these three pillars, companies not only ensure they are able to communicate their sustainable way

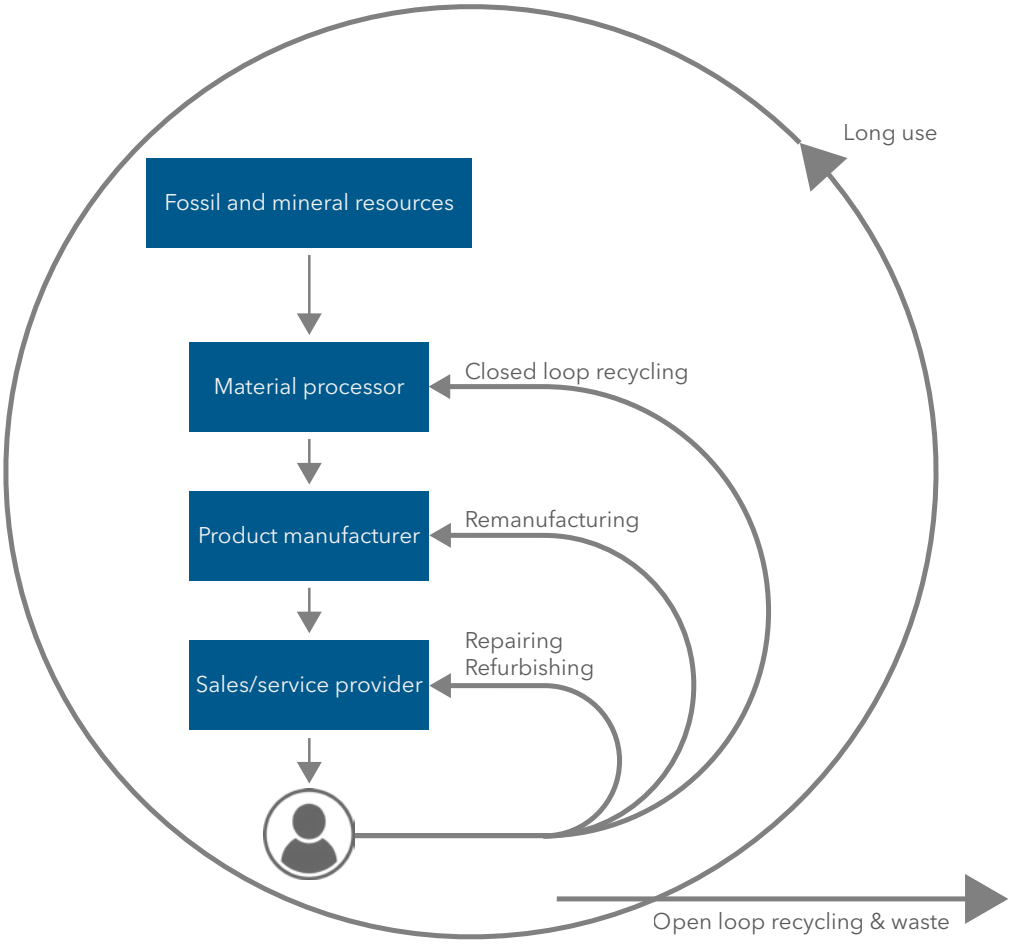


FIGURE 6 Visualization of the Circular Economy model (Bakker et al., 2014, p. 4)

of working and reap the benefits of their actions financially through increased sales or improved reputation (Rochlin et al., 2015), but also ensure they will be able to repeat this process in the future, as their focus shifts away from the use of non-renewable resources (Holliday, 2001).

A good CSR strategy is interwoven with the business strategy, it aligns with the purpose of the company to ensure an effective implementation without unnecessary time or money investments (Ludema & Johnson, 2018; Maas & Boons, 2009).

Derako already focuses on sustainable growth by buying sustainable wood with the corresponding certificates, such as FSC and PEFC. Other than responsible production of wood, these certificates enable repeatability by replanting forests and ethically by ensuring a certain standard pay grade and living conditions. Their communications on this topic are currently limited to mainly their website.

CIRCULAR ECONOMY AND CRADLE TO CRADLE

The Circular Economy (CE) can be seen as the next step from CSR. In a CE a different approach to our current economy is proposed, focusing on keeping the materials in a loop for as long as possible, while enabling companies and societies to thrive.

The definition of CE and C2C are often intertwined. In this thesis, C2C is seen as part of CE, where C2C mainly focuses on shifting from our traditional take-make-dispose model, also called Cradle to Grave, towards a more sustainable closed-loop system, referred to as C2C (Lieder & Rashid, 2016). Although there is no general definition of the CE (Kirchherr et al., 2017), in this thesis CE is considered the broader approach including the adaptation of products towards services and the associated business model changes, while providing a strong basis for sustainable growth.

C2C mainly focuses on materials (Braungart et al., 2007) and material loops, with a lean towards social justice. In this focus, C2C assesses five categories: material health, material recycling, renewable energy and carbon management, water management and social justice (C2C Pii,

REgenerate	Shift to renewables, both in energy as well as materials
Share	Maximisation of usage of the product through sharing
Optimise	Increase in performance and efficiency by reducing waste in the whole chain
Loop	Closed loop, keep products in a loop as long as possible
Virtualise	Reduce the amount of physical products through replacement with digital products
Exchange	Replacing old materials or methods with new, more advanced ones

FIGURE 7 ReSOLVE model by the Ellen MacArthur foundation (2015)

n.d. a). With these categories, certain criteria have been set to define whether a product deserves a basic, bronze, silver, gold or platinum C2C certification (C2C Pii, n.d. b).

For Derako the implementation of C2C has mainly led to mapping the materials in their current products. In order to ensure no chemicals from the banned list (C2C Pii, n.d. c) are present, Derako has validated the materials in the product with its suppliers. Both their product lines proved to be fit for a silver C2C certification without major adjustments. This certification is currently an opportunity for Derako to show their sustainable performance. However, a silver C2C is not considered a highly distinctive performance in the current construction industry, as stated by Derako themselves.

In comparison to C2C, CE focuses on keeping the (material) value of products as high as possible for as long as possible, and therefore takes a step further towards a completely sustainable circular system. Within a CE series of loops describes the different types of treatment a material can get to extend the life span of a product, see *figure 6*. Closing these loops would ultimately result in no need for the use of raw materials, the elimination of waste and completely eliminate emissions by making use of renewable energy sources.

The loops as shown in *figure 6* describe that in a CE a product, once it will not longer be suitable to use as intended, can be repaired, refurbished, re-manufactured and finally recycled (Bakker et al., 2014). These steps follow an order where the least effort is considered first (repair), in this way the product can still serve purpose while investing minimal additional energy or materials. The next steps, refurbish and re-manufacture, all command a higher influx of either material or energy. If

IN PRACTICE: CIRCULAR ECONOMY

Noah Baars (City Analyst) & Tamara Veldboer (Senior Consultant) from Circle Economy are working with companies and municipalities to discuss and implement the CE into their operations. As they experience, there is a growing interest from different directions in the building industry. They mention that more and more companies see the benefits and needs for a more circular approach to the materials being used.

Veldboer is active in a coalition that looks at the CE in construction and building. The example case being used is HAUT, a 73 meter high building made from wood, being constructed in Amsterdam. According to Veldboer, main issues that arise in applying the CE in this industry is that all stakeholders are required to work together on incorporating CE into their processes. In order to stimulate stakeholders to work together, all stakeholders involved in the process need to see the benefits of CE, which is often not the case.

A strong motivator could be for governments, such as municipalities, to incorporate sustainability requirements into their tenders. This would require applying companies to think about the topic beforehand.

However, governments seem to be taking a different appoach and require builders to initiate sustainable solutions themselves.

As Veldboer mentions, in order for the construction industry to be able to progress forward, it is crucial to bring different stakeholders together to define how the industry can change and grow together. This is especially true when aiming for a CE.

taking these steps, the prolonged use should justify this investment. Otherwise the product should be recycled, where the aim is always to up-cycle the material, rather than down-cycle. This means the material will serve an equally valuable or higher value purpose. An example of this might be turning wooden pallets into a garden lounge set.

In order to make the type of actions business can take more concrete, the Ellen MacArthur foundation (2015) has defined six points of attention for businesses in the ReSOLVE model: REgenerate, Share, Optimize, Loop, Virtualise,

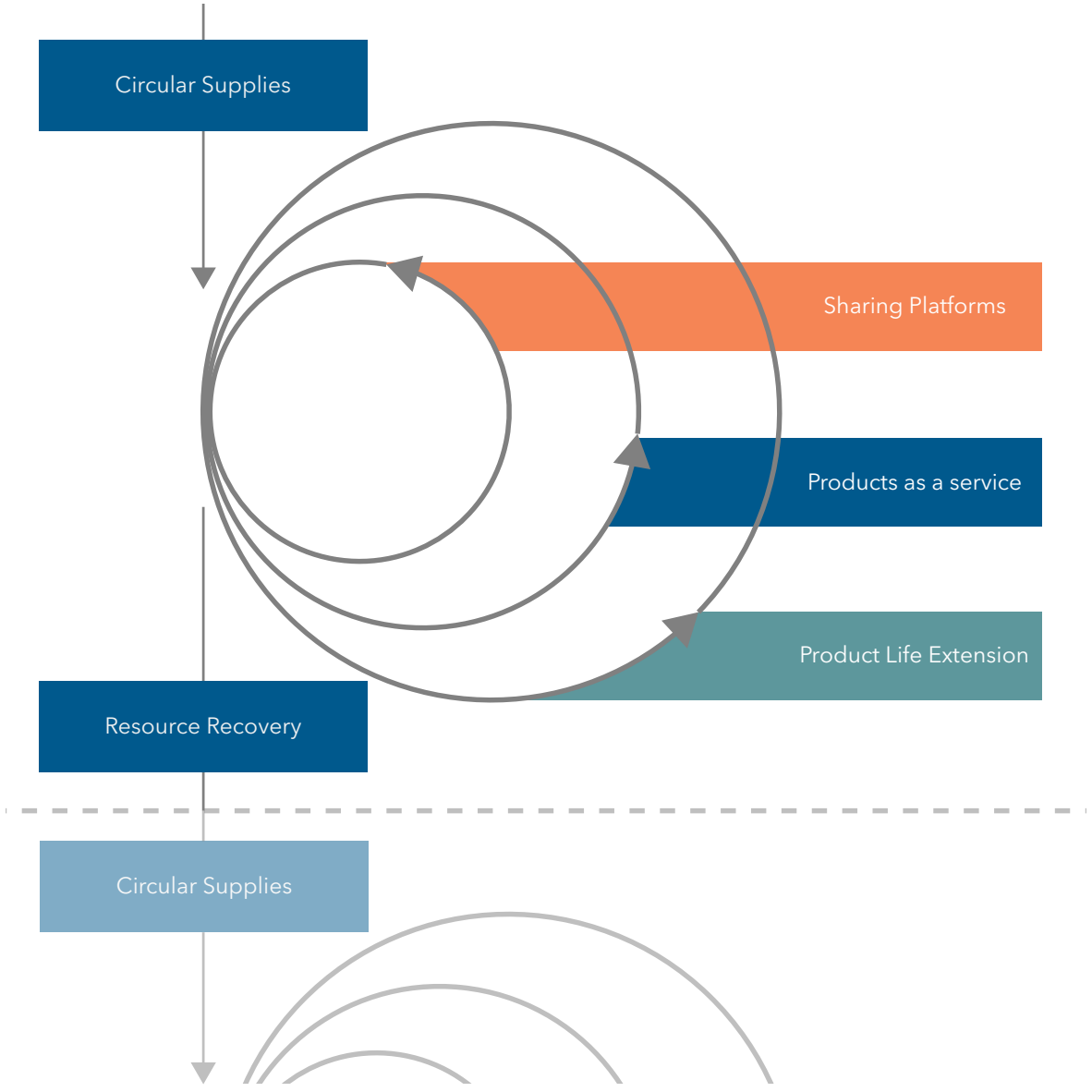


FIGURE 8 Five types of circular business models according to Lacy et al. (2014)

Exchange. See *figure 7*. These six points represent possible directions for Derako to aim for concerning a CE.

CIRCULAR ECONOMY IN THE BUILDING AND CONSTRUCTION INDUSTRY

CE is applicable to many products, from consumer electronics to housing. In a report by the Ministerie van Algemene Zaken (2016) about the future of CE in The Netherlands, the construction sector is mentioned as one of the top priorities. According to this report, the Dutch construction sector is accountable for 50% of the raw materials used, 40% of total energy consumption and around 30% of the total water consumption in the Netherlands. Moreover, around 40% of the total waste involves construction and demolition waste. Also the emission of the sector are high, around 35% of the nationwide CO_2 emissions are from this industry. See *figure 9*. These high percentages mean an opportunity for improvement with great impact.

The report sets specific goals for the sector to reposition towards a CE, however it mentions the government will refrain from setting legislation to prevent creating a higher financial burden. The government will provide opportunities and advice, but the responsibility of change is within the sector itself. This passive role of the government might be an issue, see *in practice: circular economy on page 25*.

However, some of the Dutch housing industry companies are reacting proactively, by adaption of CE initiatives. A research conducted by Slot (2019) assesses the adoption of CE initiatives in the Dutch housing industry. It states the industry is currently at the end of the introduction phase,

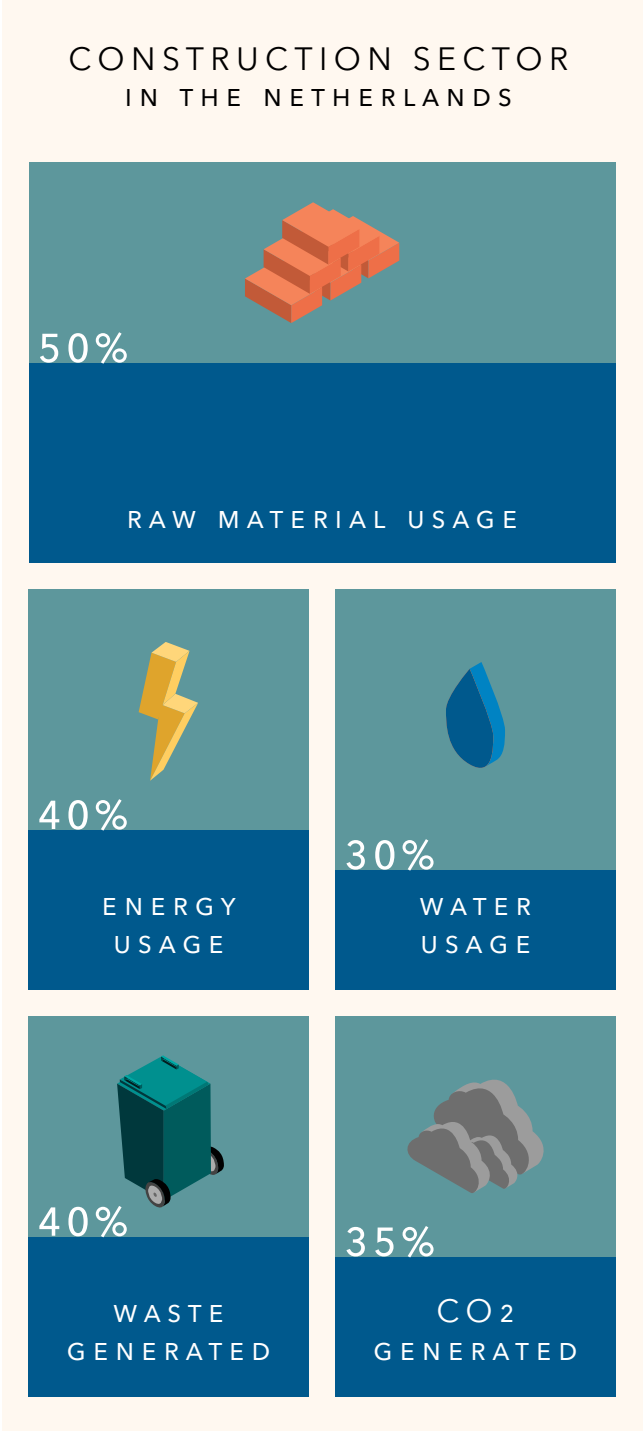


FIGURE 9 Impact of the construction industry in the Netherlands

meaning the skepticism around CE is mostly nonexistent, albeit the barriers in adopting a complete Circular Business Model (CBM) are still evident. Two of these main barriers, as defined by Slot (2019) are lack of experience in CE and lack of consensus on the definition and measuring method of a (successful) CE.

The introduction phase is the first phase of a complete economic cycle defined by Dorée et al. (2003). The four phases that complete the cycle are introduction, expansion, maturity and stagnation. Each of these phases has specific characteristics in terms of structure, behavior, performance, competition, collaboration and concentration, described by Dorée et al. (2003). A simplified description of these characteristics can be found in *figure 10*.

CIRCULAR BUSINESS MODEL

A CBM is crucial when trying to adopt the CE. It offers the potential for businesses to thrive and create a strong competitive advantage while adopting the CE (Ellen MacArthur Foundation, 2013). Therefore, as defined by Mentink (2014, p. 24), a CBM is considered "the rationale of how an organization creates, delivers and captures value with and within closed material loops". Lacy et al. (2014) identified five types of business models that occur in the context of a CE: circular supplies, resource recovery, product life extension, sharing platforms, products as a service, see *figure 8*.

These five types represent the basis of adopting a CBM.

For the majority of businesses, the adoption of such a CBM means radical innovations to their business model are needed (Boons et al., 2013). Most current business models do not allow for effectively closing the loop, as it does not focus on retrieving the materials from the user once the product is no longer in use, nor does it promote collaboration between businesses.

An example of this is the consumer electronics market, in which the business models focus on making profit from selling products to consumers. As a result, the manufacturer is stimulated to sell as much as possible. Meanwhile, the user becomes the owner of the product, which means the manufacturer is not responsible for the afterlife anymore. Users could be stimulated to recycle the product after use, but this does not put the material back in the hand of the manufacturer.

A possible business model which supports a CE is leasing or renting such products. By doing so, the end manufacturer will always stay owner of the product and therefore be able to keep the value of the material. For the manufacturer, this means it can drastically reduce the amount of raw materials, as it knows exactly what the products are made of, and therefore how the materials or components can be reused in different

Introduction	Small scale production and market. High costs, low margins	**Current state CE**
Expansion	Increased production scale, larger market	
Maturity	Large scale production and largest market possible	
Stagnation	Large scale production and decreasing market size	

FIGURE 10 Four phases of the economic cycle by Dorée et al. (2003) and Slot (2019), indication the current state of the CE in The Netherlands

applications. Furthermore it stimulates improving quality of the product.

In addition to a solid CBM, companies must be able to successfully apply the CE in their operations. In order to do so, Cristoni and Tonelli (2018) have defined six areas of intervention, topics a company should pay extra attention to: innovative product design, reverse cycle, green internal operations, supplier engagement, internal alignment and external collaboration.

When looking at a company such as Derako, going completely circular poses numerous challenges. For example, ensuring a reverse cycle. In order for Derako to ensure a product is taken back at end of life, Derako has to be able to track the product and the owner over the whole lifespan, sometimes ranging up to thirty years and multiple owners. Furthermore, Derako needs to be given the opportunity to dismantle the product from the building, which is currently, due to the way of demolishing a building, often not possible. It would require Derako to financially take into account the take back of the product, either having a negative item on the balance sheet for a long period of time or creating a completely new financial business model, for example focused on renting or leasing the product.

CONCLUSION

Over the previous decades, the interest in sustainability has grown. Many initiatives, labels and certificates create opportunities for companies to become more sustainable on a multitude of levels. However, this high number of initiatives and labels also create complexity and make it hard to keep track of the most valuable opportunities.

The Circular Economy is a promising alternative for our current linear way of consuming and is showing a promising development in the Netherlands and in the construction industry. For Derako challenges such as ensuring a reverse cycle could prove to be difficult, but also offer great opportunities such as new business models and possibly a competitive advantage.

STRATEGY

ABOUT STRATEGY

Strategy is part of every company. Whether you are a painter or planning to launch a new tech company, there are certain strategic factors you take into consideration.

In strategic design three main questions lay the foundation of many projects:

1. Is what I am going to do desirable?
2. Is what I am going to do viable?
3. Is what I am going to do feasible?

Or in other words: can it actually be done, does it make sense to do and is there a market or desire for it (Calabretta et al., 2016).

Viability and feasibility can be considered relatively straight forward. Viability focuses on whether the product or service makes sense to implement on a business level, does it generate profit and does it align with what we already do. Feasibility is mainly about whether the technology, space, time, people and so on are available at that given point in time.

The first factor, desirability goes a bit further. It focuses on the needs and desires of people, however, often those desires are not explicit (Calabretta et al., 2016). In order to uncover the latent needs of consumers and users, it is crucial to understand this group and show empathy. Only in this way, desirability can focus on improving lives and fulfilling true needs, rather than staying superficial (Brown & Katz, 2011).

A strategy is by definition focused on longer term. That means aforementioned questions do not only apply to tomorrow, or next week, but also in the years to come after that. This makes a strategy especially valuable if you are planning for future endeavours such as a new product line.

ABOUT THE FUTURE

In order to create a strategy that is fit for this far future, it is crucial to realise how such a future would look like and how the strategy, and therefore the business, might fit in. Schwartz (2012) describes how a look in the future is achieved. He defines the act of scenario planning, in which multiple stories are created that represent plausible futures. By doing so, companies have direction on where the future most probably will head to. As underlined by Calabretta et al. (2016), these predictions are merely an approximation of the real future, but offer a sufficient projection to make grounded strategic decisions.

Creating these aforementioned plausible futures can be based on mapping the future context. In the ViP methodology this process is described as building a world using building blocks. These blocks are called factors, which can be: "observations, thoughts, theories, laws, considerations, beliefs or opinion" (Hekkert et al., 2011, p. 141). Factors should not be influenced by how the designer would like to see the world, but rather be an objective approach.

These factors can be split into different categories, describing various types of building blocks: developments and trends, and states and principles (Hekkert et al., 2011).

Both developments and trends are evolving factors, they are constantly changing. By projecting this change into the future, one can get an impression of how this future might look like. States and principles on the other hand are

relatively constant. They are based on natural human behaviour or nature laws. States and principles are not likely to change, but might be relevant to visualise the future context.

The operations at Derako are mainly linked to building and construction, therefore their market is primarily influence by trends and developments in this segment. Within this segment, the differences in trends and developments are small. Both architecture and construction are not sigificantly different, whether it concerns offices, public spaces or recreational purposes. For example, the application of new techologies in construction will not differ when a swimming pool is being built as opposed to a municipality office.

SUSTAINABILITY IN STRATEGY

In the case of this thesis, the focus will be on creating a sustainability vision for Derako. As underlined by Calabretta et al. (2016), strategic design plays an ever growing role in strategic desicion making, especially for companies that aim for meaningful innovation. Baldassarre et al. (2019) describe how strategic design can play a role on four different levels of design for a sustainable development: product design, product service system design, business model design and ecosystem design. On a product level this can simply mean steering an organization towards rethinking the life cycle of their product. On an ecosystem level it could mean focusing on the coalition between organizations in order to strive for cross-organizational sustainability improvements. These four levels all require a completely different approach in creating a strategy. For Derako, the levels of product design, product service system and business model design are the most relevant when it comes to creating a sustainability roadmap. For example, when designing for a CE, these three levels will have to be taken into account.

STRATEGY AT DERAKO

Derako focuses on creating high quality, durable products which are easy to install. Their main strategy revolves around this focus. However, it has proven difficult to target all relevant different stakeholders with the same strategy (see chapter *Stakeholders (page 44)*). When focusing on a sustainable strategy, this is especially true, as different strakeholders within the process have varying needs and ambitions on this topic.

However, for a strategy to succeed it does not necessarily mean all needs of all stakeholders need to be fulfilled. In many cases a strategy will create bigger value for one specific group of stakeholders.

CONCLUSION

A strong strategy is critical to stay relevant in an ever changing market. Through solid trend research and expert interviews, a predictive image of the future can be shaped which will provide good directions in creating a strategy.

Incorporating sustainability in a strategy has been done for many years and can offer valuable handles in becoming more sustainable. The strategy has to be coherent over the first three levels of design, namely product, product service system and business model design.

When planning a strategy at Derako it is important to realise which stakeholders are going to be addressed and how their needs are being fulfilled.

ROADMAPPING

ABOUT ROADMAPPING

Whereas a strategy is a great starting point for improvement, it is not the final step in this case. A strategy may provide the necessary guidance on new product development, exploring new markets or implementing innovative technologies, it does not plot those developments over time. This is relevant, as plotting over time helps to make the strategy clear, tangible and actionable.

A roadmap does exactly that, it plots the strategy over time with the incorporation of several other elements, such as user values, markets, products or services, technologies to be used and possible partners. By Simonse et al. (2015, p. 8) a roadmap is defined as "... a visual portrait of market/ product/technology plans plotted on a timeline".

As described by Kim (2016), a design roadmap differentiates itself from conventional roadmaps by incorporating the user of the product or service which is being designed, into the roadmapping processes. By doing so, the roadmap will be created based on the projected user needs and aim to stay relevant in the future market, whereas traditional technology or product roadmaps often fail to effectively predict the future.

Kim (2016, p.37) states a design roadmap is a way to "achieve strategic business goals on a long-term basis". The strategic challenges can differ greatly between companies and their context. Whilst defining the strategy, in this case a sustainable strategy, these challenges will become apparent through thorough research on this context.

The main aim of this roadmap is to help Derako in working towards a sustainable future. The roadmap should be a valuable tool for Derako, which they can use to ensure progress and staying relevant in the market they operate in, through the implementation of appropriate products, services or process improvements.

THE PROCESS OF ROADMAPPING

In her book on Design Roadmapping, Simonse (2017) described the process of building a design roadmap in great detail. The foundation of building such a roadmap lies in the three phases: value mapping, idea mapping and pathway mapping. Each phase results in part of the roadmap, with the final phase being the last step

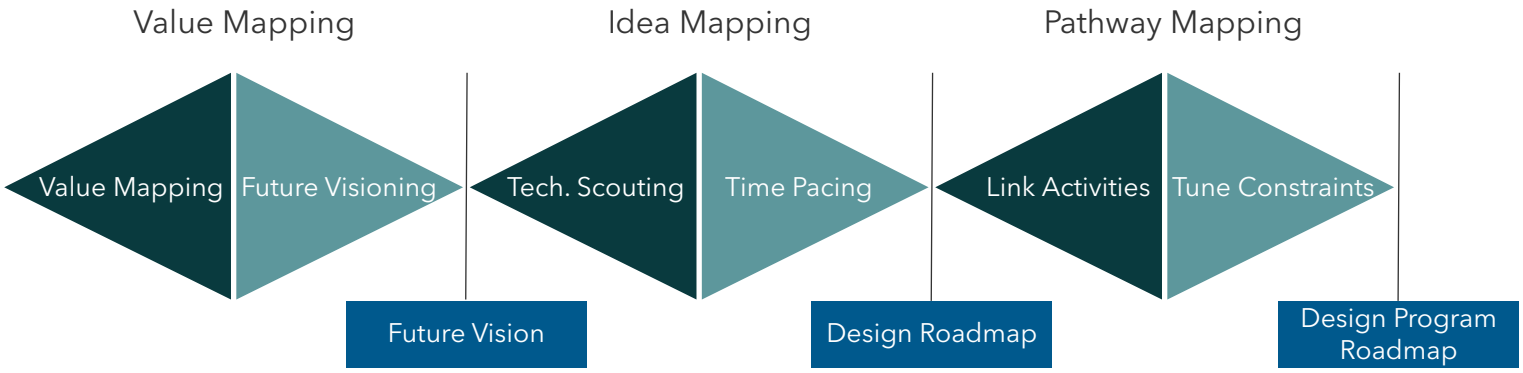


FIGURE 11 Roadmapping process by Simonse (2017, p. 18)

towards a complete roadmap. See *figure 11*. The first step, value mapping, will be done through thorough trend research, which will result in trend clusters. These trend clusters will be mapped to create an image of where Derako is currently in the market, and where they might potentially be heading. Based on this map, a future vision statement will be shaped.

The idea mapping stage is home to technology scouting. In this phase, user values will be linked to these technologies to create ideas which will solve certain predicted future needs. Consequently these ideas will be mapped over time through time pacing. The result of this phase is the design roadmap.

Finally there is the pathway mapping stage, in which certain details will be further elaborated on, such as lead times or investments. Here, a balance between all the aspects such as user values and technology development will be looked for, in order to create a realistic timeframe. Furthermore the different pathways will be aligned to the constraints such as manpower or investment.

VISUALIZATION

As already became apparent in the aforementioned definition of a roadmap by Simonse et al. (2015, p. 8), a roadmap contains a strong visual element. Through this visual element it will aim to inspire and spark creativity within the company. Though, the visual element is not the final objective, as described by Kerr and Phaal (2015), the visual image should reflect the content of the roadmap and facilitate communication of the strategic message.

Furthermore Kerr and Phaal (2015) mention a roadmap should show the essence of the intent, while laying emphasis on the most important parts of the roadmap. The content combined with a strong visual should mobilize action with the intended audience.

FUTURE OF THE ROADMAP

The roadmap is largely based on the strategy, which on its turn is based on the future scenario. As mentioned before, this future scenario is an approximation of the desired future, which is underlined by Ahola et al. (2010, p. 13): "[. . .] future development is likely to include some elements that are presented in these roadmaps, but there will also be new and surprising elements that obviously could not have been taken into account during their creation." Due to this, a roadmap should be an evolving entity, constantly reacting to new developments in the market and users.

CONCLUSION

Roadmapping is a valuable method to systematically unravel opportunities for Derako. The roadmap will, based on trends and the future vision, give Derako a clear indication of where their opportunities lie for the future. By incorporating several factors such as possible partners and technologies, the roadmap will give a clear overview of what steps need to be taken and what is needed. A visual representation of the roadmap will be used to communicate within Derako and create engagement.

TAKE-AWAYS

For many companies, sustainability is an important, but complex topic. A high amount of unclear or overlapping initiatives, labels and certificates create a jungle of possibilities. To see the potential and apply it into current business often seems difficult. This is also true for Derako. There have been important improvements and serious efforts into for example a C2C certification, but a strong message or direction on sustainability is lacking. This is relevant, as the industry is clearly moving towards a more sustainable future and customer demand on sustainability is slowly but surely rising.

The CE offers a highly promising perspective for the construction industry, in the Netherlands the first steps towards a CE in this sector have been made. However a completely CE is still far away, it is important for Derako to investigate the opportunity.

Sustainability can be a strong differentiator in a competitive market and should therefore be carried out through the means of effective communication. While doing so, Derako should be cautious to prevent greenwashing in any way.

For Derako to become more sustainable, sustainability should be an integral part of their strategy and cover different levels of design such as product, product service system and business model level. Especially when adapting a CE, these three levels are of critical importance to successfully execute the strategy associated with the CE.

Other than creating a roadmap to lay out the plans for Derako, it is important to realise the importance of a visual representation of the roadmap. Creating a strong visual can work as inspiration for all employees within the company.


DERAKO
Solid Wood Systems

IN PRACTICE: INTERFACE

An excellent example when it comes to making sustainability an integral part of business is Interface. Interface set out on their journey to have zero negative impact on the planet by 2020, they called it Mission Zero®. Being a carpet tile manufacturer, this was not a logical step, especially not in 1994.

However, through the vision of one man, Ray Anderson, Interface was able to become a purpose driven flooring company. Not only by changing their own ways of working, but by pushing the complete supply chain to collaborate. Interface was able to introduce new business models and products to obtain their goal.

In order to achieve these high ambitions, Interface questioned many aspects of the business. The first question being, how would a company look like if it was designed by nature? With that question in mind, Interface designed their own framework, The Seven Fronts of Sustainability, being: Eliminating Waste, Benign Emissions, Renewable Energy, Closing The Loop, Resource Efficient Transportation, Sensitising Stakeholders and Redesign Commerce.

Through setting agressive goals and designing a measurement system to test and quantify their achievements, Interface was able to act upon their goals. Meanwhile the Seven Fronts acted as a strong communication tool within and outside the company, bring more than just inspiration, but also strong handles to act upon.

In 2019, Interface was able to reach their goal, and inmediatelly set out on a new goal: Climate Take Back™. Their new aim; giving back to the world, reversing climate change and leaving a positive impact.

Interface aims to inspire other businesses to take their responsibility, and be the change themselves. By sharing their knowledge with the world through nine lessons, they hope to help others to face the future. The lessons can be found on the right.

Interface has been able to archieve what was seemingly impossible from the start, but through their aim (sustainability), with a strong vision (strategy) and a solid plan (roadmap), they were able to make it happen.

Reference: Interface (n.d. a and n.d. b)

Some explanation on the selection of this example can be found in *appendix 2 (page 125).*

1 Shoot for the moon

2 A change in mindset can change everything

3 Every vision needs a plan

4 Take a circular approach

5 To change everything you need everyone

6 A wrong turn can lead to the right result

7 Be transparent

8 Start a ripple, create a wave

9 Raise the bar

3 Current Context

In this chapter the current context of Derako will be uncovered; what does their process look like and who are the most important stakeholders. The research will also focus on the current status of sustainability at Derako, what have they done to improve, how do the employees feel about sustainability and what are the main bottlenecks.

THE DERAKO PROCESS

In order to better understand Derako and their processes, I have been part of the production team at Derako for four days. During this I have been able to experience first hand how the process works from start to finish. This time was indispensable experience for this project, as it gave me the opportunity to talk with employees in the workshop, ask them about specific parts of the process, the production methods used and improvements that have been made over the years. Furthermore I was able to fully grasp the complexity of working with a natural material like wood.

THE PROCESS

Derako buys wood project specific, which means for each project is decided what type of wood, the size, type of certificate, quality and quantity of the wood is needed. The quantity is decided while taking into account dropout of raw wood due to low quality, losses in processing and accounting for a small amount of remnant slats.

This raw wood is ordered from wholesalers or distributors, when the wood arrives at Derako, it will be checked for quality and whether the specifications are correct. The wood will be sawed and planed, the result of this is the gross size wood.

If the wood will be treated with a fire retardant, this will always be done externally. Afterwards, the wood will be dried, this can happen internally or externally. The result is the treated gross wood. If the wood will not be treated with a fire retardant, it will not be dried.

Now both product lines will follow a different process. The Grills will be planed and drilled which will result in the net wood. The Lineair product will be planed and grooved, also resulting in the net wood.

The Grill product will first be painted, then cut to length, assembled and packed, ready for shipping.

The Lineair product will be cut to length first and receive tongue and grooved on the front sides. After this the product will be painted, optionally a non-woven tissue will be applied and finally the product is packed for shipping.

In *figure 8* a visualization of the process can be found, including an indication of the wood waste streams.

WOOD WASTE

As becomes apparent from the analyzing the process, there are numerous streams of wood waste in both products, this can range from raw moth to completely finished slats with a quality issue. Dropout wood is also present in different stages of processing, from raw planed wood to painted slats. See *figure 13*.

Currently these streams are not separated, all dropout and cut off pieces end up in the same wood waste container. In the rare occasion completely assembled panels (Grill) are being discarded, these will end up in the general waste bin, due to the metals in the panel.

The moth will be separated from the wood, raw moth will be used for the furnace at Derako, which provides heat for the drying chambers and heating the building. Treated moth will be collected in a container. See *figure 14*.

The wood waste streams have been mapped, see *appendix 1A (page 124)* for an elaboration.

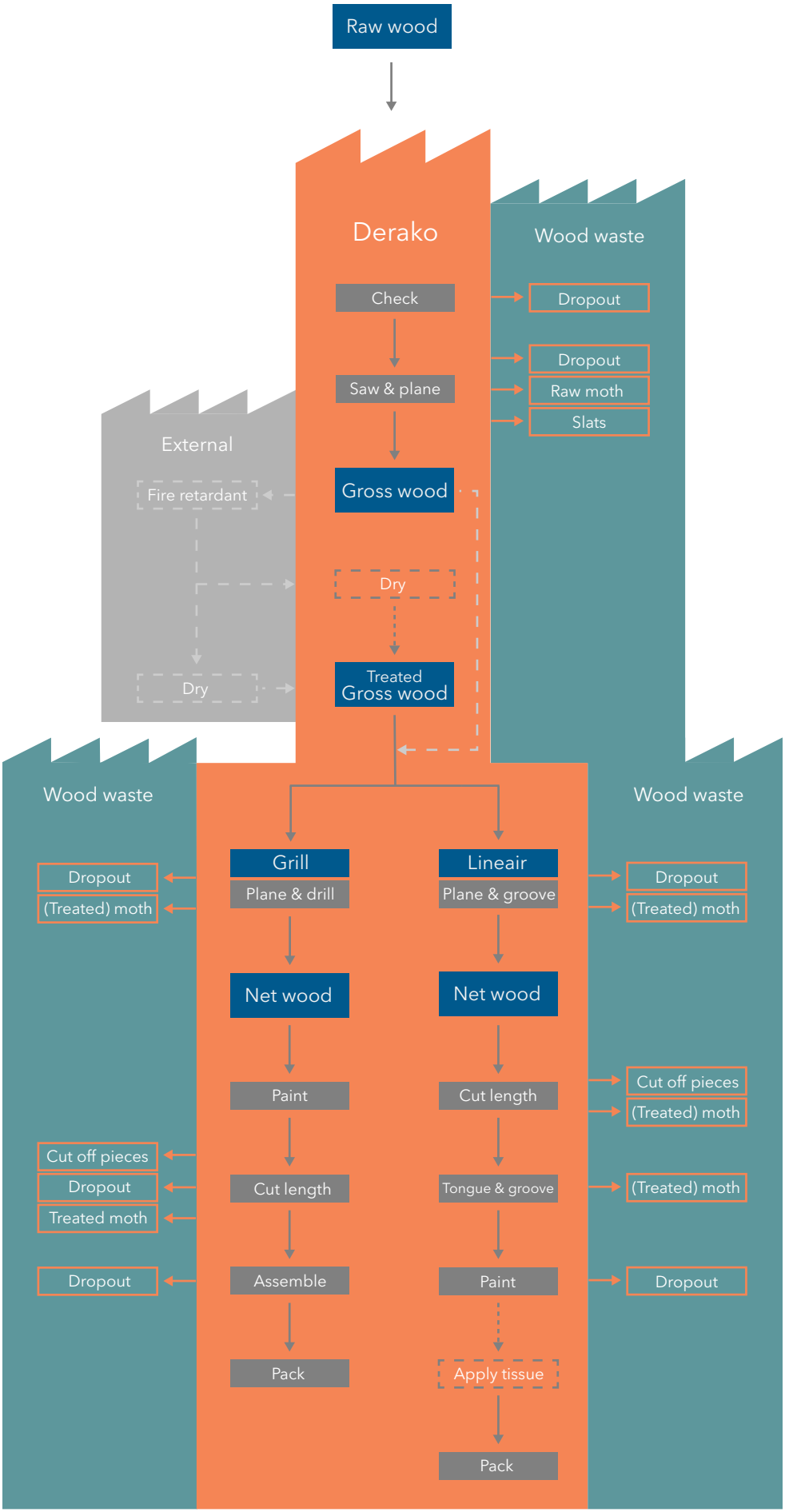


FIGURE 12 The process visualized with the wood waste streams

OTHER WASTE

Other waste is being generated as well. A large part of this waste is packaging from incoming materials, for example small plastic boxes, paint buckets or straps around incoming wood. Additionally there is waste generated from residual materials such as clips, rails or dowels. See *figure 15*.

For each waste stream, there is a separate bin: metal, aluminum, paint, wood A-class, small chemical waste, transparent foil, plastics, paper and cardboard and remaining waste. See *figure 16*.

GENERATING WASTE

Derako itself uses packaging material to safely ship goods. The Grill panels are packed using a couple of layers foam foil and thin plastic foil. This method has proven to be the most effective in preventing imprints on the panels. See *figure 17*.

Linear panels are sealed in plastic and packed with slats in between. These slats are remnant or dropout slats from production. See *figure 18*.

Both products are additionally wrapped with black plastic foil to prevent discoloration of the product. This wrap is sometimes used within Derako if the material is stored for a longer period of time in the workshop. See *figure 19*.

Derako has designed their own crates, which are strong and have a low material intensity. These crates are made from newly purchased low quality wood. Their size depends on the size of the content. See *figure 20*.

The use of plastic is known to be environmental unfriendly, especially when processed in such large quantities. At construction sites it is not always possible to successfully separate waste streams and therefore plastic is being disposed as general waste. Furthermore it is common for light materials to be mislocated from the construction site, for example due to hard winds. The plastic waste streams have been mapped, see *appendix 1B (page 125)* for an elaboration.

The crates can create a burden on a construction site, as mentioned by Derako themselves. Due to their large scale it is difficult to handle and dispose. Some builders even see value in the material and put them up for sale on Marktplaats. This clearly indicates it is seen as a shame to dispose the crates after a single use.

CONCLUSION

With their current process, Derako is able to create fully custom made, bespoke products that completely fit customer requirements. However, their process is rigid and wasteful, creating many different streams of redundant waste materials. Currently these waste streams are barely or not utilized, causing a monetary and environmental burden.

Derako is also responsible for creating waste at constructions sites, mainly in the shape of packaging materials such as plastics and large wooden crates. These materials serve a single time purpose and are hard to reuse or repurpose in their current shape. Therefore their function and application could be reconsidered.

FIGURE 13 Dropout wood waste

FIGURE 14 Collection of treated moth

FIGURE 15 General residual waste

FIGURE 16 One of the separate containers, in this case metal

FIGURE 17 Packaging of Grill panels

FIGURE 18 Packaging of Lineair panels

FIGURE 19 Black plastic wrapping used internally and for transport

FIGURE 20 The crates for transport

STAKEHOLDERS

STAKEHOLDERS OF PROCESS

As with many production companies, Derako has quite a complex map of stakeholders. These include stakeholders from whom Derako buys, such as the manufacturers of the rail system, the aluminium dowels or their patented clips, but also wholesalers of wood. The map also includes stakeholders to whom Derako sell their products, ranging from building owners and end users, towards architects and contractors.

In this analysis the main focus will be on plotting the stakeholders concerning the inflow of wood and stakeholders in the sales process. Other stakeholders will be touched upon, but have little influence on the overall sustainability performance of Derako, as the volume of this product is relatively small. See *figure 21*.

Harvester
Going down the line of wood, the main material inflow for Derako, the first stakeholders involved are the harvesters or loggers. They are responsible for harvesting the wood from forests or tree farms. This group of stakeholders is quite far from Derako and there is no direct line of contact. The harvesting industry is old fashioned and reluctant to change.

Sawmill
The wood will usually be milled by a sawmill, who will decide the size of the wood. These sizes differ per country as these sizes are often standardized in commercial sizes that are common locally, for example inches in the USA or millimetres in Europe. The end product of the sawmill is referred to as raw wood. The sawmill is a far stakeholder as well, often old fashioned and reluctant to innovate.

Trader or Agent
An optional third stakeholder is a trader or agent, which is solely responsible for buying and selling the wood to wholesalers. A trader does not add to or deduct from the material.

Wholesaler
The fourth stakeholder is usually a (relatively) local wholesaler, generally speaking located in West-Europe. This is where Derako buys the raw wood. Wholesalers are responsible for keeping large stocks of woods. When Derako needs a certain type or size of wood, they are dependent on a collection of wholesalers to have that type of wood in the right quantities. If not, the first option is to buy a different (bigger) size, resulting in more waste in the process.

Derako Employees
When the wood arrives at Derako, it will be handled by Derako employees. Derako is highly dependent on the aforementioned stakeholders to deliver the right sizes, quality and volume, as it will influence their process.

Leegwater or Woodsafe
Once the wood has been planed to the gross size, more than half of the wood will be treated with fire retardant. This happens externally at Leegwater (Heerhugowaard) or Woodsafe (Västerås, Sweden) . Once this has been done, this stakeholder will ship the wood back to Derako to have it dried, or it will be dried externally.

Hunter Douglas
The end product is either sold through Hunter Douglas, a Derako partner responsible for the sales abroad. In case Hunter Douglas sells a Derako product, Derako will handle all organizational processes such as making product drawings, production and distribution. Hunter

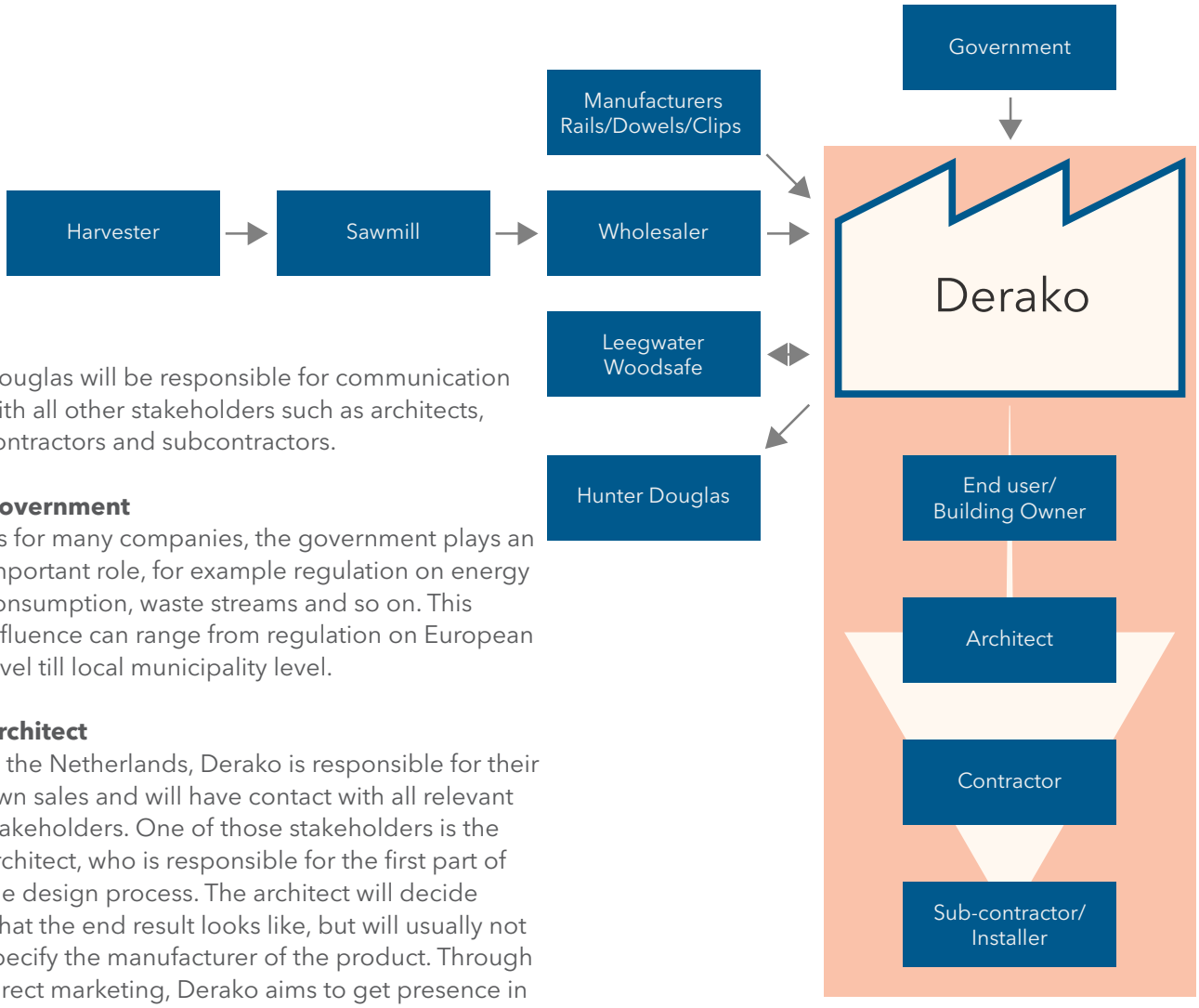


FIGURE 21 Visual representation of the stakeholder map, with the focus of this thesis highlighted.

Douglas will be responsible for communication with all other stakeholders such as architects, contractors and subcontractors.

Government
As for many companies, the government plays an important role, for example regulation on energy consumption, waste streams and so on. This influence can range from regulation on European level till local municipality level.

Architect
In the Netherlands, Derako is responsible for their own sales and will have contact with all relevant stakeholders. One of those stakeholders is the architect, who is responsible for the first part of the design process. The architect will decide what the end result looks like, but will usually not specify the manufacturer of the product. Through direct marketing, Derako aims to get presence in the mind of the architect, possibly leading to the architect specifying Derako in the design. This would increase the chance of Derako receiving the project. In case of more complex projects, for example the ING Paviljoen which features a double curved wooden Derako ceiling (see *figure 22*), Derako will be involved early in the process. Derako will work together with the architect to ensure the complex project can be realised.

Contractor
From the architect, the design is handed down to the (main) contractor. The contractor is responsible to construct the building within a certain budget. The contractor will ensemble a team of the needed installers or subcontractors to perform the construction and installation of the building.

Installer
The installer or subcontractor will be asked to put a bid for the project, specifying the costs and the product brand, for example a Derako product or one of their competitors. In order to ensure Derako being featured, the marketing of Derako focuses on installers as well.

In the end, the (main) contractor will decide which installer will win the bid and therefore whether Derako will get the order. Consequently, the marketing of Derako also focuses on the contractor, in order increases the changes of the contractor choosing for a Derako product.

End User
The final users of the Derako product, such as employees or visitor of the building are stakeholders, but do not have any contact with

Derako. However, their influence on the Derako product does seep through in the long run. The end users are at the basis of the trends and developments, such as increasing demand for sustainable products.

Building Owner
The building owner is somewhat on the same level as the end user, in a sense that there is no contact between the owner and Derako. However, their influence on the Derako product is significant. In the end, the building owner will be partly responsible for making the purchase decision. Furthermore, buildings owners will be responsible for the push of trends such as circular or sustainable building, which again influences Derako.

Transport
A group of stakeholders not mentioned, but present throughout the whole process are the transporters of the Derako products. This group is crucial for the operations of Derako, but their influence on the product is limited.

USERS GROUP

For the Derako products it is hard to specify a single group of users. The interactions with a Derako product are limited, as the main function of the product is of visual nature. Interactions occur when the product is being installed or when a Derako product is used on a moving object such as a door or a hatch.

Therefore the following user groups can be identified in an interaction level: installers or subcontractors and end users of the space.

However, other stakeholders have to be taken into account in the overall design innovation process,

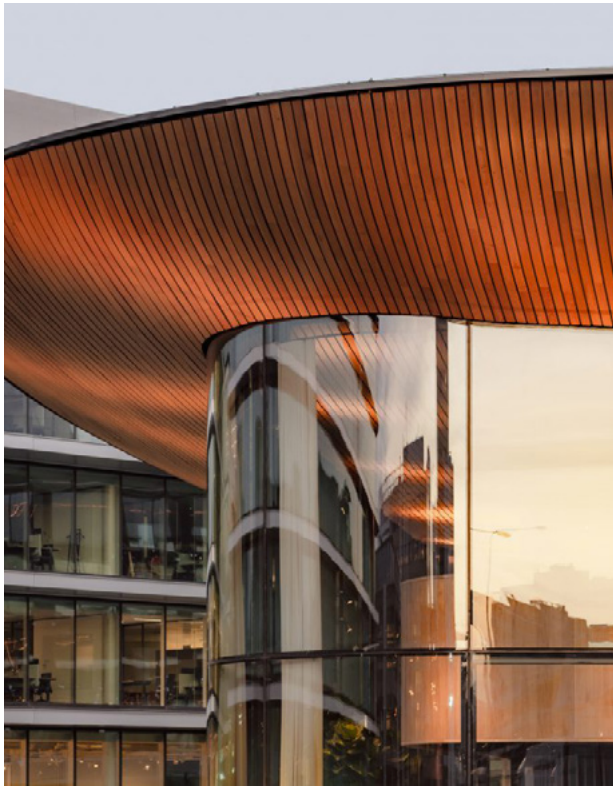


FIGURE 22 ING Paviljoen desgin by Powerhouse Company, wooden ceiling by Derako (Capelleveen, 2019)

as their influences on the market is significant. These groups are the architects and the building owners.

An obvious group which are not considered users are the contractors. Even though they are an important group in the overall decision taking, they do not have direct interaction with the product. Furthermore, their influence is limited when it comes to innovation and product development. Most of these developments are pushed by the client such as the building owner or the architect, as stated by Stefan de Meijer (Powerhouse Company) and Erwin Ockers (Boele & Van Eesteren). An example of this is that when a building is made, decisions about the sustainable

performance of the building will not be made by the contractor. Rather, they will follow what the client or architect desires.

STAKEHOLDER NEEDS

As described in the chapter *Boundaries of this thesis (page 18)*, in this thesis the focus will be on the sales side of the stakeholder map, being the architect, contractor, installer, end user and building owner, also see *figure 21*.

These stakeholders all have different needs and requirements when it comes to the Derako product. As mentioned before, the interaction with the Derako product is relatively small. For example, the end user will mainly desire the Derako product to provide a pleasant atmosphere with good acoustics and possibly contributing to a healthier work environment. The building owner will consider the same elements as the end user, but will additionally be focussed on the practical elements of the product, such as ease of installation and maintenance and costs. Depending on the user and the type of building, the sustainable performance of the product might be relevant as well.

The installer is focussed on installing the product. Therefore important needs are ease of installation, fit of the product and price.

For the contractor, their needs are mainly dependent on the needs of the client, if they desire a certain property, for example a certain look, price or sustainable performance, the contractor has to take those needs into account.

The needs of the architect are a bit more complex. Architects are often visionary, aiming for out-of-the-box designs. These can involve custom made ceilings or walls (see *figure 22*), in which case the architect requires form freedom and collaboration with Derako to create such shapes. In many other cases the architect needs revolve mainly around versatility and visual attraction of a product.
In specific cases, an architect aims to create a sustainable building, in which case the products present in the building need to adhere to certain guidelines.

The needs as mentioned above have been derived from extensive research and a number of interviews with experts, a full lists of involved experts can be found in *Industry Research (page 67)*.

CONCLUSION

The stakeholder map of Derako is quite complex. Both the market of raw wood and the construction industry are quite traditional, and innovation is slowly adapted.

The users of Derako are not as clearly cut out as in many consumer products. In this case, the user of a space is also a user of the Derako product, even though interaction may be limited. As this thesis focusses on improving the sustainable performance of Derako, the influence of the end user can be considered low and will be left out of scope.

The needs of the stakeholders involved at the sales end are various, mainly because this group ranges from architects to end users. As a result, every product introduced by Derako must find a balance in fulfilling as many needs as possible from as many different stakeholders as possible.

SUSTAINABLE EFFORTS BY DERAKO

Over the previous years, Derako has set out to become a more sustainable business. In order to achieve this, Derako has made various efforts, such as finding a destination for wood waste and certifications to support and proof their sustainable efforts.

WASTE WOOD

Derako aims to sell on parts of their remnant and waste wood to be used in other industrial applications. This wood can be in various states of processing, from untreated sawdust to completely processed and painted slats. Wooden slats can be sold on to other woodworkers such as carpenters or cabinetmakers, sheltered workshops and so on. However, these parties are often demanding on the quality, for example only wood of a specific size and quantity. Meeting these requirements costs a lot of manual labour while the financial gains are limited. Moreover, it has proven to be difficult to find enough parties to sell the large amount of redundant wood Derako has.

The untreated and treated sawdust Derako has as a result of sawing, planing and other treatments, gets collected through a central collection system. If raw wood is being processed, the sawdust ends up in their silo while the sawdust of treated wood ends up in a container outside to be discharged by an external company. The (untreated) sawdust from the silo is being used to heat the building in the winter and to provide heat to the drying chambers inside the building.

Within the workshop, separating waste is a daily task. Throughout the workshop there are numerous different types of bins which all serve their own purpose: metal, aluminum, paint, wood A-class, small chemical waste, transparent foil, plastics, paper and cardboard and remaining waste.

Part of the waste collected at Derako will be sold, other materials do cost money to dispose. For some materials this changed considerable over the past years. The residual wood used to be sold for money, while nowadays it costs money to dispose. This development is one of the reasons for Derako to reconsider their (wood)waste stream.

CRADLE TO CRADLE

Derako has a silver C2C certification on all their products, which has been a great effort for Derako in terms of time investment. In terms of changes to their products, it has proven little changes were needed.

ISO 14001

Derako has an ISO 14001 certification, which focuses on an EMS. The EMS systematically identifies, prioritizes and controls environmental aspects of the business, such as water and air usage, noise disturbance and energy usage. ISO 14001 does not prescribe the acceptable norm of any of the aspects, rather it requires companies to constantly improve upon those aspects (NEN, n.d. a).

CERTIFIED WOOD

Derako is invested in selling FSC and PEFC certified wood as much as possible. These certifications are industry standards and are therefore much sought after by clients. These certification can be seen as a must nowadays, although not all wood sold will have such certifications, not being able to deliver with certification results in decreasing sales. Both

FSC and PEFC focus on growing and harvesting the wood sustainably while taking care of local communities in the process (PEFC, n.d.; FSC, n.d.).

BREEAM and LEED

A multitude of certifications and performance indicators are available to benchmark the sustainable performance of a building. Examples of these are BREEAM or LEED.

Derako products can contribute to the rating on those certifications, a building will score extra points on the BREEAM assessment when a Derako product has been installed. Derako mainly contributes to the use of sustainable materials, healthy indoor climate and acoustics.

Roughly the same applies to LEED, which Derako is also familiar with. This certificate is more widely used in the United States of America.

HIT PROFIT

Derako has been certified by Hit Profit on their energy consumption and savings. This certification focuses on saving energy through the business to reduce costs and become more sustainable.

CONCLUSION

Derako has been able to improve their business and operation over the previous years, allowing for a silver C2C certification, among other certifications. By doing so Derako proves to be willing to become more sustainable while taking the opportunity to grow.

When looking critically at the business, these certifications are a good indication of going in the right direction, however there are many opportunities to improve further. These can range from investing in solar power and critically reducing the wood waste towards introducing a circular product line.

EMPLOYEES ON SUSTAINABILITY

In order to develop a sustainability strategy and roadmap, my strong belief is sustainability should be an integral part of the organization. Therefore a survey was conducted to investigate whether sustainability is represented well inside Derako. The questionnaire can be found in *appendix 3A (page 126)*.

First of all, a distinction was made between sustainability in the daily lives and work lives of the employees. Secondly the respondents were asked whether they either work in the office or in the workshop, as the assumption was there would be a difference in mindset. The respondents were asked to rate certain statements on a 7-point Likert Scale.

The results of the questionnaire can be found in *figure 23*. Additionally the table with results can be found in *appendix 3B (page 127)*.

Certain conclusions can be drawn from the questionnaire. First of all it is worth noting there are only minor differences between office and workshop employees in the perception and interference of sustainability in their daily lives. The highest notable difference is whether sustainability is deemed an interesting topic by the respondents (office 5.6/7, workshop 4.8/7).

However, when looking at the results of questions about sustainability at work, the differences are more significant. When respondents are asked whether they often take sustainability into consideration at work, office employees score considerably lower than their workshop collegues (office 4.1/7, workshop 6.4/7). Also when asked whether they know what is expected of them on the topic of sustainability, the differences are large (office 4.9/7, workshop 6.8/7). When the respondents were asked whether they are being stimulated to handle materials sustainabily, again workshop employees score considerably higher (office 4.3/7, workshop 6/7).

These large difference could be largely attributed to the fact that workshop employees actually handle a lot more materials than office employees and are therefore more conscious about their actions. However, one could argue that when office employees sell the product, their input can influence the end result and therefore the material use for a specific project.

Finally, two questions were asked about the general performance and perception around sustainability of Derako, namely whether employees are proud of how Derako handles sustainability (office 4.6/7, workshop 5.6/7) and whether respondents would describe Derako as a sustainable company (office 4.7/7, workshop 5.6/7) .

CONCLUSION

When asking office and workshop employees about sustainability at Derako, the differences are significant. Workshop employees seem to be more engaged with the topic and have a better understanding of what is expected of them. As a result, they would be more likely to describe Derako as a sustainable company. The reason for this may lie in the fact that handeling the materials and separating waste streams is part of their daily work life, whereas office employees are less engaged in these kind of activities.

Generally speaking, while the majority of the employees feels sustainability is an important topic, Derako is not being described as a highly sustainable company.

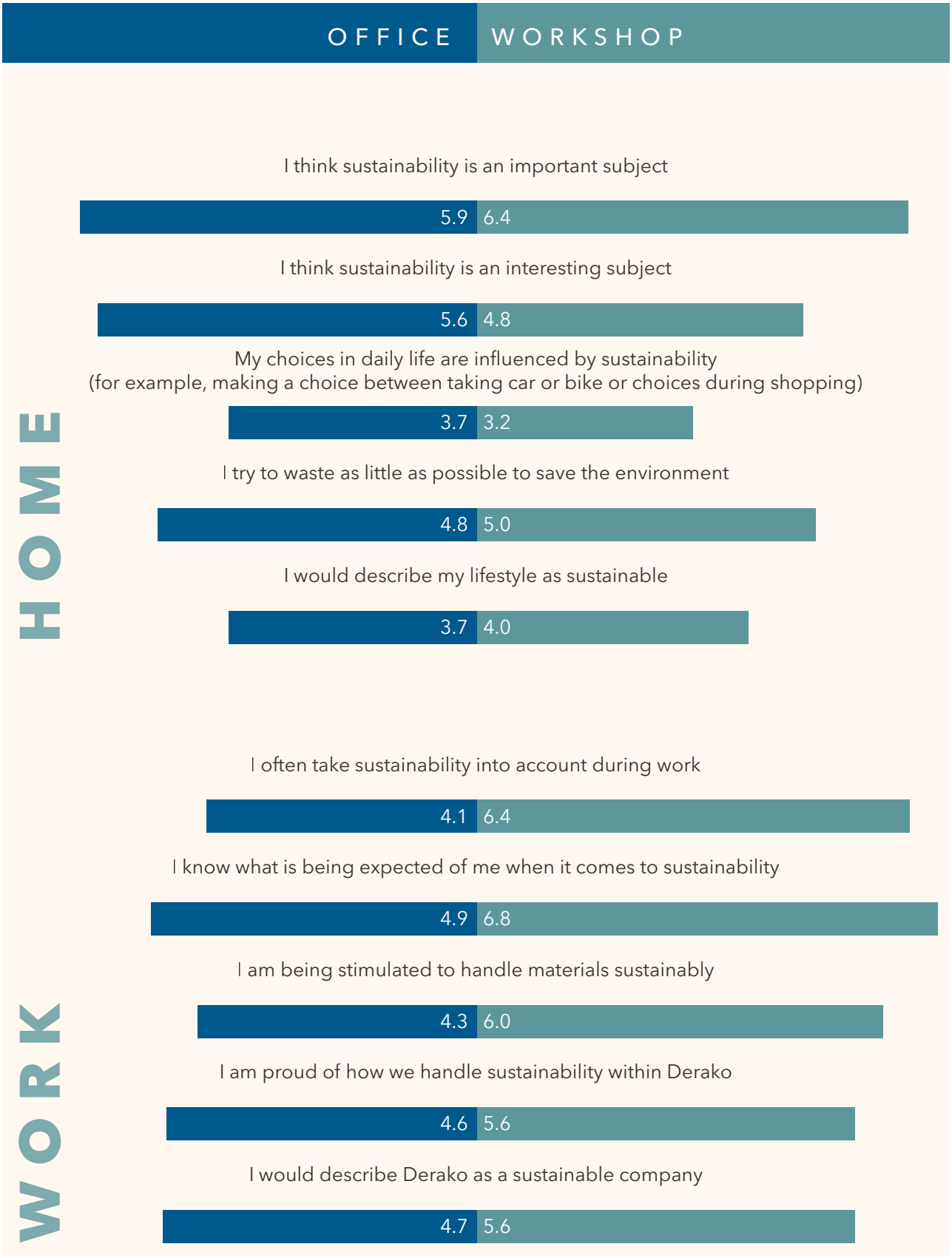


FIGURE 23 Average scores as results of the questionnaire among employees, all rated on a 7-point Likert scale.

CURRENT MAIN BOTTLENECKS

PRODUCT AND PROCESS

As mentioned by Derako themselves, the main waste of their operation is the large amount of woodwaste generated. Less than 50 percent of the wood bought by Derako ends up in their final product. The other 50 percent is being sawed, planed or simply thrown away. This has a big impact, both financially as well as on their sustainability performance.

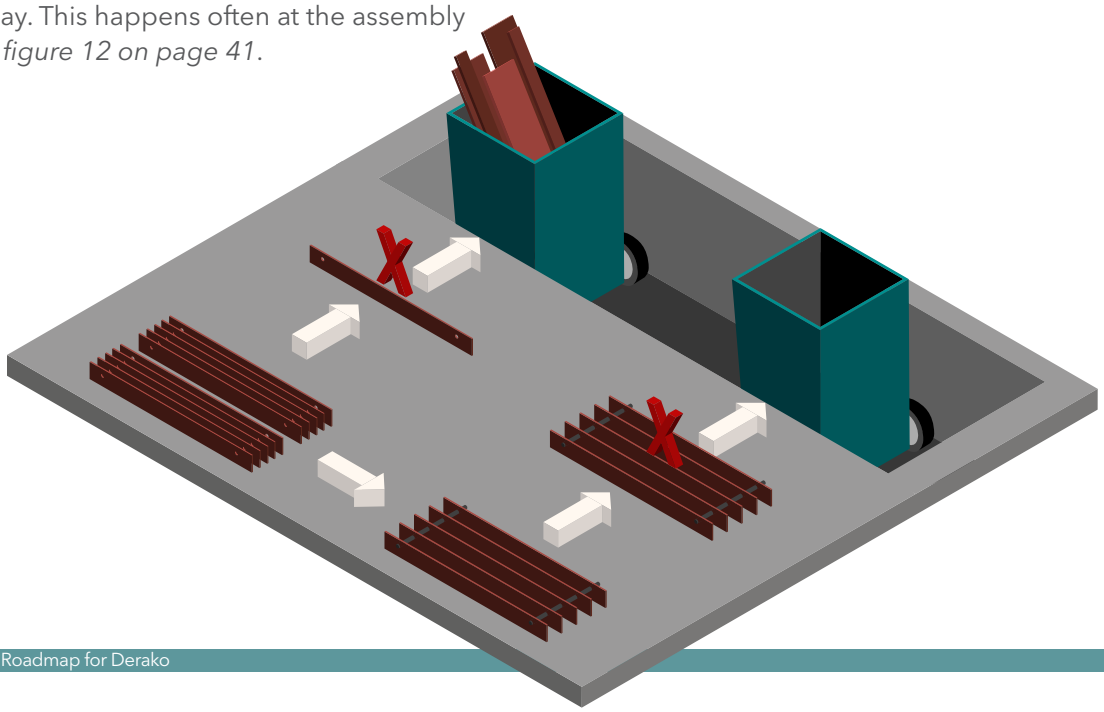
The two product lines Derako offers, Lineair and Grill (see *figure 1* & *figure 3 on page 13*), both have their own unique production method with their own bottlenecks.

The properties of the Grill product line leave little room for imperfections in the wood, as the Grill panels are being delivered in a specific length. This means every slat has to be this exact length without major imperfections. If a slat has an irregularity or is damaged, this specific slat is sent back in the process and might be cut down to be used for a shorter panel. If it is not possible to use the slat for a shorter panel, for example because there are no shorter panels in the project or the slat is damages on multiple points, the slat will be thrown away. This happens often at the assembly stage, see *figure 12 on page 41*.

For the Lineair product line Derako makes use of a different principle. Unlike the Grill product, the Lineair product does not consist of assembled panels, instead Derako will deliver the required amount of slats to cover the surface area of the project. The slats are most often not of a specific defined length, but are being cut according to the material properties. This means, if there is a knot, a crack or any other imperfection in the wood, that piece is cut out. As a result, the remaining pieces are of different lengths and are mounted as such, Derako call this 'falling size' or 'falling wood' (in Dutch: vallende maat/hout).

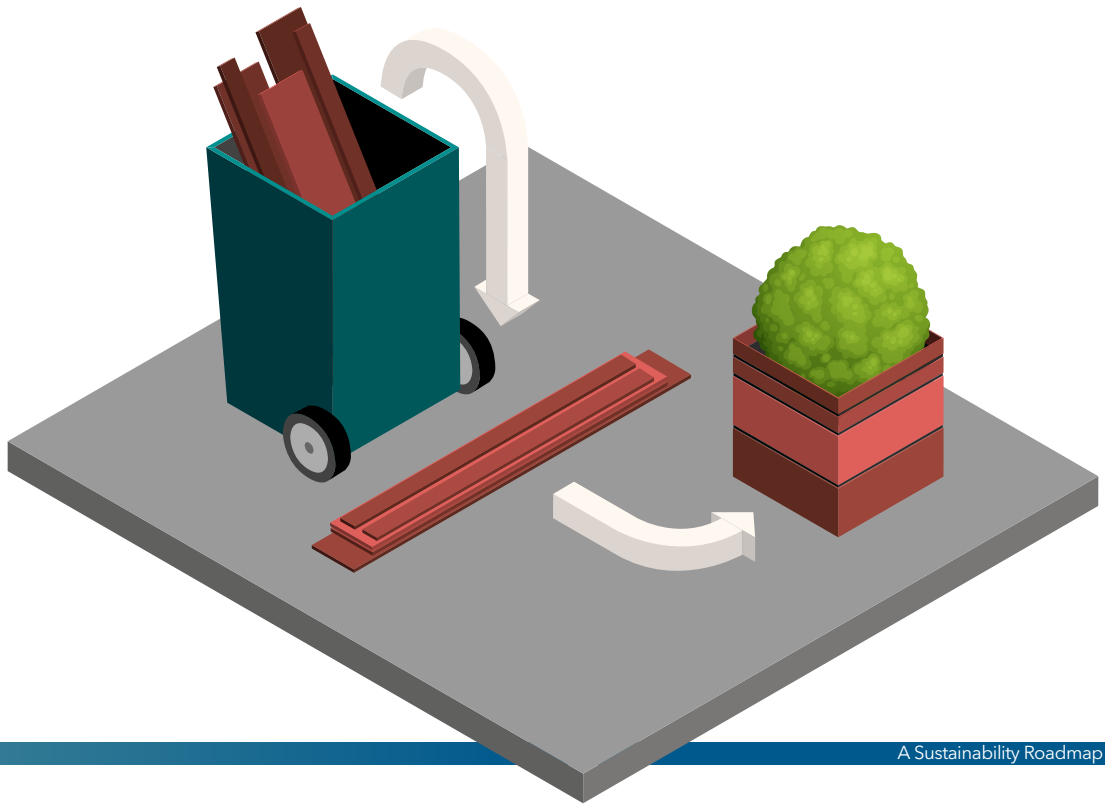
In some cases, the Lineair product line is applied using a specific length of slats, for example in small hallways where the use of falling sizes would be visually unpleasing.

As a result of this production process, the Lineair product line is less susceptible to waste than the Grill product line. However, the Grill represents a larger amount of the sales, although being the more expensive option.



REUSE WOOD WASTE

Reusing wood waste presents certain challenges for Derako. First of all, there are different types of wood waste streams, all in different state of processing, sizes and wood types. These streams are currently not separated and therefore hard to reuse. Furthermore, due to the large scale of wood being processed, it is hard to find a fitting destination for the material. Smaller amounts can be sold on to parties such as schools or cabinetmakers, for these larger batches this is challenging and time consuming.

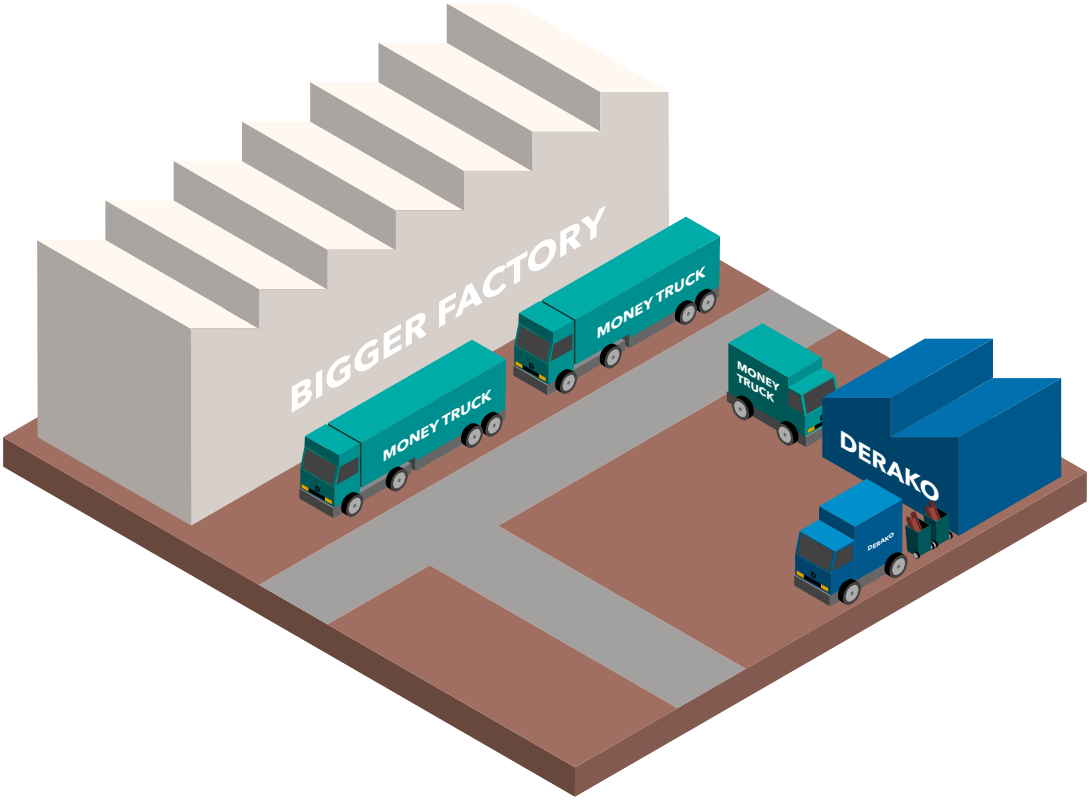


STAKEHOLDERS

In order to minimize waste in the processes, some stakeholders have to be considered. Firstly the sawmill, who decide what sizes the wood will be delivered in and therefore how much of this wood will be wasted. This part of the industry is highly traditional and not likely to change. In addition, although being a large player in the market, Derako does not purchase enough to dictate certain sizes from the sawmill.

Secondly the customer, who decides which sizes to fabricate and install. This is partly a similar issue as with the sawmill, namely the size decides how much wood will be wasted. The customer can be steered on this decision by mentioning the costs and sustainability savings that can be made, but ultimately the customer will decide.

While Derako has made big steps towards a more sustainable business, their growth is partly limited by their customers. Derako operates in a higher price segment, in which they earned their place by delivering a high quality product. Sustainability is a part of their identity, also justifying the higher price. However, not all decision makers in the purchase process will be influenced by this. For example, an architect might be attracted by the sustainability aspect, but for installers this might be completely irrelevant. The issue that arises with this is the need for different marketing communications for different stakeholders. A communication focused on solely sustainability aspects will simply not work for all customers.



LIMITED BY SIZE

Another aspect that limits growth in sustainability is the fact that Derako is a relatively small company. At Derako, the most important aspect is the day to day routine, meaning selling and producing the products. At Derako there is no large innovation team or R&D department. If there is a need for improvements or innovation, time has to be reserved, meaning other aspects of the business will be slowed down. Investing time and possibly money is one of the biggest limiting factors for Derako to innovate radically.

CONCLUSION

Derako seems to be stuck in their habits of handling materials. Their current products allow little room for reducing waste while keeping the same high quality standards, partly because their process is optimized for customization and client satisfactions.

Reusing the wood waste of Derako is challenging as there are numerous types of wood waste and the quantities are large.

In becoming more sustainable, Derako would benefit from a more close collaboration with both their suppliers as well as their customers.

As a SME, Derako does not have the means nor the time to focus on constant innovation, as their day to day operations requires constant attention. For Derako it might be relevant to quantify how much time and money can be allocated for innovation.

TAKE-AWAYS

Derako is focused on creating custom made, high quality products that align with the customer requirement. This gives them a strong position in the market, they are seen as a reliable partner for architects and contractors. However, their way of working poses them with some challenges.

Wood Waste
First of all, their process is wasteful and rigid. Different waste streams are generated within their workshop, of which a big part is wood waste. This wood waste comes in different shapes, ranging from treated moth till completely finished panels. Other than using the raw moth in their own furnace, reusing these waste streams has not been successful yet on large scale. If done successfully, Derako can contribute to a cleaner production while saving money in the process.

Other Types of Waste
Additionally, there is a large amount of other waste generated on the internally and on construction sites. Internally this is mainly plastic, for example plastic wrapping which is being used between separate processes.
Externally plastic and wooden packaging materials are the biggest polluters. The wooden crates are made of new, B-quality, wood and it is seen as a waste to throw them away. Furthermore these crates are large and a hassle to store. Plastic between different panels and around the product is only used for transport and serves no other purpose afterwards.

Reduce and Reuse
In order to become more sustainable, Derako has to look into reducing and reusing waste.

Internally Derako has two main waste streams, wood and plastic. Reducing internal plastic waste is an experimental process of investigating where plastic can be replaced with a reusable, material.

Reducing the wood waste is a bigger challenge. Their current process is designed to create custom made products. Their Grill Base-Line is a start in reducing waste, optimising a product to fit the purchase sizes of the wood will reduce waste during planing and cutting to length.

Also reusing their wood waste streams posses challenges. As described, there are different types of wood waste streams, all in different state of processing, different sizes and wood types. These streams are currently not separated and therefore hard to reuse. Furthermore, the scale of this waste streams is large and therefore challenging.

Employee Engagement
Derako is the sum of its employees. In order to improve in any way, employees have to be engaged and proactive in minimizing waste. This applies to all employees, from office to workplace. Currently, it seems workplace employees are carrying the main load of reducing and reusing materials. Office employees should be stimulated to think about reducing waste through their own role, for example sales or logistics.

Working With Stakeholders
The interaction the stakeholders of Derako is quite complex, as the role of Derako can change from project to project.

For Derako it is important to balance the needs of different stakeholders for each development. In order to successfully implement solutions to improve sustainability, it might be needed to involve different stakeholders in the process. This can for example be done through collaboration with large contractors to reduce waste, for example the plastic and crates used for shipping.


Project name
Order number
Woodspecie
Module
MIGROS Manor Fase 1
22956
Am. Red Oak
105
DERAKO

Trends

This chapter will focus on uncovering the relevant trends in the context of Derako, where the trends will be split in three parts.

First, mega trends describing the big overarching trends that develop slowly over time. These trends often influence many different market and company segments. See *appendix 4A (page 129)*.

Secondly trends in the built environment will describe how the environment Derako is operating in might change. These trends include construction, material, technology and sustainability trends.

Finally the market trends, these trends will describe the (changing) needs of the market in the coming years. For additional market trends, see *appendix 4B (page 130)*.

References for all trends can be found in *appendix 4C (page 131)*.

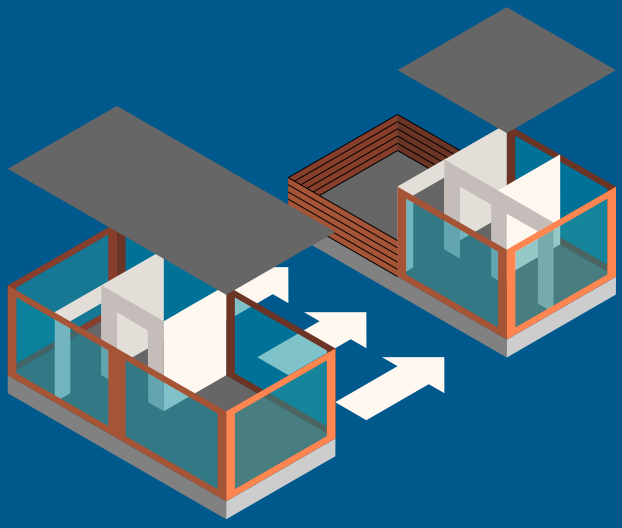
Furthermore some of the regulation trends will be discussed.

BUILT ENVIRONMENT

FLEXIBLE BUILDINGS

Urban areas are getting increasingly more crowded, while the world is changing more than ever. Needs and desires of people and businesses change in a high rate. As a result buildings become irrelevant much quicker.

Flexible buildings offer great opportunities, allowing for short or long term changes, from moving a wall to complete dismantling of a building. It can be applied in various places, from office buildings to personal living spaces. Flexible buildings can provide to specific needs at specific times whilst being more sustainable.

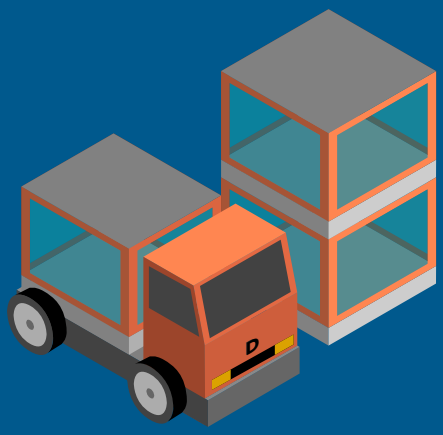


PREFAB & MODULAR BUILDINGS

Little space during construction in the city, high pressure on construction times and nuisance during construction for local residents. These factors all present challenges for building in the urban environment. Driven by these challenges, a possible solution has been introduced: prefab and modular building.

Prefab and modular building provide the opportunity to make certain walls or sections elsewhere, where the conditions are optimal. Through this, there is a large opportunity to reduce waste, limit mistakes and therefore lower the costs of construction.

There prebuild sections are transported to the building site where these sections will be assembled into the larger building.



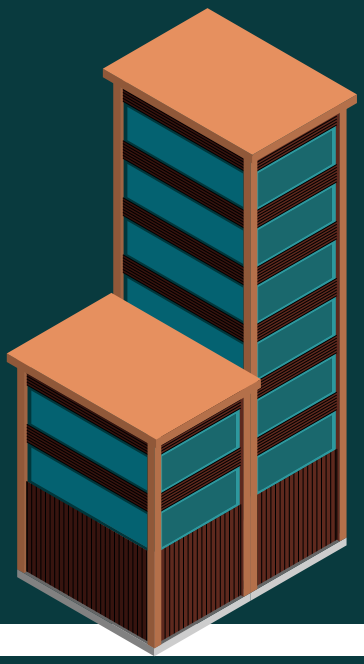
FLEXIBLE & MODULAR BUILDINGS

A future of flexible and modular buildings. Buildings will largely be built off site and assembled on site. Many aspects of a building will be able to adapt to new users or new functions. After use, a building can easily be disassembled. Assemblies can be reused or materials can be regained from them.

BUILDING WITH WOOD

Wood has been around as a building materials since time immemorial, often used for personal homes as light construction or decoration. However, wood is proven to be a good structural building material offering plenty of freedom and possibilities for building high rise. For this application, Cross Laminated Timber (CLT) is a widely used material.

Construction with wood is proven to be environmental friendly and not (much) more expensive than steel or concrete. Moreover, wood is readily available. These factors result in an increasing interest for wood as construction material.



GREEN BUILDINGS

Green buildings in the most literal sense of the word. Cities cope with different environmental challenges, such as increasing heat, air quality or loss of biodiversity. Green buildings can contribute greatly in solving these challenges. Green buildings incorporate trees, plants and wildlife into the urban buildings, creating a small oasis of nature in the concrete jungle.

Furthermore, by bringing nature closer to people, certain benefits for health and joy of living become apparent. Some examples of green buildings in the Netherlands are Wonderwoods or The Valley.

INCORPORATE NATURE IN THE CITY

Sustainability and health are becoming increasingly important factors in our lives. Together with the trend of urbanisation, we will bring nature into the city. Building with wood is a sustainble way of building, providing serious health benefits to humans and surrounding nature. By incorporating green, buildings can serve as part of a greater ecosystem, making room for flora and fauna.

TECHNOLOGY & DIGITALIZATION IN BUILDINGS

Technology seems to never stop developing, this also applies to cities and buildings. Technology is getting more important in all parts of a building life, from construction and the period of use all the way towards disassembly. With the introduction of robots, drones, augmented and virtual reality technologies, BIM and many more, the world of construction will continue to change. Meanwhile, sensors and automation will create smart buildings.

SMART CITIES & BUILDINGS

Cities and buildings with become increasingly smarter, gather more and more data whilst taking care of the environmental factors such as temperature, air quality and lighting. Smart cities and buildings provide opportunities to reduce energy usage and optimize the work and living environment, allowing for a healthier lifestyle and making the users happier.

SMART TECHNOLOGY IN CONSTRUCTION

The construction industry is slowly but surely adapting to (smart) technological developments. The use of technologies in construction will change the way buildings are being constructed. Additionally, it will change the way we live and work in buildings and cities. Through data and automation, buildings and cities will become more efficient and more effective in their purpose: proving a pleasant place to live.

CIRCULAR BUILDINGS

The CE is becoming increasingly relevant. The construction industry is pushed by the fact that it is responsible for the highest amount of pollution of any industry. Whilst being a slow moving, conservative industry, circularity is beginning to get grip on the construction industry.

Many governments and companies are aiming for a shift towards a CE. A future where buildings can be disassembled and where materials can easily be reused over and over again. In order for a building to be circular, many aspects have to be taken into account from the start, such as material choice, stakeholder involvement in design, construction and disassembly.

MARKET TRENDS

The market trends describe the needs of the market in the coming years. Several big trends in construction, working and health have been identified, which can be found in *appendix 4B (page 130)*. The trend of econvience is most relevant for Derako and their desire to become more sustainable.

ECONVENIENCE

The trend where users are seeking ecological products or experiences, but are not prepared to overpay or put in a lot of additional effort. Ecological solutions should be conveniently available and affordable. They should offer the same amount of functionalities as non-ecological products. Therefore econvenience is directed towards people who actively admire a sustainable lifestyle as well as the ordinary consumer.

CONCLUSION

Three types of trends have been researched, all providing their own insights and together creating a look into the future.

First, the mega trends provide an overarching overview on where development is heading. Topics such as urbanisation, climate change and consequently sustainability and material scarcity come forward and dictate part of the market developments.

As a result, markets are reacting. The built environment is a highly poluting industry, therefore taking big steps towards a more sustainable future. Flexible and modular buildings provide for more reuse and more efficient use of materials. Incorporating nature into the built environment provides many benefits, from improving sustainability and promoting biodiversity to increasing the health and wellbeing of those living in the cities. Smart technologies in construction create opportunities to built better, more efficient and safer. Furthermore it stimulates efficient use of the buildings by optimising space and energy, while creating a pleasant living environment. Finally, the Circular Economy is upcoming in the sector, giving a completely different approach to using materials.

The market demands are changing as well. Now more relevant than ever is the trend of econvience, where users are looking to live sustainable, but are not ready to invest large amounts of time or money in this.

REGULATION

In order to stay relevant in the coming years, Derako has to be conscious of what regulations are going to influence their operations. The regulations can put pressure on production, transport or sales, but also marketing.

An example of such a regulation is the taxonomy on sustainable businesses (European Council, 2019). This classification system provides a common language for businesses and investors on sustainable activities. In doing so, the European Union aims to increase investments in environmentally sustainable businesses, as through this classification it is clear which business is truely environmentally sustainable. This classicifcation seems to be largely focussed on sustainable financing, but shows a direction of where also general sustainable marketing might be headed. As a result, it might be needed for companies to prove their claim of being sustainable.

In construction itself there are certain guidelines for building, these guidelines are described in the building code (in Dutch: bouwbesluit) (Rijksoverheid, 2020). This building code is largely focussed on safety, health, usability and sustainability. Closely looking at the topic on sustainability reveals energy efficiency of a building is one of the main topics. On general sustainability, such as material usage and recycling or reuse, there are little strict guidelines. For example, it is stated the building has to limit the environmental burden in terms of material usage, but how much or to what extent this has to be done is unclear.

Numerous subsidies are available for sustainable entrepreneuship. As example, the DEI+ subsidy stimulates the CE by awarding subsidies to companies that are able to recycle or reuse waste streams of others. Other government initiatives such as MIA/Vamil offer tax deduction for investments that stimulate the recycling of materials or a decrease in material usage.

Generally speaking, although there are stimuli for improving sustainable performance, the government does not seem to put strict regulations on companies for becoming more sustainable. As described in the chapter on *Sustainability (page 22)*, the government also refrains from setting legislation for the construction industry to become more circular.

However, politics are a complex matter in this sector and the direction of sustainability. The construction sector might be one of the first to be influenced by new restrictions or rules, as the industry is currently the most poluting industry. An example of this is the crisis surrounding PFAS.

To get a full grasp of the topic of politics and regulation, and additional research can give clarity. For this thesis, this is out of scope.

CONCLUSION

Although the government is not aiming to strictly regulate sustainability or the Circular Economy, there are certain influences from the European Union and local governments. These still mainly focus on stimulating, rather than regulating.

Overall the topic is complex, but relevant for Derako. The Circular Economy offers the opportunity to stay ahead of the curve and prevent surprises of new regulations concerning the sustainable performance of products and companies in general.

INDUSTRY RESEARCH

In order to better understand the industry, the interaction between different stakeholders and their motivations to improve, several interviews have been conducted. A full list of interviewees and collocutors has been added and can be found below.

These conversations have provided critical information for this research. For example, light has been shed on the complex interactions between Derako, the architect, contractor and installer. Interviews with experts on the CE and the construction industry have provided insights on how this industry is developing and what role the CE plays in this development.

A full list including names can be found in *appendix 11 - Confidential (page 154).*

EXPERT LIST

Functie	Bedrijf
Purchases and Logistics	Derako
Managing Director	Derako
Purchases Wood	Derako
Sales Manager	Derako
Marketing and Communication	Derako
Head of Production	Derako
Environmental Specialist	Wildcap
PHD Candidate Climate Design and Sustainability	Faculty of Architecture & the Built Environment, TU Delft
City Analyst	Circle Economy
Senior Consultant	Circle Economy
Strategist	Fronteer
Engineer	Powerhouse Company
Planner	Boele & Van Eesteren
Sr. Researcher Circular Re-source Flows	Faculty of Architecture & the Built Environment, TU Delft
Commericeel directeur	Bovero
Category Manager Circular Economy and Waste	Unilin
Circular Woodworker	Herso

Sustainability Vision

Based on the trends previously described, a vision will be created during a co-creation session involving the employees of Derako. The outcome of this session will be further elaborated on and detailed, to create a coherent and holistic vision which fits Derako.

WHY A VISION?

A vision must be created to give guidance to the developments for Derako. As mentioned earlier, the vision will guide Derako towards a more sustainable future in multiple parts of their operation. In doing so, sustainability can become a more integrated part of the organization, thus have a bigger impact.

The roadmap which will be created as final step of this thesis, will be based on this vision. It will describe through which means this vision can be achieved and what steps Derako can take to do so.

CIRCULAR ECONOMY AS A BASIS

Based on the research conducted of the industry and relevant trends, together with conversations with different stakeholders such as architects, contractors and experts, the developments of the CE in the construction industry is deemed an extremely important driver for innovation and sustainable development. Together with governments, big companies and clients are aiming to build in a more sustainable and circular fashion. This development has been assessed as the most important and relevant way of becoming more sustainable in this specific sector.

Furthermore, Derako already has a C2C certification on their products, proving their products are already a step in the right direction. Previous conversations with Derako employees proved their interest in the topic of sustainability in general.

As counselor for Derako on this topic, I set out to show Derako the importance and opportunities of a CE. This meant constant intereaction with Derako on the topic of circular products and showing how their products could be adapted to fit a CE.

As a result of this, together with Derako, the decision has been made to take CE as basis for the vision, strategy and roadmap. The CE will be a driver for sustainable innovation in the direction of one of the trend clusters.

CO-CREATION VISION

A co-creation is an integral part of the strategic design process. Co-creation can be used on several levels of strategic planning. Co-creating with customers can add value by including customer perception and experiences in the strategic process, while creating customer engagement (Frow et al., 2015). Co-creating with suppliers can work towards a better supply chain intergration.

For Derako, the co-creation is mainly kept inhouse for this part of the process. Although, several benefits become apparent for in-house co-creation, such as enhanced employee engagement (Frow et al., 2015) and gaining company wide input.

Co-Creation At Derako

Through this co-creation, the aim is to create a first version of the vision that is both grounded in research and supported by the employees. Derako being a small company, all employees are important stakeholders in the processes. As the production is done in-house, and not outsourced, it is deemed important to involve workplace employees to think about the future of Derako, and their role in this future.

A co-creation session was designed based on

methods and tools developed and tested by strategic consultancy Fronteer.

This co-creation of three hours was organized and participants were invited, namely four employees of the office and four employees of the workshop. The aim of this is to spark interaction between these employees and create a more lively discussion. As a facilitator, my role is to observe and guide the participants through the process, without influencing the results. This role allows for Derako employees to take ownership and give their honest input.

Limitations
Due to unforeseen circumstances, the co-creation has been redesigned to shorted the time spent. Workshop employees were asked to think about Derako and CE for one hour, whereas the session with office employees has been shortened to two hours. More elaboration on the limitations of this change can be found in *appendix 5A (page 132)*.

Setup
The setup of the session and the worksheets can be found in *appendix 5B (page 132)* and *appendix 5C (page 133)*

In a homework assignment participants were asked what company inspired them on sustainability and for what reason.

These examples and explanations were used to create a set of Golden Rules. Those rules describe what important factors are to take into account when becoming a more sustainable company, according to the participants. They serve as source of inspiration and alignment on the topic at hand.

FIGURE 24 Golden Rules as defined by the office employees

Results Session Workshop
The first part of the session with workshop employees focused on gaining insights on how Derako could become more sustainable. As to be expected, the conversation mainly focused on improving processes and usage of materials in the workshop. For example, questions were raised whether the usage of plastic foil wrapping the wood in the workplace is necessary, as often the wood is being processed the same day. These type of comments can have a direct impact on the operation, as they are relatively easy to test and verify.

The results of this session were used in the second session as source of inspiration.

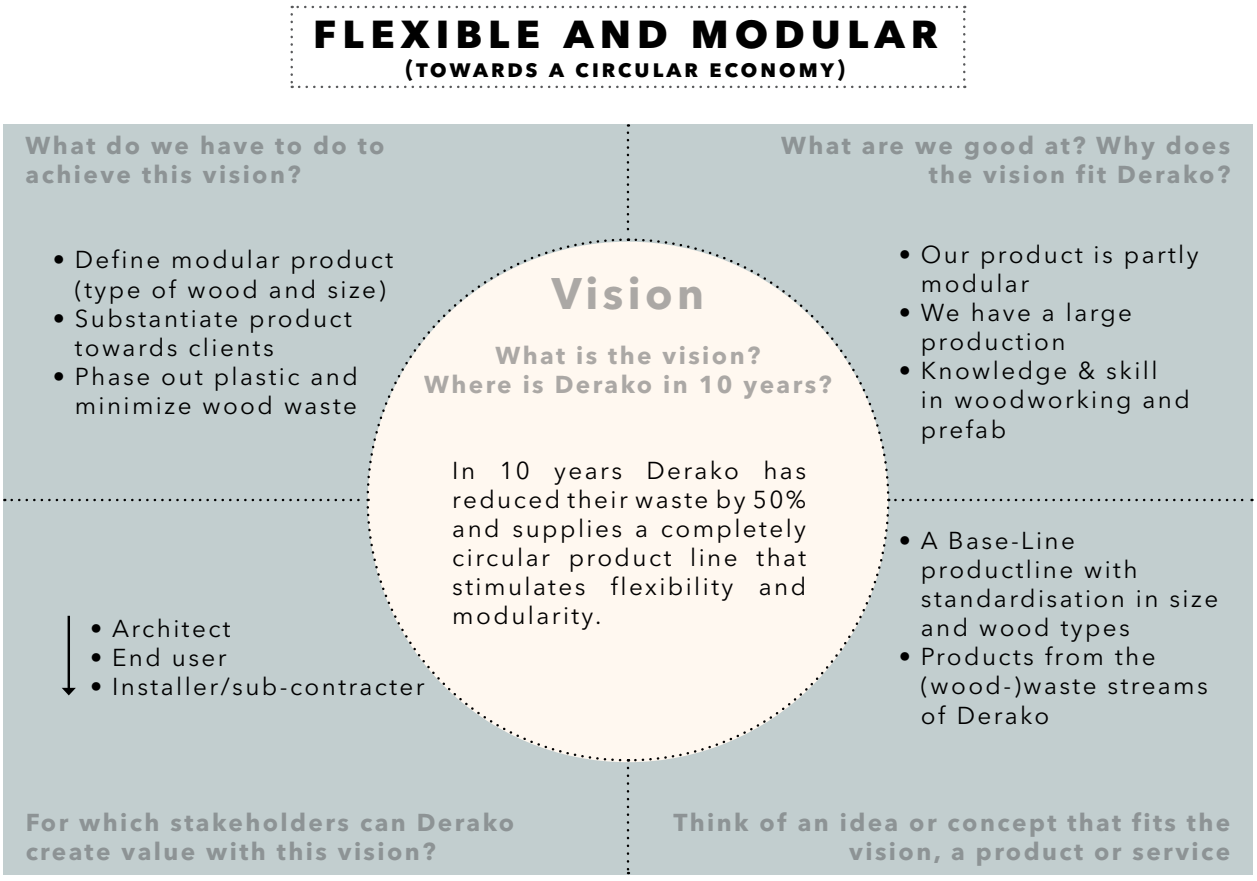
Results Session Office
The second session with office employees focused more directly on creating the vision. First the golden rules were shaped based on the homework assignment given. These golden rules can be found in *figure 24*. A picture taken during the co-creation can be found in *figure 25*.

FIGURE 25 The second part of the co-creation at Derako

Before the brainstorm, the trend clusters as described in *Trends (page 58)* were presented, participants were asked to pick a trend cluster which resonated with their vision for Derako. After some discussion, all participants agreed on continuing with the cluster of flexible and modular for the remainder of the brainstorm.

Picking this cluster was mainly based on the fact it aligns with current product properties of Derako, such as the product being easily removable. The Base-Line product seems to be especially fit for modular design as it already limits the amount of varieties such as size and wood types.

Based on this cluster, the worksheet has been filled in, see *figure 26*.



Co-creation - Vision creation
Worksheet 'Brainstorm'

FIGURE 26 Co-creation worksheet filled in by the office employees

VISION

The first version of this vision consists of two parts, with the first part being:

In 10 years, Derako has reduced their waste by 50%

This part underlines the need for a true reduction in waste or reuse of waste streams. Derako is motivated and optimistic to improve their current way of working, for example through saving material by replacing single use plastics with reusable materials. Also reducing wood waste through optimized products and processes is part of this vision. Reusing the wood waste, which is inherent to working with wood, can reduce the amount of waste even further.

This part of the vision is initiated by both workshop and office employees, who both indicated there is room for improvement.

See *figure 27* for a visual representation of the vision.

The second part of the vision is focused on a product and service development level:

In 10 years, Derako supplies a completely circular product line that stimulates flexibility and modularity.

This part of the vision takes into account the trends of flexible and modular building, while creating a circular product line. It is focussed on a long term adaption to the market development. Currently Derako has started their Base-Line. This Base-Line consists of fifteen standard sizes and four types of wood. This Base-Line could be the basis of a modular and circular product line with little adaptions in the product. The main focus would lay on how to standardize the product to facilitate modularity and create the ecosystem to facilitate a circular product.

A completely circular product line means it is designed and created according to CE standards, for example containing no harmful materials or substances. Furthermore the product might be redesigned to optimally facilitate repair or disassembly. An ecosystem has been designed to facilitate sales and take back of the product. Creating a circular product line means investigating the needed changes and improvement to the current product, for example whether the current method of applying fire retardant is up to the standards of circularity. Furthermore it requires to look into the opportunities of maintaining a circular rotation of the product. Questions arise, like whether Derako themselves is going to retrieve and redistribute the product or if a partnership with an external company is needed for this. Additionally, who is going to be the target group of the redistributed product and how are they going to be reached? What kind of branding will the redistributed product get?

Questions like these will be answered while creating a strategy for the new product line.

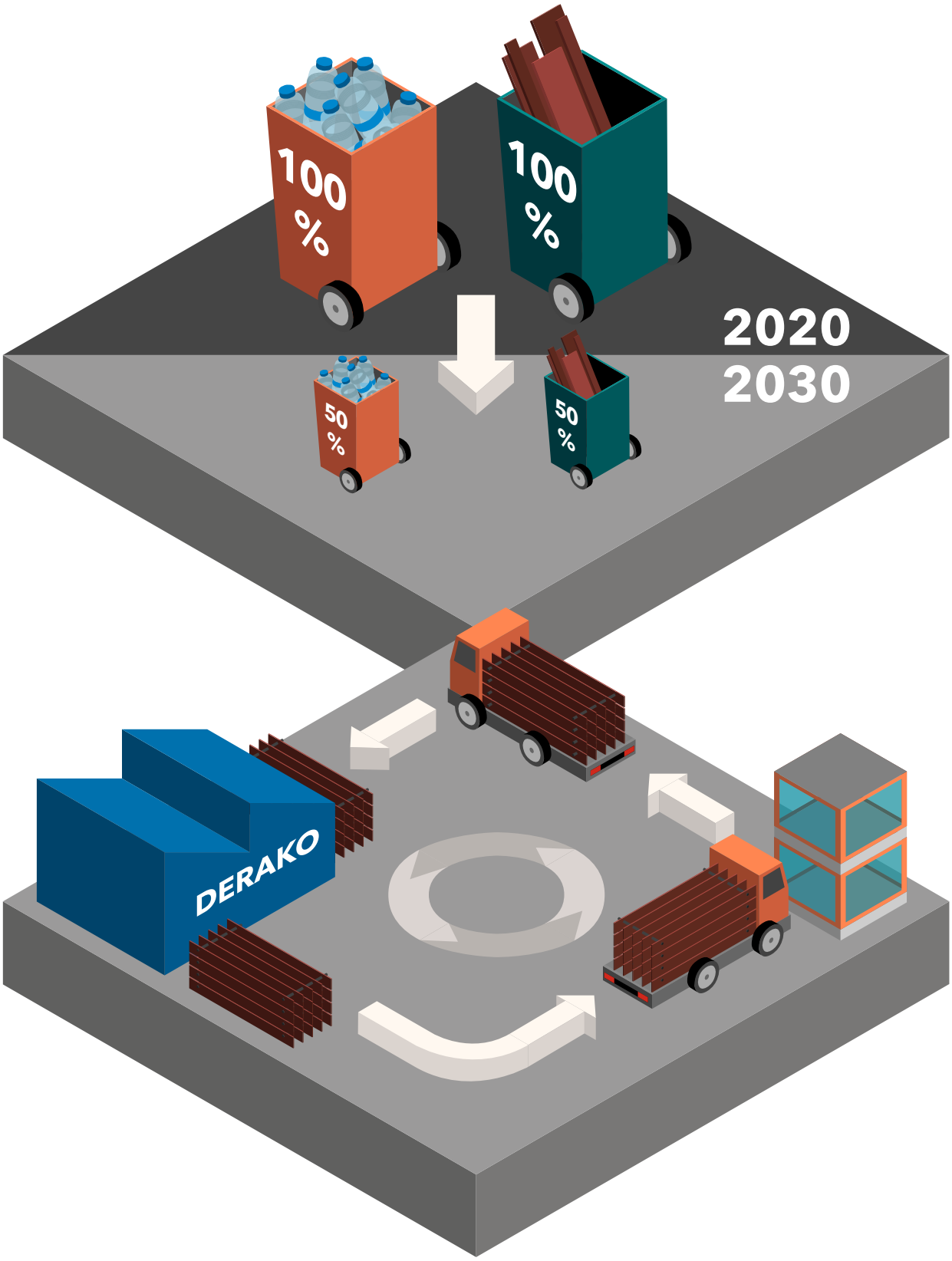


FIGURE 27 Visual represenatation of the vision

Sustainability Strategy

The vision, which has been determined in the previous chapter, will form the basis for the strategy.

In this chapter, the strategy will describe how the vision will be achieved, what the main approach of reducing waste and introducing a circular product line will be. Regarding the circular product line, the strategy will describe what the product line should look like, how it should be marketed and what stakeholders are relevant.

The vision will form the basis for the strategy. As the vision consist of two separate parts, the strategy will also describe these two separate parts, namely reducing waste created by Derako and creating a circular product line that stimulates flexibility and modularity.

Design solutions have been highlighted and will be input for the waste reduction plan and roadmap.

REDUCING WASTE

The first part of the vision focusses on two important improvements, namely reducing waste production and giving value to the remaining waste streams.

Reduce Waste Production

The first priority is reducing waste production. If the amount of waste produced is minimized, there is no need for giving value to that waste anymore. Certain waste streams will not be able to be fully eliminated, such as the wood moth, which is an inherent part of the production process. For these type of waste streams, a value should be created, for example creating a product from the moth, either internally or externally.

First, in order to reduce the amount of waste produced, it is important to realise where the waste is being generated and define the biggest waste streams. The separate waste streams can be defined as wood waste and residual waste.

The wood waste streams have been described in *the derako process (page 40)*. In *appendix 1A (page 124),* the process of analysing these wood waste streams has been elaborated on.

Reducing the wood waste production can start in the sales process by selling the product in such a way that the wood can be processed efficiently. This means the final slat size (width and high) is adjusted to the size of raw wood. In doing so, less wood is turned into moth during the first steps of processing. This principle will be the basis for the circular product line.

In order to reduce residual waste production, the focus must be on the workshop, where the majority of the residual waste, largely plastic, is being generated. Different types of plastics are being used, such as foil, sheets and straps. Furthermore, plastic is being used to ship the products, as described in *the derako process on page 40*. The total amount of plastic used at Derako can been found in *appendix 1B (page 125).*

Reducing the residual waste stream will mainly consist of assessing whether current use is strictly necessary. The next step is to find alternatives for these single use plastics, such as materials that can be used multiple times, for example fabrics or reusable plastics.

Giving Value

After reducing the waste production, the residual waste will be given a high end value through recycling or upcycling. In this case, this step will mainly focus on wood waste, as this source of waste is inevitable in the production of Derako.

Giving value can range from creating high value products and thus upcycling wood waste. This is preferred over using moth for the heating at Derako, which can be considered downcycling.

In order to give value to the wood waste, a clear image of different types of wood waste has to be present, e.g. moth, slats, dropout or cut off pieces.

Furthermore it is important to know the volumes of this waste, as this will decide the possibilities for giving value to these streams. See *appendix 1A (page 124)*.

Giving value through creating products from waste can happen internally at Derako, for example by creating other type of Grill Panels from rejected slats. Creating other types of products from wood waste will have to happen externally, as Derako states they are currently not interested in creating other products than their current product line.

CIRCULAR PRODUCT LINE

The second part of the vision focusses on creating a product line that is fit for the CE, while targeting flexible and modular applications.
Three main aspects in successfully launching a circular product line are defined; product, market, partners.

Product

The first step into a CE is for a product to be 'healthy', which will be decided through an analysis. In this analysis, the product will be assessed on the fit to the CE, meaning it contains no harmful materials, being produced sustainably with the use of renewable energy, and so on.

Also part of the CE is the cycling of products or materials. Often this results in more complex logistics than the ordinary *order and deliver* products. In the case of Derako, changes in these logistics mainly revolve around retrieving, storing and redistributing the product.

In order to retrieve the products, it is important to be able to track the products through their lifetime. In the current market, often a building is handed off when construction is done. This means the contracter is no longer resposible for the building and product, this also means the connecting factor between Derako and their product is lost. Being able to track a product, even when the building is sold on, is crucial to be able to retrieve a product. Consequently, if a product is being retrieved, a method of carefully packing and shipping the product has to be available.

A different side of the logistics focusses on ownership of the product. Often, in a CE, the product stays in the ownership of the provider and the product is offered as a service, often referred to as *Product-as-a-Service (PaaS)* or *Product-Service Systems (PSS)*. The question is whether Derako is able to adopt such a system, both in terms of desirability as well as financially. If not, customers need to be activated to return the product to Derako, either through monetary incentive or a different method.

If a PSS is not possible, a solution should be available to track the product throughout its life, for example through sensors, by making use of the *Internet of Things (IoT)*.

Market

Like any product, a circular product is dependent on the market. The market Derako operates in ranges from suppliers to customers. Within this market, Derako has to work with suppliers to ensure their products are fit for the CE, for example whether the wood is sustainably sourced and the fire retardant contains no harmful materials.

On the other side of the spectrum, Derako has to ensure contact with their customers concerning the circular product and be aware of the market, as the product needs to align with the demands

and wishes of the customers. In order to do so, Derako must keep a close contact with architects, contractors, installers and so on.

After the first use, the product needs to be recircled or resold. In order to do so, a demand from the market has to be created. Derako has to ensure their customers know about and are interested in this second use product.

Partners

In order to adopt a CE and successfully introduce a circular product line, Derako needs to work together with partners in the industry. The main goal of the circular product line must be to reduce waste and increase the sustainability performance of the product and improve the overall sustainability in the industry. Partners play a crucial role in ensuring this. Different types of partners are needed, ranging from architects, contractors and installers to engineering firms and transporters. Together with these partners, through the circular product line, Derako is able to make an impact on the market. See *figure 28*.

FRONT RUNNER

The main motivation for Derako in becoming more sustainable is intrinsic. It is evident that reducing their waste results in certain economic advantages, which function as a catalyst to invest in sustainable solutions. However, aside from saving costs, Derako can use their sustainable performance and circular product line to become a front runner in the industry. In doing so, Derako is able to take create a strong position on sustainability, opening new business opportunities.

A strong positioning on sustainability would be mainly focussed on architects and large contracters, where the interest in sustainability seems to be the highest compared to other stakeholders. It seems that claiming a spot in the mind of these stakeholders, when it comes to sustainability, can result in interesting opportunities with a focus on sustainability and circular construction.

The final focus is on the clients of the construction, such as governments, large companies or investors. The interest in building sustainably is increasing, Derako can contribute to this increase by creating awareness for the availability of circular construction products.

CO-CREATION IDEAS

A co-creation has been organized to generate ideas for the strategy, wast reduction plan and roadmap further down the line. The aim of the co-creation was to get in valuable ideas from different parts of the organization and create employee engagement.

See *appendix 6A (page 136), appendix 6B (page 136)* and *appendix 6C (page 137)* for more information.

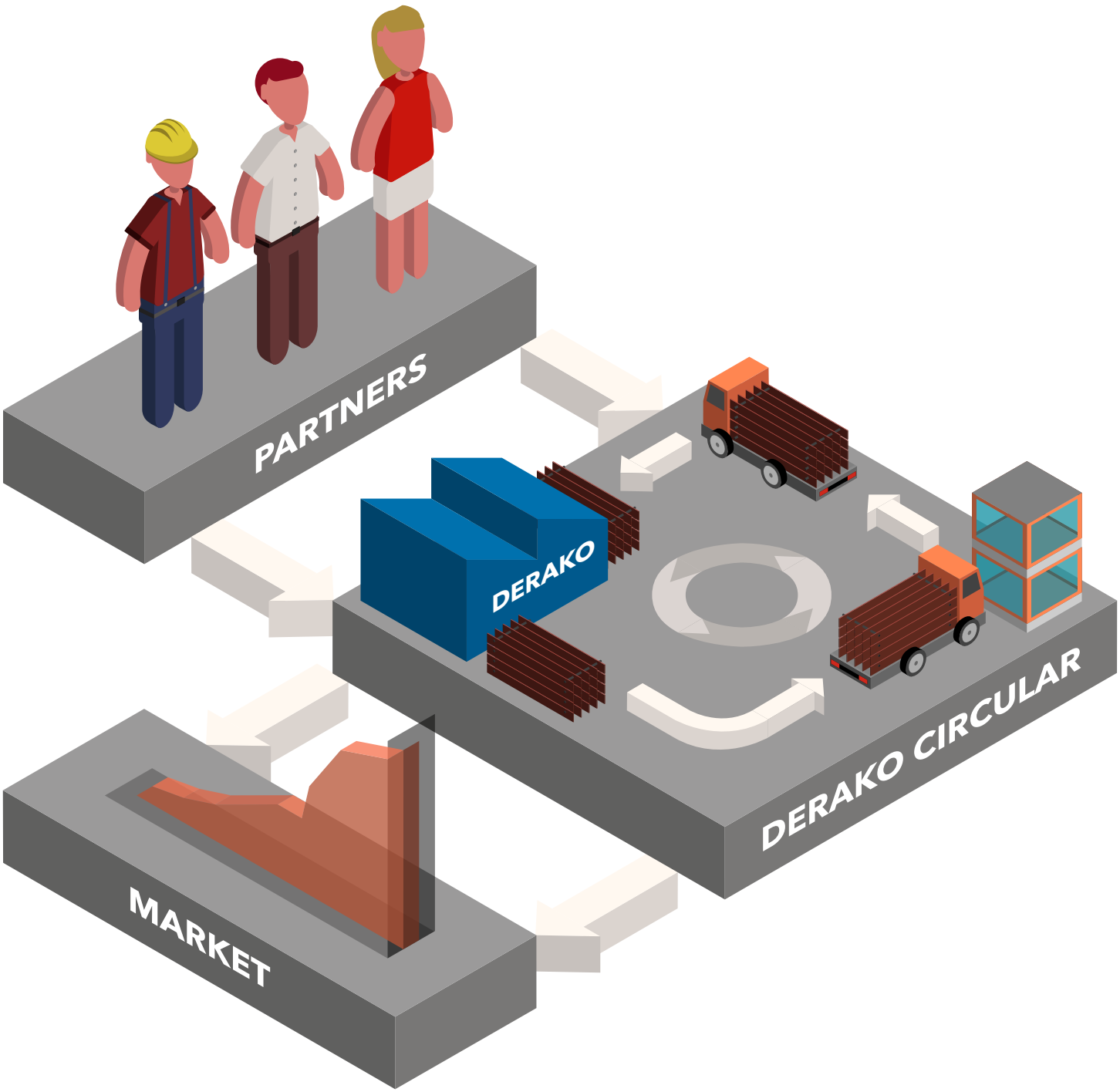


FIGURE 28 The strategy revolves around working with partners to facilitate the market of circular products

Waste Reduction Plan

Two separate documents will support the two sides of the strategy. First a waste reduction plan will describe how Derako can reduce their waste, offering them handles on reducing plastic waste and on creating partnerships to facilitate upcycling of the wood waste. The reduction plan will be focussed on both office and workshop employees.

WASTE REDUCTION

The waste reduction plan mainly focusses on the first part of the vision, namely:

In 10 years, Derako has reduced their waste by 50%

During creation of the strategy and the reduction plan, it became apparent that the vision lacks clarity. Therefore, it has been revised to:

In 10 years, Derako has reduced their non-renewable waste by 50%

This means the woodwaste is taken out of this equation, resulting in an additional vision:

In 10 years, Derako has reduced their wood waste by 90%

Finding a high value application for waste, in particular wood waste, is also considered reducing. A low value application, for example making pellets from wood, is not considered reduction of wood waste. See *figure 29*.

CO-CREATION

Through the means of a co-creation Derako employees were involed once more to think about sustainability and more specifically, waste at Derako. Sadly, due to unforeseen circumstances this co-creation was canceled at short notice. Therefore a more informal meeting was organized with remaining available participants, to get input on the matter of waste at Derako. The input of this informal session has been incorporated in both the waste reduction plan, as well as the circular product roadmap.

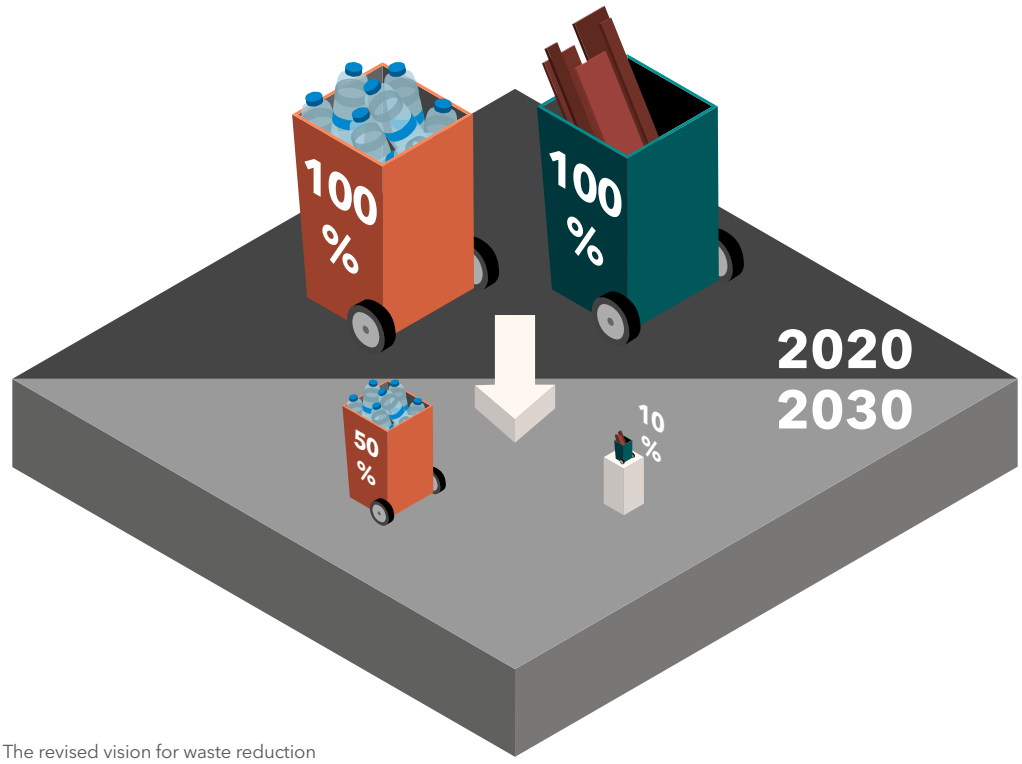


FIGURE 29 The revised vision for waste reduction

WASTE REDUCTION PLAN

The waste reduction plan is an actionable plan that sets specific goals for the reduction of wood waste and residual waste. This plan is an inspirational document focussed at both office and workshop employees of Derako.

In order to successfully plan for waste reduction at Derako, the separate waste streams have been mapped. The biggest waste streams have been defined as wood waste and plastic waste, both internally as well as outgoing (shipping). For a further elaboration on these two streams, see *appendix 1A (page 124)* and *appendix 1B (page 125)*.

For the reduction plan, three horizons have been defined, see *figure 32*. These three horizons are in line with the horizons for the circular product roadmap.

For Derako to successfully implement the waste reduction plan, it is crucial to monitor the amount of waste being generated at Derako, this applies to both the wood waste as well as the residual or plastic waste.

See *figure 35 on page 88* for a visualisation of the waste reduction plan.

FIGURE 30 Wrapping the wood for internal storage to prevent discoloration

FIGURE 31 Improved situation, only wrapping the top of the pile reducing the material usaged by more than 50%

FIGURE 32 The horizons and their corresponding timespan

PLASTIC WASTE

The plastic waste stream consists of different smaller streams, which can be split up in incoming, internal and outgoing waste.

The stream of incoming waste is exists of incoming packaging materials, mainly small plastic boxes or bags, PET straps and wrapping materials.

Internally the plastic streams consists of PET straps and stretch film which is being used for storage.

Finally there is a stream of outgoing packaging materials, such as PET straps, stretch film, flat film, foam wrap and more. Currently, this stream is the biggest of all waste streams. Waste from this streams is not being disposed at Derako, but at the construction site.

The aim is to address all three separate streams in all the horizons. Each horizon has a focus, see *figure 33*.

FIGURE 33 Focus on plastic waste reduction for each horizon

Furthermore, a reduction aim has been set for all three horizons. These aims have been set using the values of 2020 as starting point. See *figure 34*.

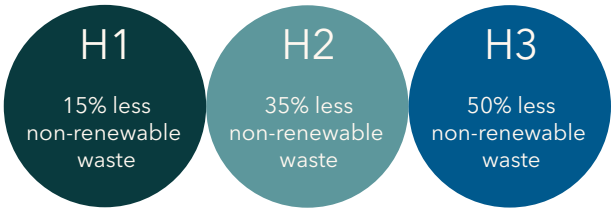


FIGURE 34 Aim on plastic waste reduction for each horizon

HORIZON 1

The first horizon has a focus on **reducing** the plastic waste with the aim to decrease the plastic waste production by 15% before 2023.

Incoming Waste

Incoming waste, such as plastic boxes or packaging materials must be reduced. By connecting with suppliers and discussing the opportunities for different packaging, such as bulk packaging, the amount of plastic can be reduced significantly. The aim is to be able to order supplies without large volumes of plastic waste.

Internal Waste

Internal waste can be reduced by critically looking at the usage of plastics. An example of this is the usage of black stretch film in the workshop. This film is being used to prevent discoloration of the product and dust on the product while being stored at the workshop. In the current situation, the complete package of wood is sealed if stored for any period of time. See *figure 30 on page 85.* However, in many cases this packaging is unnecessary and the use of plastic can be reduced by over 50 percent, see *figure 31 on page 85*. When the wood will be internally stored for a short period of time, only the top of the product will be covered to prevent dust on the product. This change was one of the outcomes of the first co-creation with workshop employees.

Outgoing Waste

Outgoing plastic is considered waste, as its use is always singular. The material will be discarded as the product is being unpacked at the construction site. This stream being the biggest waste stream, reduction on outgoing plastic is crucial to make a

significant impact.

In order to successfully reduce the amount of outgoing plastic waste, it is crucial to get a good image of the amount. The first step in reducing is to assess the need of this plastic in different use cases. The second step is to reduce the amount of plastic needed for shipping, for examply by optimising packaging or replacing plastic with a different type of material. Finally, reduction can be realised through a return shipping system, where both the crate and the packaging materials are being returned and reused.

Partners
To reduce the incoming plastic, the conversation with suppliers is crucial. This conversation should revolve around reducing the amount of incoming packaging at Derako, for example by using of alternative packaging materials or shipping method.

Internally Derako should keep the conversation with employees going. The input of workshop employees has proven their value in the co-creation session for the vision creation, see *Results Session Workshop (page 72)*, and can continue to do so.

For both internal as well as outgoing waste, it can prove helpful to connect with sustainable packaging partners, to rethink the current usage and choice of materials.

Finally, talk with stakeholders to start the conversation about packaging. With contractors and installers it is crucial to think about a return shipping system to reduce waste. Input from these partners can prove crucial for this type of innovation.

HORIZON 2

The second horizon has a focus on **alternatives** for the use of plastic and the aim is a 35% decrease in plastic waste production before 2027.

Incoming Waste
In the second horizon, the conversation with suppliers continues to find alternatives for plastic packaging, such as reusable materials or return packaging.

Internal Waste
For internal use, alternatives for the application of, for example, stretch film and PET straps can be tested. PET straps could be replaced with lashing straps. Instead of stretch film, reusable plastics or blankets can be used to cover the product and protect them from sunlight and dust. Testing solutions in the workshop will give workshop employees the opportunity to give input and will empower them to make suggestions.

Outgoing Waste
In order to find alternatives for outgoing products, the first step is to realise whether the material is being used in a one-way system or a return system. One-way materials should be of low environmental impact, biodegradable and low pricepoint. Materials in a return system should be durable and convenient for both logistics as well as handling.

The newly introduced circular product line does create a platform for experimenting with a return system on a smaller scale.

Together with other big suppliers of construction elements, Derako should investigate alternatives for packaging waste. When a industry wide solution is present, a return system can be used

much more efficiently. An example of this are IBC containers, which are the industry standard for storing and transporting liquids.

Partners
The conversation with suppliers should continue to further reduce the amount of redundant packaging and plastic.

Internally all employees should feel empowered to make suggestions to reduce waste, which can be tested in the workshop.

Solutions for outgoing waste, such as a return shipping system for packaging should be co-created with relevant stakeholders like contractors and installers.

Furthermore a conversation with other suppliers of construction elements can prove useful towards an industry wide packaging solution.

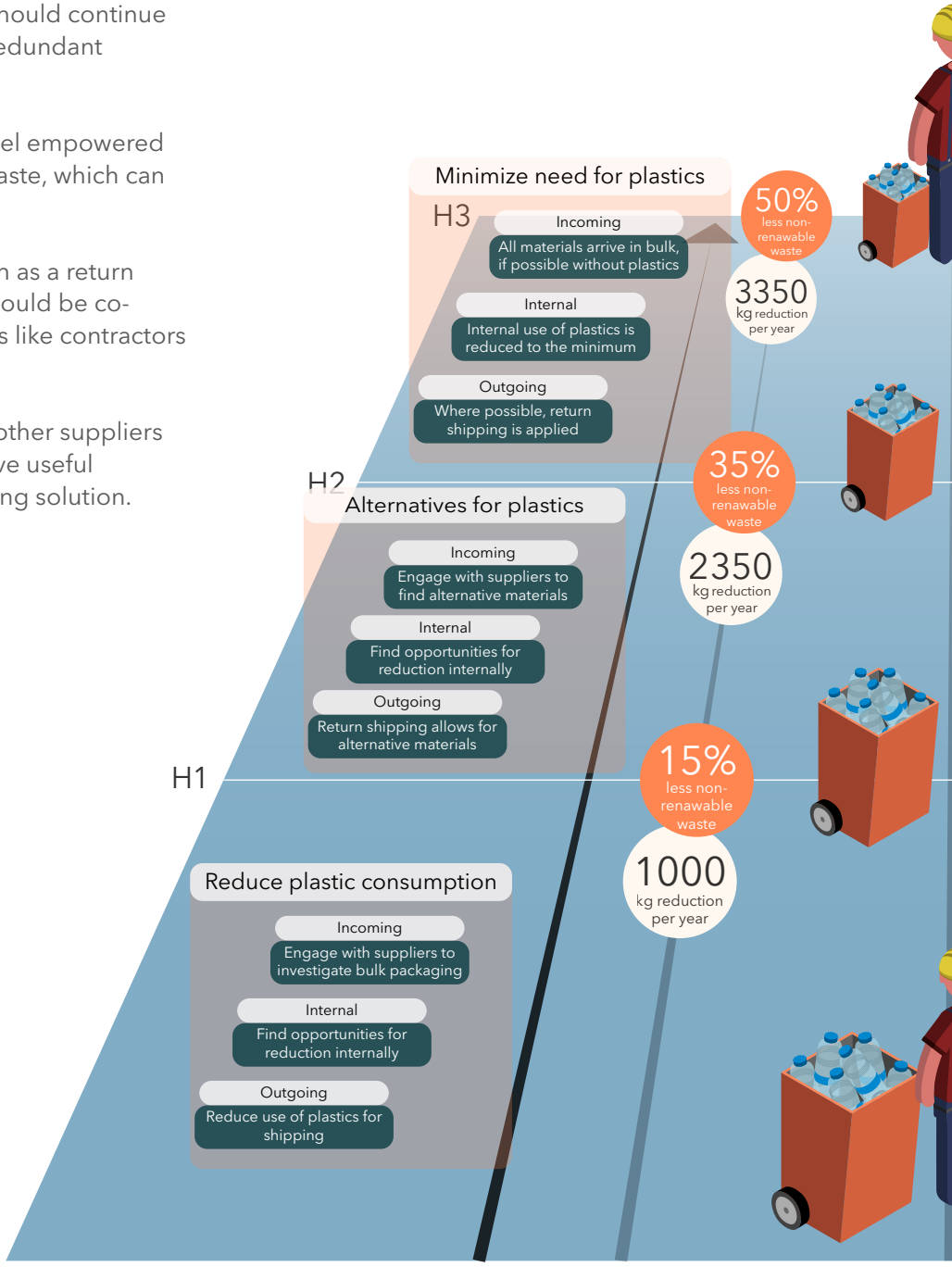
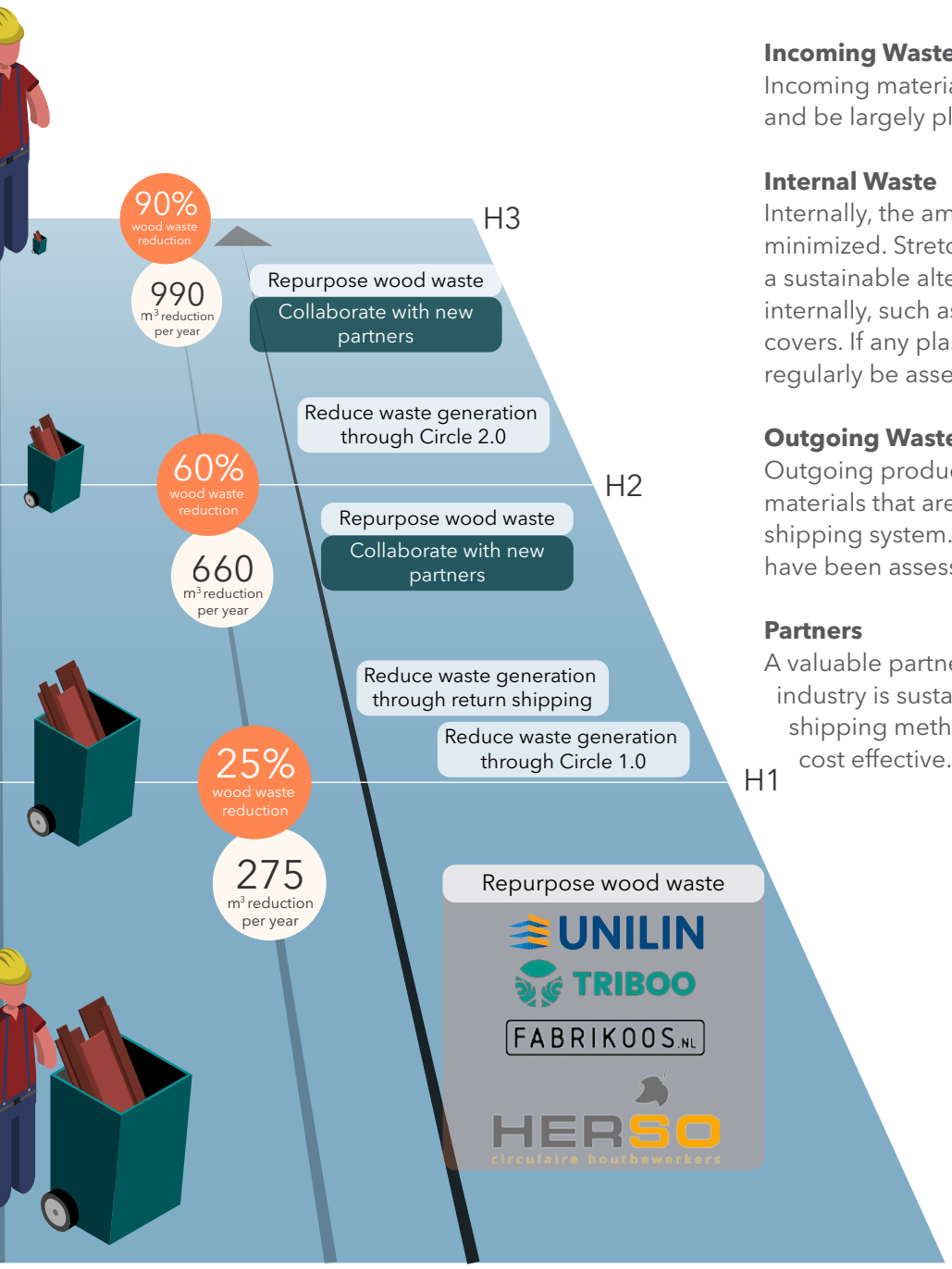


FIGURE 35 Waste Reduction Plan



HORIZON 3

The third horizon has a focus on **minimizing** plastic usage, the aim is a 50% decrease in plastic waste before 2030.

Incoming Waste

Incoming materials should solely arrive in bulk and be largely plastic free.

Internal Waste

Internally, the amount of plastic used will be minimized. Stretch film has been replaced by a sustainable alternative that can be reused internally, such as thin, durable blankets or covers. If any plastic is being used, this usage will regularly be assesed.

Outgoing Waste

Outgoing products are mainly packed in reusable materials that are returned through a return shipping system. Any other packaging materials have been assessed on sustainability.

Partners

A valuable partnership with other suppliers in the industry is sustained to build an effective return shipping method, which reduces waste and is cost effective.

WOOD WASTE

WOOD WASTE

The wood waste streams also consist of different smaller streams. In each stream the wood is in a different state of processing. This can be split up in moth, cut off pieces and dropout/slats.

For the wood waste, the focus in the different horizons is the same, reducing the amount of wood waste through minimizing the wood waste production and giving value to the remaining wood waste.

Furthermore, an aim has been set for all three horizons. The aims have been set compared to the values of 2020. See *figure 36*.

FIGURE 36 Aim on wood waste reduction for each horizon

Horizon 1
The main focus of the first horizon is on finding and connecting with partners that can give value to the waste streams of Derako, with biggest challenge being the high volumes of wood waste.

Numerous partners have been defined and can be found in *appendix 7 (page 138)*.

For the first horizon, the highest value can be found in quickly repurposing high volumes of wood waste. Therefore big partners such as Unilin can prove to be valuable. For other types of repurposing, such as applying waste in furniture, partners such as Triboo or Fabrikoos can be part of a relevant collaboration.

Herso is already a partner of Derako for a number of years, using the wood waste of Derako as a raw material for tables and more. However, as became apparent after visiting Herso and meeting with circular woodworker Rik Ruigrok, Herso can be much more than a customer for the wood waste stream. The amount of knowledge and experience with circular woodworking within Herso can prove to be a valuable contribution to Derako, possibly inspiring Derako to create a new product from their own woodwaste.

Horizon 2
In the second horizon, reduction is realised through the introduction of the circular product line. Through the optimized sizes of the circular product line, less waste is being generated. Furthermore, part of the waste is being looped back into the Cloak Wood product with MDF core. Additionally, through the introduction of Circle shipping, the amount of outgoing wood (waste) is being reduced.

The search for and connecting with partners continues, realizing a higher amount of upcycled wood waste.

Horizon 3
The amount of wood waste generated is reduced through the introduction of the second generation circular product, which provides the opportunity to completely disassemble and repair panels.

The search for and connecting with partners continues, realizing a higher amount of upcycled wood waste.

8 Circular Product Roadmap

The second document is a roadmap that will describe the introduction of a circular product line with a focus on the trends of flexibility and modularity. The roadmap will include the needed ecosystem, marketing activities and suggestions for partners active in sustainability.

ROADMAP DETAILING

The circular product roadmap focusses on the second part of the vision, namely:

In 10 years, Derako supplies a completely circular product line that stimulates flexibility and modularity.

During creation of the strategy and roadmap, it became apparent that the circular product line can be introduced in shorter timespan than 10 years. Therefore the roadmap focusses on optimizing the circular product line as much as possible in the timespan of 10 years.

A circular product line is defined as a product which is produced with as little environmental impact as possible throughout the entire chain and is part of a wider CE where products are not discarded but reused throughout their lifetime. More specifically for Derako, the circular product line will focus on sustainable wood choices, efficient packaging with little waste and being able to recircle the product after its first use.

For the circular roadmap, the focus will be on designing, introducing and maintaining a circular product with the corresponding logistics and ecosystem. Therefore, the roadmap has been split into three different aspects as described in *circular product line (page 79)*: product, market and partners. In each of these aspect, different timelines will be created.

PRODUCT

The product describes the product in the broadest sense, including the product itself and the supporting systems such as tracking, collection and bring the product into a new cycle.

Product Line

In order to launch a circular product line, some standardization is needed for the Derako product. This ensures more control over the production, being able to produce more efficiently, but also prevents putting custom made products on the market that only have one single application.

Standardizations for the Derako product mean limited variations in wood type, sizes and colors. These standardizations are one of the first decisions to be made to create a successful circular product. Preliminary discussions already mentioned focussing on the Grill product, mainly due to their easy disassembly from the building. Furthermore, ruling out colour choices other than transparent and only offering panels treated with fire retardant have been mentioned as measures to limit variations.

For choices of wood it seems obvious to go with some of the most popular options, for example pine, oak and African whitewood (also called abachi). However, one has to consider the environmental impact of these types of wood. For example, conditions of breeding and harvesting, but also distance travelled to be processed. In this case, pine seems to be a valid option when sourced from Europe. In the case of oak, when limited to European oak, this could have been a valid option. However, the quality of oak wood is often poor and therefore a lot of waste is created in the production. A valid alternative mentioned is larch (lariks), which can be sourced locally from

the Veluwe.

Additionally, cloakwood, a new product of Derako is a valid third option for the circular product line. Cloakwood consists of a core made from lower quality and cheaper wood, such as pine, which has been layered with a thin layer of veneer. This veneer is made from a different type of wood, which can range from oak to cherry wood. By doing so, more expensive looks become available for lower prices. Furthermore, the core can also be made using MDF, creating an even lower cost product with a high quality look. MDF also offers the possibilty to use the Derako wood waste and turn it into new MDF panels, closing the waste loop.

In an ideal circular situation, a product is able to be disassembled completely, for a Grill panel this would mean removing the slats and dowel. When being able to do so, a panel can easily be repaired, for example by replacing a couple of damaged slats, instead of being recycled, therefore increasing the circular aspect of the product.

In order to facilitate this, the product needs a redesign. This redesign might have little to no impact on the performance of the product itself, however the impact of such a redesign on the overall production process will be significant. Therefore, this redesign should only be considered when an added value has been defined throughout the phase of selling and recollecting the circular product line.

Tracking
In order to be able to retrieve the products after their life cycle, it is of utmost importance to know where the products are and when they are being returned. The earlier this is known to Derako, the better they are able to logistically process the product, such as collecting, repairing and reselling the product. Therefore, a system needs to be in place to either connect with the current owner of the product, or keep them informed on the possiblity to return the product after use.

Such a system can be based on technology, for example making use of IoT sensors to track the location of the product and give owners the opportunity to connect with Derako. Making use of these sensors can prove to be helpful, as additional services can be added, for example giving the owner an opportunity to make images of the product and digitally linking it to the product. In this way, Derako can make an initial assessment of the state of the product, before retrieving the actual product.

Repurpose
After retrieving the product, the products must be prepared for repurposing. This means cleaning, repairing or restoring the products before reselling as a high quality product. In this phase, it is crucial Derako is always in charge of the product, however the work of for example cleaning the product can be outsourced. Derako should maintain ownership and be in charge of the quality of the product at all times.

Collection and Transport
Regarding the transport of the circular product, some improvements would benefit the overall circular performance of the product. Currently the product is being transported in custom made crates, built from newly bought wood. These crates form a heavy construction in order to support the weight of another crate during transport. At the construction site, these crates need to be dismantled and discarded, after which the wood will loose its value.

In order to ship sustainably, a return crate system should be in place, allowing to ship with little to no waste. The CO_2 emissions of a return system increase due to the additional movements needed. However, the transport sector has a strong motivation to become more sustainable, partly pushed by governments, partly by companies themselves (Banning (2016) and Seijlhouwer (2020)). Furthermore there is the possibility of compensating CO_2 emissions, in contrast to generating waste.

Additionally, shipping without waste is becoming increasingly important for some clients (LBP Sight, n.d.). Therefore it is crucial to investigate the possibilities of wasteless shipping.

When the first cycle of the product has been completed, it will have to be redistributed. In order to facilitate this redistribution, the product needs to be ready to be disassembled from the building and shipped back to Derako, after which it can be restored, if needed, and redistributed. These steps can be done inhouse, or externally.

Product Service System

In the long run, the product of Derako, in a CE, can be transferred to a product service system (PSS). Currently, this would pose too much of a burden on Derako, mostly financially. The costs of production for a Derako product are high, therefore the initial investment for each product in a PSS are high.

In the construction industry, the current need for PSS is relatievely low. The industry can be considered somewhat oldfashioned and the products far from the typical PSS-products. However, as stated before, the CE is gaining ground in the construction industry. PSS are inherently connected to the CE, therefore a PSS should be assessed to find out whether it creates an interesting opportunity for Derako at a later moment. This assessment can be done through conversations with the partners and potentially setting up a pilot.

MARKET

The market part of the roadmap mainly focusses on the planning of the marketing and the stakeholder conversations. It evaluates when certain marketing steps need to be taken and describes what partners should be addressed.

Marketing

The focus of the marketing is to promote the products in the right markets and at corresponding target groups. The roadmap will describe when certain marketing steps need to be taken. Derako has their own marketing inhouse, with great knowledge of the market. Therefore the specific marketing actions will not be further elaborated on in this part of the process.

Stakeholder Conversation

The timeline of stakeholder conversation focusses on pointing out which stakeholders are needed to successfully introduce and maintain a circular product line. These stakeholders will be linked to potential partners, companies that are active in the field of sustainability or CE.

PARTNERS

Partners are a crucial part of the circular product line, ranging from architects to installers and from transporters to restoration partner. Derako needs to work together to create and fulfil demand at the client side, but also work with logistics partners to efficiently and successfully transport and retreive products.

Therefore, the partners described are companies Derako can work with, either as client or partnership from which both companies benefit.

All partners are suggestions of companies that focus on what is needed for Derako at that moment in time. Derako has a lot of contact with different types of stakeholders which might prove relevant or valuable next to the suggestions made.

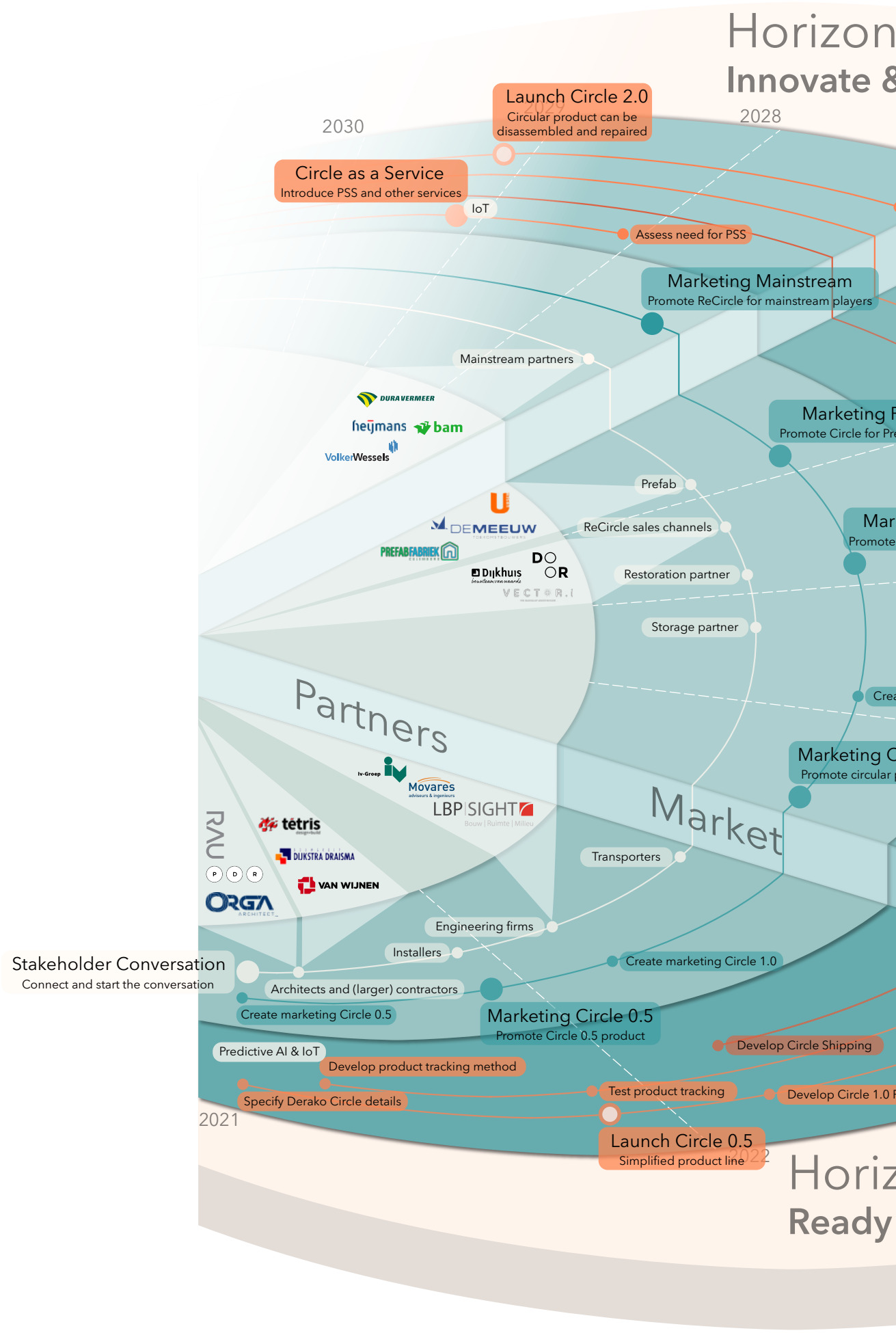
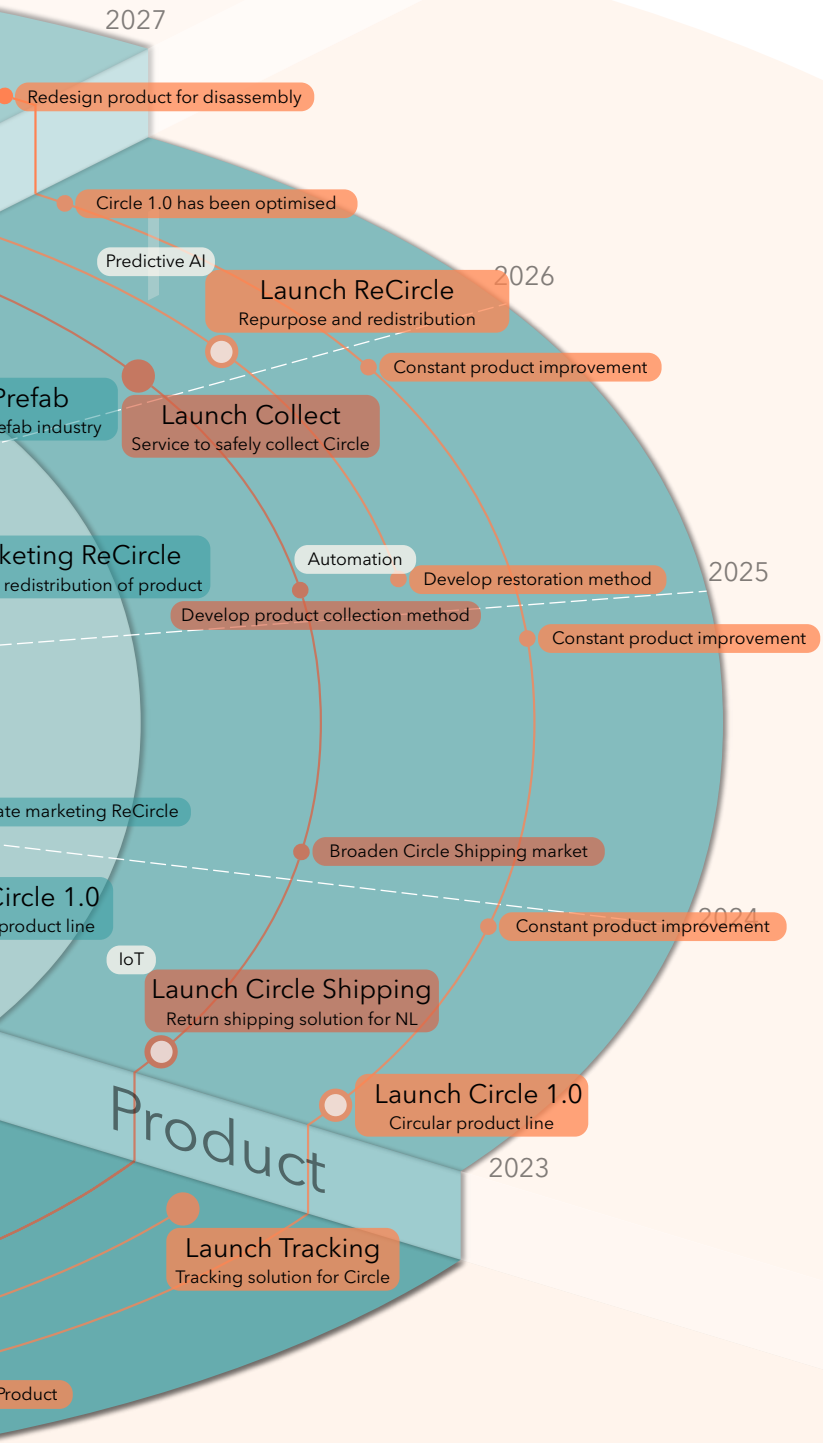


FIGURE 37 Circular Product Roadmap

3
& resell



Horizon 2
Launch & relaunch

zon 1
for launch

Legend

- Internal process start
- External launch
- Link to waste reduction
- Text
- Technology

HORIZONS

The roadmap has been split in three horizons, all with their own vision.

HORIZON 1 - READY FOR LAUNCH

The first horizon focusses on preparing Derako and the circular product for launch. The main goal of the first horizon is testing and preparing for a successful launch of the circular product line. Detailing the circular product line, developing product tracking method, develop a return shipping method, starting up the marketing and starting the conversation with stakeholders.

HORIZON 2 - LAUNCH & RELAUNCH

The second horizon revolves around launching the circular product line. It involves all necessary steps such as return shipping solution and launching the marketing.

Additionally the relaunch is part of the second horizon. It involves all steps needed to prepare this relaunch, such as the collection, restoration and marketing.

HORIZON 3 - INNOVATE & RESELL

The final step of the roadmap is the third horizon, where the focus lies on innovation and reselling of the product. Reselling the product mainly revolves around finding possible sales markets for the ReCircle product, for example more mainstream contractors.

TIMEPACING

The timepacing of the roadmap has been based on the current Derako product and fit to the CE. Currently, the Derako product already can be considered a sustainable product, therefore there is no need for a complete redesign. The biggest change for the circular product line is to standardize the product, in doing so Derako has to look into sustainable wood types and efficient sizes.

After deciding and testing those decisions with a preliminary, not yet circular, product line, the actual product line can be introduced. Together with this product line, a return shipping method and product tracking solution will be launched. The first phase of the roadmap has been designed to facilitate this in terms of timing.

The second phase of the roadmap is mainly depending on the first Circle 1.0 products to be placed and returned. As the timespan of this is relatively uncertain, the timepacing of the second phase is an indication. If the products are being returned after several years, the collection and redistribution can start.

PRODUCT

PRODUCT LINE

2021

Specify Derako Circle Details
Derako's circular product line, Derako Circle, must be specified. Standardization details like wood type and sizes have to be defined. All decisions are to support the philosophy of a circular product, for example sourcing wood locally. Wood types that have been mentioned are larch (lariks), which could potentionally be sourced from the Veluwe. Furthermore the potential of using MDF based Cloak Wood has been underlined. Sizes should be based on the possible purchasing sizes and should support efficient production with minimal waste. Only transparent varnish will be available.

2022

Launch Circle 0.5
The preliminary circular product line will be launched. This product line will not yet be completely circular, but will test the market on offering a simpler, less customizable product line. It will offer less options than the recently introduced Base-Line. Through Circle 0.5 Derako will be able to streamline the processes and optimize the choices made on standardizing the product line.

Develop Circle 1.0 Product
Lessons learnt in Circle 0.5 will be applied in the Circle product development.

2023

Launch Circle 1.0
The truly circular product line will be launched. Based on the learnings from Circle 0.5, the Circle 1.0 will be offered as a circular product line, which will be returned to Derako after its use cycle. A business model canvas (BMC) has been created to support the value proposition of Circle 1.0. See *appendix 8A (page 140).*

2024

Constant Product Improvement
The product will have to be assessed on its circular performance, and where possible improvements will be made. This could involve different types of (more) sustainable wood, more sustainable choice of paint or improving the sustainability of the mounting materials.

2025

2026

Circle 1.0 Has Been Optimized
Circle 1.0 has been optimized, the product is at a high level of circularity, the materials integrated in the product are healthy and of high quality. The Circle is able to add value to the product portfolio of Derako, without needing additional attention.

2027

Redesign for Disassembly
A next step for the circular product line. Whereas it was not possible to disassemble and fully repair Circle 1.0, a new design creates a fully dismantable product. The need for this redesign is based on collected information on panels from Circle 1.0. If there is little to no need for complete disassembly, for example because panels rarely get damaged or there is a good alternative use for the damaged panels, a redesign is not needed.

2028

2029

Launch Circle 2.0
In case a redesign is needed, Circle 2.0 is introduced. Circle 2.0 is a new step towards a ultimate circular product. Disassembly can facilitate the reuse of wooden slats from the panels, instead of destruction and downcycling.

TRACKING

2021

Develop Product Tracking Method
The Circle product has to be tracked in order to be able to retrieve the product after use. Several option are available, ranging from IoT sensors to track location to providing clear instructions with the product on how to handle returning the product to Derako. A financial incentive is also a good motivator to be more active on returning the product.

2022

Test Product Tracking
The designed system can be tested, in case of instructions this could be done through user test. When a technological solution is proposed, the Circle 0.5 products can form a basis for testing.

Launch Tracking
Launch the tracking solution for the upcoming Circle 1.0 product.

2023

REPURPOSE

2025

Develop Restoration Method
After the product has been retrieved, certain panels might require cleaning, repairs or restoration. As the panels are not fit for disassembly, it is important to thoroughly assess whether a panel can be repaired or restored if needed. A method of restoration could be dipping the panels in transparent paint, which will even out minor scratches and imperfections in the surface layer. This can be repeated for several life cycles.

2026

Launch ReCircle
ReCircle is being launched as a product. A ReCircle product offers a high quality, modular solution at a lower price point, as the products are available from recollection. As a result, the products can contain minor imperfections and are not available at any moment in time. Through predictive AI, Derako can get a grip on incoming products, therefore are able to better handle their ReCircle stocks. A BMC has been created to support the value proposition of ReCircle. See *appendix 8B (page 141)*.

COLLECTION AND TRANSPORT

2022

Develop Circle Shipping
Circle shipping is based on a return crate, allowing Derako to ship their Circle product with little to no waste. Circle shipping will replace the wooden crates and use of plastic with crates that can be returned, most likely made of metal, and packaging that can be reused, for example reusable plastics or sheets of fabric.

2023

Launch Circle Shipping
Launch the Circle shipping method for the Netherlands. Ensure waste free shipping. Service is also available for non-circular products at extra cost.

2024

Broaden Circle Shipping Market
Broaden the market for Circle Shipping to other countries, such as Germany and Belgium.

2025

Develop Product Collection Method
Develop a method of safely collecting and shipping the product. Either through a Derako collection team or clear instructions on how to disassemble and pack the product. Test whether these instructions would be sufficient to safely ship the product.

2026

Launch Collect
Launch Collect, provide the service for collection of ReCircle products.

PRODUCT SERVICE SYSTEM

2028

Assess need for PSS
As the CE is gaining ground, more products are being offered as a PSS, assess whether this would be a fit for Derako products too.

2029

Circle as a Service
If the need exists, introduce Circle as a service. The service must support the existing PSS in the construction industry at that moment in time. The service could consist of short or long term leasing of the product. Also additional services such as panel replacements, repairs or repainting of panels could be offered as part of the service.

MARKET

MARKETING

2021

Create Marketing Circle 0.5
After Circle 0.5 is based on the principle of the Base-Line, a simplified product is offered at a lower price point. With Circle 0.5, the market will be tested for such a product, however also with a focus on sustainability. Circle 0.5 cannot be marketed as a circular product, but can be sold as a more sustainable option, with the optimized sizes, sustainable wood choices and modular properties.

2022

Marketing Circle 0.5
Circle 0.5 can be marketed to all current stakeholders, such as architects, contractors and installers.

Create Marketing Circle 1.0
Based on the results of Circle 0.5, Circle 1.0 will follow. Circle 1.0 is a completely circular product, and has to be marketed as such. Circle 1.0 will offer a sustainable, modular and flexible product at a competitive pricepoint.

2023

Marketing Circle 1.0
Circle 1.0 can be marketed to all current stakeholders, such as architects, contractors and installers. Additionally, engineering firms who are active in the field of sustainability and circularity can be targeted.

2024

Create Marketing ReCircle
In case the product is being redistributed after its first use, the value proposition of the product changes. Therefore, a new marketing on the ReCircle product should be created, which can target either the same, or additional target groups, such as more mainstream contractors or architects.

2025

Marketing ReCircle
Marketing of ReCircle will be launched, bringing a new type of business for Derako. The first phase of this process will be focussed on creating awareness and demand of the product. Later on, when ReCircle has been launched, the marketing can shift to actively selling the product.

2026

Marketing Prefab
The prefab industry is a growing market, the modular Circle product is a perfect fit for any prefab module. Marketing should start focus on prefab offices or shops, while later on exploring the possibilities of prefab homes.

2027

2026

Marketing Mainstream
The Circle product has been around for some years, fulfilling its purpose in a circular building environment. Having gained this position, it can now also appeal to more mainstream parties that do not have a specific focus on sustainability or CE. Attracting to these parties would require to focus on the pricing of the Circle product. The ReCircle product can be sold as more affordable and shorter delivery times than the Circle product.

STAKEHOLDER CONVERSATION

2021

Architects and (larger) contractors
The first step in the stakeholder conversation are the architects and (larger) contractors. Those stakeholders are already investing in adopting a more sustainable and circular way of working. The conversation with these stakeholders should revolve around the desire for circular products and the possibilities of collaboration.

2022

Installers
A bit later in the process, the installers are also involved. Their desire for sustainable and circular products is often lower. If a circular product is required, this demand often comes from building owners or architects. The installers are following these requirements, therefore Derako should mostly focus on informing and awareness on Circle.

Engineering Firms
Engineering firms are often part of a construction team. Their input mainly revolves around technological details and calculations. In this role, they also have an influence on decisionmaking concerning sustainability. Therefore it is valuable to connect with these firms and inform them about Circle.

2023

2024

Transporter
The conversation with the transporter revolves around the return shipments. These shipments should be performed in an efficient manner, both financially as environmentally. This means that unnecessary trips should be avoided. For example, empty crates can be collected when the driver passes the location of the crates, after which the crates can be stored at the transporter. The crates will be returned to Derako if the transporter is picking up a new load of Derako products.

2025

Storage Partner
If needed, Derako needs to partner with a party that can facilitate storage of the ReCircle products.

Restoration Partner
Depending on the volumes and logistical possibilities, Derako should consider working with a restoration company to take care of cleaning, repairing or restoration. At any moment in time, Derako should remain owner of the product.

2026

Prefab
As Derako is actively selling Circle for the prefab market, close contact or collaboration with promising prospects is required.

2027

Consumer Market Partner
In order for Derako to successfully participate in the consumer market, Derako should consider partnering up with hardware stores, interior design shops or interior designers.

LINK TO WASTE

The Circular Product Roadmap has a focus on the circular product line, but has certain elements that cause reduction of waste. These elements have been marked on the Circular Product Roadmap, see figure 37 on page 98.

Launch Circle 0.5
In Circle 0.5 certain standardizations cause a reduction of waste production. The sizes have been optimized to facilitate efficient production with minimized wood waste.

Launch Circle 1.0
Circle 1.0 continues the trend of optimized sized, reducing waste production on a larger scale. Furthermore, products that return after their first use are no longer considered waste, indirectly reducing the amount of waste.

Launch Circle Shipping
With Circle Shipping, Derako is able to drastically reduce the amount of waste produced in shipping the product, both wood as well as plastic waste, through the application of reusable shipping materials such as crates and for example blankets.

Launch ReCircle
ReCircle allows Derako to reuse the product, rather than the product ending up as waste. This indirectly reduces the amount of waste. However, it also allows Derako to reduce production of new products, while selling the same amount of products. As a result, the amount of waste created in production is also reduced.

Launch Circle 2.0
Redesigning the product to allow for repairs minimizes the waste in production, but also reduces waste in the ReCircle process, as it allows for returning panels to be repaired if needed.

TRANSPORT

The transport of the Circle product must happen sustainably, therefore the current shipping method must be revised. The aim is to ship without any form of waste, resulting in a return shipping method, Circle Shipping.

The return shipping method should be based on foldable or demountable crates, as described in *circle shipping (page 112)*, different scenarios are possible for transport and the corresponding crates.

In all scenarios crates should be easily transportable in an unmodified trailer. Also, in order to efficiently facilitate return shipping, crates should be foldable, decreasing the surface area needed in the trailer and therefore lowering costs, as the price of transport is calculated based on length meters and width (full width or half width). Additionally, this reduces the surface area needed for storage of the crates.

Scenario One
Derako develops their own return crate. This means the crates should be simple and easy to produce. Crates can be made from wood or metal, but should be reusable and durable.

As in this scenario all crates should return to Derako, it is valuable to stack as many crates as possible and therefore reduce return shipping costs.

Scenario Two
Derako makes use of existing crates. This scenario requires the same transport methods as scenario one.

Scenario Three
Derako develops an industry standard for shipping large goods together with partners.

This scenario depends on Derako working together with partners to create a nationwide coverage with the crate system, therefore minimizing the amount of movements, drastically lowering transport costs. This always leads to lower storage costs, less handling and less production costs. Usage of this system can be paid through subscription or pay per use.

PACKAGING

Scenario one and two allow for sustainable packaging materials, such as reusable blankets. These materials can easily be returned with the crate. In the third scenario this is a bit harder, therefore Derako and partners should assess whether a packaging can be developed that can also be used industry wide. If not, Derako has to look into packaging materials that are more sustainable, such as fabrics or paperbased materials.

REDISTRIBUTION

The redistibution is a big part of the circular product line. In order to successfully redistribute the products after their use, it is crucial to think about the logistics and marketing of the ReCircle product line.

Logistics
The first step of the ReCircle is to collect the product. Collect is a service which will facilitate safely collecting the product. As described, this could either be done with the help of a Derako Collect team or clear instructions on how to disassemble and pack the product. For this Derako could work with trusted partners that are known with safely disassembling a building. An example of such a party is New Horizon (see *appendix 7 (page 138)*).

Once the product has been collected, it has to be prepared to recircle, either through cleaning, repairing or restoring the product. This can be done inhouse, or parts of this can be outsourced. In any case, Derako should maintain ownership and control over the product, ensuring the quality of the product is maintained. After preparing the product for recircling, it has to be documented and stored.

Marketing
As described, the ReCircle product can be marketed to the same target group as the Circle product, mainly focussing on the sustainable part of the product while offering an even more cost effective alternative to the Circle 1.0 product.

However, the ReCircle product also offers other benefits which might appeal to different customer groups, such as delivery from stock. This might be relevant for temporary buildings or even the event market such as trade fairs.

For Derako a decision has to be made on how the ReCircle product will be advertised, and whether the focus is on quickly repurposing the product at a lower price, or restoring the product and reselling at a higher price. In either situation, Derako has to capture the essence of the ReCircle product in this marketing, namely a durable, high quality product with a low environmental impact.

A BMC has been created for the ReCircle product and can be found in *appendix 8B (page 141)*.

PARTNERS

As part of the roadmap, partners have been indicated. These partners focus on the sustainability or CE in their own field of work.

For Derako it is important to involve these partners in the development of the circular product line. This means starting a conversation about a CE and define the interest of those parties in circular products.

For example, the conversation with architects should be focussed on how Derako can offer circular products, supporting architects in a goal to build more sustainably or circular. The conversation should revolve around what type of products the architects are looking for, are there specific needs Derako can cater to with this product. The same applies to engineering firms focussing on sustainable or circular development.

With the contractor the conversation can focus on other aspects, such as the logistics of installing, but specifically taking down the product after use, ensuring it to return to Derako in the best shape possible. Together with the contractor and installer a method should be designed to facilitate this process.

The installer plays a smaller role in the process. The interest in sustainability of the installer seems to be smaller, as their main focus is on price. An installer will buy and install a sustainable product when this is a requirement made by the architect or contractor. The interaction between the installer and Derako will mainly focus on informing the installer about the circular product line, therefore increasing awareness.

The installers might play a role in disassembling the product after the first use. For this to happen effectively without damaging the product, Derako can consider partnering with some larger installers and provide clear instructions on how to disassemble, pack and ship the product.

The transporter should be involved in the process as well, discussing the opportunities of sustainable transport, efficiency of the transport, storage of the crates used for Circle Shipping. A fitting partner that facilitates this sustainable way of shipping and transport is crucial to be able to cover the whole chain.

Other partners such as for restoration have been discussed before.

In *appendix 7 (page 138)* a list of partners is available. This list is a suggestive list that involves architects, contractors, installers, engineering firms, but also possible partners to handle the waste of Derako, or are interesting potential partners for a different reason.

TECHNOLOGY

When it comes to technology, Derako is currently considered low tech. The process of Derako is mainly manual labour, assisted by a form of automation in some parts of the process. Automated machinery is being designed inhouse and custom made, to facilitate the unique process of Derako.

However, Derako has no experience with more complex technology such as IoT or Artificial Intelligence (AI). These technologies have not been necessary for Derako and their current product lines.

For the circular product line, these technologies can prove as an helpful addition, in this case at the phases of tracking the product, Circle Shipping, restoration and Circle as a Service.

PRODUCT TRACKING

Tracking the product is crucial to ensure it can be retrieved afterwards. This can be done analog, for example providing clear instructions with the product about its circularity and later on staying in contact with the owner of the product. It can also be done digitally, for example by registering the product on a platform, where the status of the product can be updated by the owner. Finally it can be done through sensors. IoT sensors can measure changes in the product, for example movement, and signal Derako about this.

However, product tracking is also about knowing when a product is available, therefore being able to manage the incoming products and being able to ReCircle the product without having to store it for a long period of time.

A method that can help with this is predictive AI. AI can help in predicting when certain products are being returned by working with parameters, for example type of building and usage of this building. This might be less relevant at the start, when there is a low amount of Circle products being sold. However, when a noteworthy amount of Circle products is on the market, it can be valuable information to know when and what amount of product is being returned.

CIRCLE SHIPPING

Circle Shipping is based on a return shipping system. Depending on the type of packaging Derako will use, technology such as tracking of the packaging with IoT sensors is a valuable tool.

Scenario One
Derako develops their own return crate. This will most likely be a more costly option, therefore the urgency of returning such crates is high. A deposit is a good option, but additionally tracking sensors can help keeping track of the crate.

To assist in logistics of these crates and efficiently plan return shipment, users can scan the crate and indicate, on a digital platform, when the crate is ready for pick up.

Scenario Two
Derako makes use of existing crates. This option will most likely be cheaper, slightly lowering the urgency for returning. Depending on the costs and ownership structure of this option, tracking can still be relevant.

Scenario Three
Derako develops an industry standard for shipping large goods together with partners. A system that can be used by different manufacturers in the construction industry to pack and ship fragile goods, such as window or door

frames or other type of interior pieces. Crates would be in constant rotation and not belong to a specific business.

RESTORATION

In order to facilitate effective and efficient restoration, automation of this phase can prove helpful. In the beginning, restoration can be done by hand, assessing what type of defects are present and how they can be solved. Later on, when the types of defects are known, the most common defects can be solved by machines, such as cleaning, sanding or painting. Less common defects can still be solved by hand.

CIRCLE AS A SERVICE

In Circle as a Service the circular product will be offered as a service, for example leased out or repaired. It is crucial to know where the product is at all times, therefore the product should be tracked. Additionally, misuse such as shock impact or other types of potential damage can be registered and stored.

9

Conclusion & Discussion

CONCLUSION

Over the years, Derako has built a reputation for delivering high quality, custom made products. Derako is able to cater to the specific needs of the client, while providing the desired certificates regarding sustainability.

However, looking at the production process of Derako, a lot of waste is being generated. Not only Derako is generating high quantities of waste, the whole construction industry is responsible for vast amounts of waste and pollution. As a result, the industry has to change. Dictated by some passionate sustainable doers in the industry, also large players see the need for improvement. Additionally, clients push for sustainable innovation, opting for circular or modular buildings and the use of sustainable materials.

This project has explored the possibilities for Derako to improve on their sustainable performance, both for lowering their environmental impact, as well as to stay relevant in the market. The result is a two-fold plan, one part being a waste reduction plan, the second the circular product roadmap.

The goal of this thesis, as defined at the start, is as follows

Provide Derako with a coherent, holistic and implementable strategic sustainability roadmap based on a vision that aligns with Derako

RESEARCH QUESTION

At the start of this thesis, a main research question has been defined. This has been the overarching topic for the research and design phase.

How can Derako become a more sustainable business in the future?

This question has been split in two sub-questions, which will be concluded on separately.

Sub-Question One

What products or services could Derako introduce to reduce or re-use their waste streams to reduce their impact on the environment?

In order to introduce a product or service, an image of the industry at hand has to be formed. Through research in the field of construction, conversations with several internal and external stakeholders, trends have been defined that dictate the development in the industry over the coming ten years. One recurring topic on the agenda in the industry is the Circular Economy. This topic has become an integral part of the project, being the foundation of the circular product line.

Additionally a list of market specific trends has been defined. Together with Derako, through the means of a co-creation session, the decision has been made to focus on modular and flexible buildings.

The circular product roadmap has been developed as a tool for Derako to introduce Circle 1.0, a circular product which can answer the questions on how to reduce their environmental

impact. Circle 1.0 makes use of standardized materials, sizes and finishes, minimizing the amount of variations and increasing the ability to reuse the product, following the ideas of a Circular Economy. However, standardization also facilitates using the product for modular and flexible applications.

Alongside Circle 1.0, Circle Shipping is being introduced, a return shipping plan to ship Derako products without making use of single use crates and plastic packaging, therefore reducing the environmental impact of Derako products.

The circular product roadmap has been developed to fit Derako, in terms of product type as well as budget. The circular product roadmap consists of relatively small steps to take, testing the market and being able to execute prototypes, such as Circle 0.5.

Furthermore, the roadmap is aimed to stimulate Derako to work together with relevant partners in the market, creating a bigger impact while strengthening their position in the market.

Sub-Question Two

What process-oriented changes could Derako introduce to reduce their impact on the environment?

Research within Derako pointed out the vast amounts of waste being generated, both wood waste as well as plastic waste. This realisation was the basis for the waste reduction plan. This plan focusses on process-oriented changes, to reduce the amount of plastic waste generated and find high value applications for the existing wood waste.

Through a step by step actionable plan, Derako is able to systemetically improve on specific aspects. For the plastic waste this means actively trying to minimize the amount of incoming, internal and outgoing waste, whereas the wood waste is mainly focussed on finding partners that have a high value application for the materials.

Goals have been set for each horizon, following the timeline of the circular product roadmap.

AIMS

The aims defined at the start of the project have been guidance for the collaboration with Derako.

Keep it tangible and approachable. Derako is looking for implementable sustainability solutions on a realistic timescale.

Make sure to create a clear vision with Derako that aligns with the values and way of working Derako is known for. Create ownership during the process.

A close collaboration with Derako has ensured the solutions have been kept tangible and approachable. Derako has been part of the entire process, through discussions, conversations and two co-creation sessions.

These close collaborations have proven their value, during the project several employees have stepped up with valuable ideas to reduce waste. Some of these suggestions have been implemented immediately.

RECOMMENDATIONS

SUSTAINABILITY

This thesis has focussed on creating a sustainable roadmap for Derako, while limited to a certain time frame. Furthermore, the focus has been on improving the sustainable performance given the limitations in terms of money and investment opportunities, but also limitations in time and space available.

As a result, this thesis proposes a method to improve sustainable performance within those given limitations. However, plenty of opportunities lie outside of these limitations. For example, Derako could look into investing in space and machines to facilitate repurposing of wood waste in their own product. These techniques are known and used in the market, for example by Herso.

Currently this has not been taken into consideration in the roadmap, due to the high investments in time, money and space. However, it may prove profitable and it can offer a unique selling proposition, creating a strong position in the market and therefore a good return on investment.

It will prove helpful for Derako to investigate how much time and money can be allocated for innovation towards a more sustainable business. In this, the return on investment, in both time and money, has to be considered. However, a certain factor of responsibility applies to all businesses, meaning all activities should be good for people and planet. For Derako, taking this responsibility means assessing whether the current way of working is paying enough respect to the materials being used, but also being thrown away.

SUSTAINABILITY WITHIN DERAKO

For Derako to successfully prioritize sustainability, one or more ambassador(s) of sustainability should be appointed within the company. These ambassadors fulfil the role of ensuring sustainable development and ensuring the goals of the waste reduction plan and circular product roadmap are being achieved.

One or two ambassadors from the office and one ambassador in the workplace can use these roles to come together, discuss progress and express towards other colleagues. Assigning these roles provides a feeling of responsibility, which will help in pursuing the goals set for Derako. Furthermore, these ambassadors can form the basis of knowledge surrounding the topic of sustainability.

CO-CREATION

Co-creation has been used internally during the process of creating the vision and roadmap, and has proven to be a valuable tool to bring people and ideas together. Internally, these sessions can bring valuable insights beyond the topic of sustainability.

Co-creation is an approach that can bring any group of stakeholders together, internally or externally. Conversations and partnerships are an important part of the roadmap, through co-creation, these partnerships can grow. Co-creation with stakeholders can strengthen the bond and give a feeling of engagement, as described in *co-creation vision (page 70)*. It is recommended for Derako to use co-creation to build this bond around the circular product line.

PARTNERS AND EXPERTS

As has been stated multiple times, the conversation with partners is crucial. The focus should be on creating interest in the product, through meeting the needs of the partners.

However, there are different experts that can contribute to the sustainability of Derako in many different ways. These partners have also been listed in *appendix 7 (page 138).* Some examples of these experts are Herso and Plennid.

Herso describes their business as circular woodworking, using the waste of others to create wood tables, floors and walls. At Herso they believe no wood should go to waste and it is part of their mission to help and reduce wood waste. Herso also uses waste wood from Derako to make their products, but cannot use all the waste produced by Derako, due to the high volume. However, what Herso can do is help Derako with knowledge on how to process their own waste and create wooden planks, which can be used to create new Derako products. This type of knowledge exchange can be incredibly valuable in the aim to reduce wood waste.

Plennid is a company focussing on high value application of materials released during maintenance of public green areas. Plennid aims to bring companies together and create green and circular business models. For Derako, this might be a good opportunity to work with local wood and create unique propositions for local projects. Doing this might require a change in mindset, for example purchasing the said wood at a different point in time, possibly have a longer storage period.

LIMITATIONS

Like any project, some constraints have been encountered due to time, approach or the limitations caused by the measures surrounding Covid-19. Some of these limitations will be described

DERAKO PRODUCTION PROCESS

To start, the Derako production process is designed to facilitate production of Derako products as efficient and effective as possible. Naturally, this process has evolved over time, introducing new machines, new steps or even new products. Due to large investments in machines, the overall process is quite rigid, leaving little room for changes.

Due to lack of knowledge or experience in these specific processes or large scale woodworking in general, no efforts have been made into creating a more efficient production process. However, this does not mean there are no opportunities to create a more efficient process with less inherent wood waste.

EXPERTS

The research of this thesis has mainly revolved around online research, research at Derako and interviews with experts. Most of those interviews have been conducted online due to the Covid-19 virus.

In hindsight, some more interviews or conversations with stakeholders could have contributed to a deeper understanding of the market and the developments. Also visiting one of the sites where Derako products are being installed could have provided a valuable insight in the world of construction.

Furthermore, co-creation with experts from the field would have been a beneficial contribution to the results.

PLANNING

Some limitations have been caused by unfortunate planning, through which some information has not been gathered. For example the gathering information about the quantities of wood waste has not been successful, due to a peak in production, therefore limited time to execute the test. Had this test been planned earlier, more time would have been available.

Furthermore, the co-creations have both not been as valuable as could have been, due to unforeseen circumstances. Sadly, rescheduling was not possible, therefore they were conducted in a different shape, possibly influencing the results.

REFLECTION

During my studies as a designer, I have always felt it is my duty to design and build towards a more sustainable future. Whether it is through making worldwide impact at a large corporate, or helping a smaller SME, design can play a crucial role in this change.

My personal goal for this project was to facilitate this change. Pursuing a project where I can make an impact on sustainability has been one of my most rewarding educational experiences so far. I truly feel this project is a valuable contribution to Derako and will impact the company and their sustainable performance for the years to come.

Working with an SME has posed some challenges, but also many opportunities.

To start with, a project with an SME is limited, mostly by budget and time, but also knowledge. A SME does not have unlimited budget to invest in new machines or additional space. At an SME planning a co-creation is difficult, because the day-to-day activities continue. A SME does not have a chief sustainability officer that is up to date about all sustainability developments in the market.

However, an SME does offer you very short connections, high involvement and a lot of practical insights. These factors make that a project can be most relevant, not ending up in a drawer, but be implemented. For me, this has been a highly motivating factor.

I started this project with the aim to work with Derako, truly involving them in the project and creating engagement with the result, I feel the co-creations have contributed greatly to this cause and a lot of positive feedback confirmed those feelings.

Furthermore I have delved deep into the world of roadmaps, which has been a highly rewarding experience. The method of roadmapping has given me the much needed handles during this project and has guided me to a coherent and holistic result.

My personal goal to grow as a visual designer has led me to experiment with various methods of creating visuals, pushing my skills on this topic to the next level. Next to creating strategic visuals, the art of creating icons and illustrations has been touched upon, which were both new to me.

Some valuable learnings have been gained. The biggest of which, is to be more proactive in engaging and contacting stakeholders. Often experts are very open to dedicate a bit of their time to discuss their field of expertise. These conversations will bring plenty of new information and fresh insights.

This also reflects internally within Derako. In hindsight, certain conversations with employees of Derako should have taken place earlier in the process, preventing possible delays.

A more proactive attitude towards testing could have also prevented the current lack of information on the quantity of the waste streams.

In general, I feel this project and working with Derako has shown me that the vision and skillset of a strategic design can be a valuable contribution to companies in general. Moreover, this project has given me the confidence to use my skills and apply them to real world scenarios, and in doing so aim to make a positive impact on the future.

Appendix

APPENDIX 1A - WOOD WASTE

This elaboration is based on *figure 12 on page 41*.

In order to successfully identify opportunities of wood waste reduction and reuse, the current waste streams have to be mapped and quantified. When the individual streams of waste are clear, an estamate of the amount of this type of waste can be made.

FROM RAW WOOD TO GROSS WOOD

The first step is from raw wood to gross wood. The losses from this process can be roughly calculated through the known sizes of the raw wood and gross wood. The assumption is that all wood here is turned into moth, slats are neglected at this point.

FROM GROSS WOOD TO GROSS NET WOOD

The next step is to do the same for gross wood to net wood, which can be calculated through the known sizes of the gross wood and net wood.

CUT LENGTH

Cutting the slats to length results in cut off pieces, both in the Grill and Lineair process. In order to successfully measure the quantity of the cut off pieces, a test has been set up. This test will measure the weight of the cut off pieces for some projects relative to the size of the project.

DROPOUT

Throughout the whole process, dropout is created. This dropout consists of rejected slats of wood in various states of processing, ranging from raw wood to completely finished slats.

Currently dropout wood is being checked to see whether a slat can be used for a different application in the project. For example, a Grill slat with a defect on one end can be cut down to be reused for shorter panels.

Dropout slats of decent quality will be set aside as backup for when the factory is just short of slats for that specific project.

The current process causes the dropout wood of a project to be split up early on, meaning it is unclear how much dropout wood there exactly is.

For the test, the dropout wood of some projects will be collected and weight at the end of the project. By doing so, the weight relative to the size of the project can be determined.

TEST

The aforementioned test has been set up and is ready for execution. Due to time constraints in production, this test has not been executed yet with enough measuring points, which means there is no reliable data available.

The test is of crucial importance to fully understand the volumes of wood waste per type Derako is dealing with. When this data is known, Derako can improve their handling of waste.

APPENDIX 1B - PLASTIC WASTE

Different types of plastic are being used at Derako. Current plastic usage (projected 2020):

- PET straps 700kg
- LDPE shrink film 700kg (lineair)
- PE flat film 2200kg
- PE foam wrap 1150kg
- LDPE stretch film 1950kg
- Bubble wrap 24kg
- Flat film round 24kg

A total of approximately 6750kg of plastic is being bought and used at Derako each year. This amount is excluding the incoming plastic waste.

The plastic is being used as follows:

Internal
- PET straps
- LDPE Stretch film
- Flat film round

Outgoing
- PET straps
- LDPE shrink film
- PE flat film
- PE foam wrap
- LDPE stretch film
- Bubble wrap

APPENDIX 2 - PRACTICE CASE

Interface is a company known for creating different types of flooring, a product that does not have a strong connection to sustainability. Interface set out to become sustainable without loosing their purpose and through thoroughly assessing all parts of the business.

Interface sparked innovation from within, empowering employees to think about sustainability and act upon it.

Furthermore, Interface worked with the whole chain to improve sustainable performance, increasing the impact and creating new opportunities for collaboration.

They carry pride in their sustainability, showing others that setting goals is a valuable tool to pursue the seemingly impossible.

Interface has been chosen as practice case because of these points, and their proven success in being an early adoptor of sustainability, both in sustainable achievements as well as business growth.

APPENDIX 3A - QUESTIONNAIRE

QUESTIONNAIRE EMPLOYEES

NOTE: All questions will be answers on a 7-point Likert Scale, with 1 being 'Helemaal niet mee eens' (completely disagree) and 7 being 'Helemaal mee eens' (completely agree).

Duurzaamheid bij Derako

Zoals velen van jullie weten ben ik momenteel bezig met mijn afstudeerproject bij Derako. Ik zal mij richten op het onderzoeken van de duurzaamheid binnen Derako, met een focus op het verminderen van de afvalstromen en waarde toevoegen aan het (hout) afval wat vrij komt bij de productie.

Mijn doel is het opstellen van een toekomstvisie op het gebied van duurzaamheid. Deze visie wil ik opstellen met Derako, om op deze manier zo dicht mogelijk bij Derako zelf te blijven. Vanuit deze visie zal er een strategie worden vormgegeven, die past bij de huidige werkwijze van Derako.

Voordat het zo ver is wil ik graag weten hoe jullie als werknemers van Derako aankijken tegen het onderwerp 'duurzaamheid'. Het doel van deze vragenlijst is om dat in kaart te brengen.

In deze vragenlijst wordt met duurzaamheid bedoeld dat het milieu zo min mogelijk wordt belast, bijvoorbeeld door het tegengaan van verspilling of het verminderen van plastic afval.

Probeer de vragen zo eerlijk mogelijk te beantwoorden, er is geen goed of fout. Het is jouw mening die telt en de enquête is anoniem.

Alvast bedankt voor het invullen!

Micha

Persoonlijk

Eerst een aantal vragen over hoe je op persoonlijk vlak bezig bent met duurzaamheid

1. Ik vind duurzaamheid een belangrijk onderwerp

2. Ik vind duurzaamheid een interessant onderwerp

3. Mijn keuzes in het dagelijks leven wordt beïnvloed door duurzaamheid (bijvoorbeeld de keuze tussen auto en fiets of keuzes tijdens het boodschappen doen)

4. Ik probeer zo min mogelijk te verspillen om het milieu te sparen

5. Ik zou mijn levensstijl beschrijven als duurzaam

Zakelijk

Een aantal vragen over hoe je op werk bezig bent met duurzaamheid.

1. Ik ben op mijn werk vaak bezig met duurzaamheid

2. Ik weet wat er van mij wordt verwacht op het gebied van duurzaamheid

3. Ik word gestimuleerd om duurzaam om te gaan met materialen

4. Ik ben trots op hoe we binnen Derako omgaan met duurzaamheid

5. Ik zou Derako omschrijven als een duurzaam bedrijf

APPENDIX 3B - QUESTIONNAIRE

QUESTIONNAIRE EMPLOYEES - RESULTS

Tijdstempel	Ik vind duurzaamheid een belangrijk onderwerp	Ik vind duurzaamheid een interessant onderwerp	Mijn keuzes in het dagelijks leven wordt beïnvloed door duurzaamheid	Ik probeer zo min mogelijk te verspillen om het milieu te sparen	Ik zou mijn levensstijl beschrijven als duurzaam
26-6-2020 8:26:31	7	7	6	7	6
26-6-2020 9:00:46	2	2	1	2	2
26-6-2020 9:03:40	7	7	4	4	4
26-6-2020 9:34:41	6	5	3	4	3
26-6-2020 10:40:12	7	7	4	6	4
26-6-2020 11:10:30	4	7	1	3	3
26-6-2020 15:06:00	7	6	4	5	4
26-6-2020 15:27:07	6	6	3	5	4
26-6-2020 16:18:36	7	6	6	6	6
26-6-2020 17:29:25	6	6	5	5	4
28-6-2020 18:30:18	7	7	5	5	2
29-6-2020 9:01:58	6	6	5	5	5
29-6-2020 16:18:41	4	5	4	5	4
30-6-2020 8:26:59	6	2	3	6	4
1-7-2020 10:09:28	6	5	2	4	1
Gemiddelde kantoor	5,866666667	5,6	3,733333333	4,8	3,733333333
2-7-2020 8:53:22	7	5	5	6	4
2-7-2020 8:54:04	7	6	4	5	5
2-7-2020 8:56:01	7	4	1	7	4
2-7-2020 8:56:39	7	6	5	5	5
23-7-2020 9:45:14	4	3	1	2	2
Gemiddelde werkplaats	6,4	4,8	3,2	5	4

Ik ben op mijn werk vaak bezig met duurzaamheid	Ik weet wat er van mij wordt verwacht op het gebied van duurzaamheid	Ik word gestimuleerd om duurzaam om te gaan met materialen	Ik ben trots op hoe we binnen Derako omgaan met duurzaamheid	Ik zou Derako omschrijven als een duurzaam bedrijf	Waar werk jij binnen Derako?	Hoe lang werk je bij Derako (bij benadering)
3	4	3	3	3	Kantoor	Tussen de 2 en 5 jaar
2	1	1	1	2	Kantoor	Tussen de 1 en 2 jaar
3	7	7	7	6	Kantoor	Tussen de 1 en 2 jaar
2	3	3	5	4	Kantoor	Korter dan 1 jaar
3	6	2	3	3	Kantoor	Tussen de 2 en 5 jaar
6	1	5	3	4	Kantoor	Korter dan 1 jaar
5	6	5	6	6	Kantoor	Tussen de 5 en 10 jaar
4	5	3	5	5	Kantoor	Langer dan 10 jaar
6	6	5	5	6	Kantoor	Langer dan 10 jaar
6	6	4	7	7	Kantoor	Langer dan 10 jaar
4	6	5	3	4	Kantoor	Tussen de 5 en 10 jaar
5	6	5	6	6	Kantoor	Langer dan 10 jaar
5	5	4	5	5	Kantoor	Tussen de 2 en 5 jaar
3	5	6	5	4	Kantoor	Langer dan 10 jaar
4	6	6	5	5	Kantoor	Langer dan 10 jaar
4,066666667	4,866666667	4,266666667	4,6	4,666666667		
6	7	6	5	4	Werkplaats	Langer dan 10 jaar
5	6	5	5	6	Werkplaats	Tussen de 5 en 10 jaar
7	7	7	5	5	Werkplaats	Langer dan 10 jaar
7	7	6	6	6	Werkplaats	Tussen de 5 en 10 jaar
7	7	6	7	7	Werkplaats	Korter dan 1 jaar
6,4	6,8	6	5,6	5,6		

QUESTIONNAIRE EMPLOYEES - COMMENTS

Bij Derako prefereren wij "Duurzaam" te zijn, maar er wordt zeer, en extreem veel hout weg gegooid, en niet hergebruikt. Dit is in mijn optiek niet echt duurzaam, maar juist tegen overgesteld. Het zou fantastisch zijn om hier een duurzame oplossing voor te vinden, want het is echt heel erg zonde wat er weg gaat "De container in".

Succes met deze opdracht. geeft derako een systematisch inzicht waar we staan.
goed om dit in kaart te krijgen naast alle initiatieven en geloof dat we hierin hebben dat we het (zeer) goed doen

We verkopen C02 opslag, maar de manier hoe wij het verpakken met het vele plastic en al het hout voor de kratten vind ik erg zonde. De kratten worden op de bouw weggegooid, terwijl het goed hout is. Ik begrijp heel goed dat we de materialen goed moeten beschermen, maar ik vraag mij af of er geen andere oplossingen zijn.

Ik denk dat er een hoop afval (hout) bespaard kan worden door niet globaal 10% extra netto te bestellen. Maar het afval per houtsoort te bekijken (bijv. bij Ayous veel minder afval dan bij Eiken). Ook vaak naleveringen van een paar meter, misschien wat meer meegeven zodat dit niet nodig is (scheelt tijd & geld).

Als ALLE collega's zouden meewerken aan het milieu bij Derako kan het nog beter! Er word toch nog niet genoeg afval gescheiden. Het kan nog beter!

APPENDIX 4A - MEGA TRENDS

An analysis of mega trends has been conducted to develop an overview of the most relevant mega trends for the coming ten years. Based on extrensive research by several sources, this conclusion of the mega trends summarizes what trends are relevant for Derako and the development of the roadmap.

Conclusion on most relevant Mega Trends

- Technological development
    - o Technological developments influence production and products. More advanced opportunities present themselves to improve efficiency and quality in production, whereas the products and objects become increasingly complex and advanced.

- Urbanisation
    - o More and more big cities, increasingly bigger buildings and the rise of flexibility are all related to urbanisation. Flexibility on long term and short term. Prefab of buildings to efficiently facilitate rapid urbanisation.

- Climate change
    - o Green buildings, incorporating nature into the construction. Also reduce use of CO2 heavy materials such as concrete and steel and increase building with wood.

- Material scarcity
    - o Material scarcity influences other sectors. While wood a renewable source, when harvested sustainably. Material scarcity might have less influence on wood.

- Sustainability
    - o General activities to improve sustainability such as reducing waste and minimizing footprint become increasingly important for both companies as well as consumers.

- Increased connectivity
    - o Connectivity between people, companies and products. Connectivity increase efficiency, minimizes errors and offers many other possibilities. In the construction industry systems like BIM provide collaboration between stakeholders. Smart buildings are becoming increasingly connected.

- Focus on health
    - o Health is becoming increasingly important. Healthy food, airquality and lifestyle in general change the needs for the construction industry as well. Green buildings and wood are deemed healthy and increase joy of living.

APPENDIX 4B - MARKET TRENDS

URBANISATION

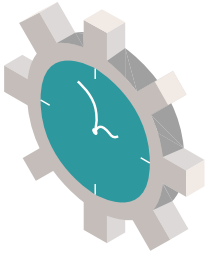
Urbanization is drawing people to the city. Cities get increasingly busier and bigger. In order for cities to function efficiently and effectively, they need to adapt. Cities need to be able to provide for all the need inhabitants in sense of living space, but also workspace, leisure and transport. This change goes accompanied with new construction and new challenges.

CONVENIENCE

Not only ecological products should be convenient, the whole need for convenience is a trend. Brands like Picnic, Uber and Bol.com provide services that make the life of consumers more convenient and are highly successful in doing so.

LOCAL LOVE

Love for local products and services. For example going to your nearby greengrocers instead of the supermarket. The same applies other type of products, for example buying a Dutch brand of clothing instead of a global brand.



FLEXIBLE WORKING

Flexibility is becoming increasingly important, with the rise of urbanization, cities have to be flexible, but users will move with it. Flexibility will be found in working, for example remote working, but also in the office itself, through flexible working spaces. These developments are pushed through the COVID-19 developments and the ever rising influence of technology.

HEALTH

A big quest for wellbeing, both mentally as well as physically. Health is becoming increasingly important, employees expect a healthy working environment, both in offices and factories. But also in homes, health is an important factor. Non-toxic materials and good quality air are key to a healthy work and live environment.

APPENDIX 4C - REFERENCES TRENDS

REFERENCES MEGA TRENDS

Arcadis (2019)
Atkinson (n.d.)
Beyond Tomorrow (2017)
Fisk (2019)
PWC (n.d.)
PWC (2016)
Roland Berger (2017)

REFERENCES BUILT ENVIRONMENT

Arcadis (2019)
Beyond Tomorrow (2017)
Bouw natuur inclusief (n.d.)
Building Radar (2020)
Capgemini (2020)
Circle Economy (2019)
Circle Economy & ABN AMRO (2017)
De Circualaire Weg (n.d.)
Fronteer (2020)
De groene stad (n.d.)
Van Hooijdonk, R. (2017)
Installatie vakbeurs (2020)
Maakindustrie (2019 a)
Maakindustrie (2019 b)
Maakindustrie (2020 a)
Maakindustrie (2019 b)
Maakindustrie (2019 c)
Prefab Beurs (n.d.)
Roland Berger (2017)
Transitieagenda Circulaire Bouweconomie (n.d.)
VPRO Tegenlicht (2019)
Wonderwoods (n.d.)

REFERENCES MARKET TRENDS

CBRE (n.d.)
Mintel (2020)
Officeinspiration (n.d.)
Saintnicks (n.d.)
Trendwatching (2017)

APPENDIX 5A - CO-CREATION 1

Co-Creation 1: Limitations
Sadly, due to unforeseen circumstances that led to a full schedule at Derako, the workshop employees were not able to fully participate in the three hour long co-creation. Due to this sudden change in schedule, the co-creation had to be redesigned. Instead, the workshop employees were asked to think about the application of CE within Derako for one hour. The co-creation session was shortened to two hours for the office employees.

The interaction between office and workshop employees has been lost, something which possibly has affected the outcome of the session.

APPENDIX 5B - CO-CREATION 1

Co-creation 1: Set-up

Workshop

9:00-9:05	Short introduction with presentation
9:05-9:20	Discuss homework (possibly make golden rules (worksheets))
9:20-9:25	Explain Circular Economy
9:25-10:00	Discussion improvements at Derako, apply Circular Economy and reduce waste

Office

10:00-10:05	Stand-up popcorn style
10:05-10:10	Introduction of project (presentation)
10:10-10:30	Discuss homework & make golden rules (worksheets)
10:30-10:40	Present trend clusters
10:40-10:50	Break, pick trends cluster

Make one or two groups

10:50-11:30	Brainstorm
11:30-11:40	Pitch results brainstorm
11:40-11:45	Last words of advice – what would you like to add?
11:45-11:50	Wrap up

APPENDIX 5C - CO-CREATION 1

Co-creation 1: Worksheets

Co-creatie sessie - Visie creatie
Werkblad 'Huiswerk'

Naam:

Welk bedrijf inspireert jou op het gebied van duurzaamheid en waarom?

OMSCHRIJF/TEKEN/LEG UIT

+

+

+

+

+

+

Co-creatie sessie - Visie creatie
Werkblad 'Golden Rules'

GOLDEN RULES

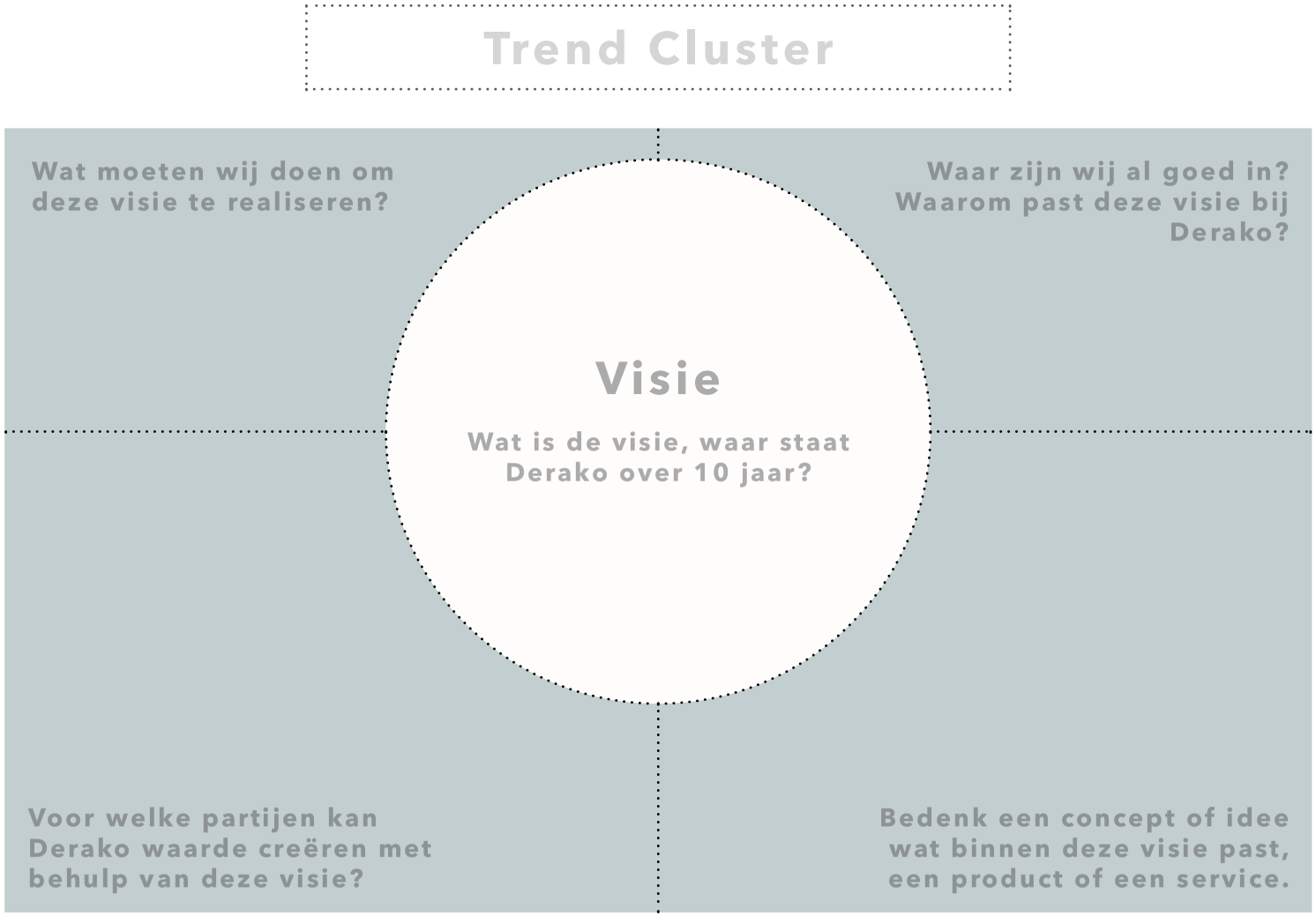
1

2

3

4

5



Co-creatie sessie - Visie creatie
Werkblad 'Brainstorm'

APPENDIX 6A - CO-CREATION 2

Co-Creation 2: Limitations
Again, due to unforeseen circumstances, not all participants were able to take part in the co-creation. The co-creations has been reframed, allowing for a more open discussion with the participants.

The main aim of the co-creation was getting input on the circular product line and waste reduction, and creating engagement among Derako employees. Therefore, there was no need for a strict set-up and the session focussed on an open and free discussion, which resulted in a valuable outcome. These outcomes have been processed and incoroporated in the waste reduction plan and roadmap.

APPENDIX 6B - CO-CREATION 2

Co-creation 2: Set-up

NOTE: This is the original set-up, which has not been fully used in this session. See limitations above.

8:50-9:00	Walk-in
9:00-9:05	Stand-up popcorn style
9:05-9:10	Introduction of project (presentation)
9:10-9:30	Discuss homework & make golden rules (worksheets)
9:30-9:45	Discuss materials, make a choice and create groups

Make three groups

9:45	Explain worksheet
9:45-10:40	Brainstorm
10:40-10:50	Pitch results brainstorm
10:50-10:55	Last words of advice – what would you like to add?
10:55-11:00	Wrap up

APPENDIX 6C - CO-CREATION 2

Co-creation 2: Worksheet

Co-creatie sessie - Idee generatie
Werkblad 'Huiswerk'

Naam:

Een voorbeeld waar afval een mooie of nuttige toepassing heeft gekregen, bijvoorbeeld een product of een kunstwerk.

VOORBEELD

WAAROM IS DIT EEN GOED VOORBEELD?

+

+

+

+

+

+

APPENDIX 7 - PARTNERS

Architects
- Door (https://doorarchitecten.nl/aanpakken/)
- Orga (https://www.orga-architect.nl/)
- Paul de Ruiter (https://paulderuiter.nl/)
- Rau (https://www.rau.eu/)
- Superuse (https://www.superuse-studios.com/)
- Vector-I (https://www.vector-i.nl/)

Contractors
- Van Wijnen (https://www.vanwijnen.nl/)
- Tetris (https://nl.tetris-db.com/)
- BAM (https://www.bam.com/nl/duurzaam)
- Heijmans (https://www.heijmans.nl/nl/expertises/duurzaamheid/)
- VolkerWessels (https://www.volkerwessels.com/nl/over-ons/duurzaamheid)
- Dura Vermeer (https://www.duravermeer.nl/over-dura-vermeer/duurzaamheid/)
- Dijkstra Draisma (https://bgdd.nl/)
- Jan Snel (https://jansnel.com/)

Engineering firms
- LBP Sight (https://www.lbpsight.nl/)
- Movares (https://movares.nl/)
- IV Groep (https://iv-groep.nl/nl/over-iv/duurzaamheid-innovatie)

Prefab
- De Meeuw (https://www.demeeuw.com/)
- Prefabfabriek (https://prefab-fabriek.nl/)
- Ursem (https://www.ursem.nl/)

Waste streams
- The Bin (https://www.thebin.nl/)
- New Horizon (https://newhorizon.nl/)
- Topjoynt (https://www.topjoynt.nl/)
- Unilin (https://www.unilinpanels.com/nl-be)
- Herso (https://herso.nl/)

Furniture of recycled wood
- Geyersbach (https://geyersbach.com/)
- planq (https://www.planqproducts.com/)
- James McNabb (http://mcnabbstudio.com/)
- HMC (https://www.hmcollege.nl/opleidingsrichting/meubel/)
- Atelier Rick Tegelaar (http://ricktegelaar.nl/products/constructed-surface-table)

- Triboo (https://www.triboo.nl/)

Potential collaborations
- Spoinq (https://spoinq.nl/)
- Fabrikoos (https://fabrikoos.nl/)
- The New Makers (https://www.thenewmakers.com/)
- Dutch Wood Artist (https://www.dutchwoodartist.com/)
- Hof van Cartesius (https://hofvancartesius.nl/)
- Circuleren (https://circuleren.nu/)
- Pavatex (https://www.pavatex.com/en/home/)

Circular support
- Spaakcs (https://www.spaakcs.nl/)
- Turntoo (http://turntoo.com/)
- Ecochain (https://ecochain.com/nl/)

APPENDIX 8A - BMC CIRCLE 1.0

Key partners

Close collaborations with architects, contractors and engineering firms.

Close contact with installers and transporter(s) to facilitate sustainable handling of the product.

Key activities

Designing and producing a circular Derako product.

Sustainable innovation within Derako on product and process.

Maintaining the material loop, actively retrieving products.

Key resources

Same as current, reusable shipping crates and shipping materials should be added as a resource.

Value proposition

Derako offers a completely circular, modular and flexible solution for ceiling and wall in the form of a circular product line.

The product, based on their Grill product is made from sustainable and locally sourced wood.

Derako is able to produce and ship the product containing little to no plastic waste and minimizing wood waste in the process.

Customer relationships

Website
Face to face
Phone
Coalition groups
Trade magazines and websites
Trade fairs

Channels

Website
Mail
Social media
Coalition groups
Phone

Customer segments

Targeted mainly at sustainable oriented customers such as specific architects or contractors.

Later this focus can shift towards more mainstream partners and the circular product line can offer a reasonably priced alternative to the known products.

Cost structure

Same as current, slightly decreasing costs for production of the circular product line, costs will be invested in developing shipping wasteless shipping method and innovation on waste reduction.

Revenue streams

Same as current, products will be sold as usual.

APPENDIX 8B - BMC RECIRCLE

Key partners

Close collaboration with installers to safely retrieve, pack and ship product. Close collaboration with transporter(s) to facilitate sustainable returning of the product.

Close contact with architects, contractors and engineering firms to inform about available products at which moment.

Key activities

Actively retrieving products.
Cleaning, repairing or restoring returning products.
Storing and actively selling ReCircle products.

Key resources

Knowledge on how to clean, repair and restore returning products.

Value proposition

Derako offers a completely circular, modular and flexible solution for ceiling and wall in the form of a circular product line.

The ReCircle product is a second hand, but high quality Grill product, available at an interesting price point.

Derako is able to produce and ship the product containing little to no plastic waste and minimizing wood waste in the process.

Customer relationships

Website
Face to face
Phone
Coalition groups
Trade magazines and websites
Trade fairs

Channels

Website
Mail
Social media
Coalition groups
Phone

Customer segments

Focus can shift towards more mainstream partners, now offering sustainable Derako products at a lower price point.

ReCircle can still appeal to high end customers looking for sustainable solutions.

Cost structure

For returning products, the cost structure changes. Costs involved are a price to pay for retrieving the product (residual value) and costs for cleaning, repairing or restoring the product.

Revenue streams

Same as current, products will be sold as usual.

APPENDIX 9 - REFERENCES

Ahola, J., Ahlqvist, T., Ermes, M., Myllyoja, J., & Savola, J. (2010). ICT for environmental sustainability: green ICT roadmap.

Bakker, CA., den Hollander, MC., van Hinte, E., & Zijlstra, Y. (2014). Products that last: Product design for circular business models. TU Delft Library.

Baldassarre, B. R., Calabretta, G., Bocken, N. M. P., Diehl, J. C., & Duygu, K. (2019). The evolution of the Strategic role of Designers for Sustainable Development. In Academy for Design Innovation Management Conference 2019.

Banning, B. (2016). Vergroening van de transportsector: versnelling door technologie en data. ABN AMRO Insights. https://insights.abnamro.nl/2016/08/91969/

Boons, F., Montalvo, C., Quist, J., & Wagner, M. (2013). Sustainable innovation, business models and economic performance: an overview. Journal of Cleaner Production, 45, 1-8.

Braungart, M., McDonough, W., & Bollinger, A. (2007). Cradle-to-cradle design: creating healthy emissions–a strategy for eco-effective product and system design. Journal of cleaner production, 15(13-14), 1337-1348.

Brown, T., & Katz, B. (2011). Change by design. Journal of product innovation management, 28(3), 381-383.

Business.gov.nl. (n.d.). Environment and energy. https://business.gov.nl/financing-your-business/subsidies/environment-and-energy/

Calabretta, G., Gemser, G., & Karpen, I. (2016). Strategic Design: 8 Essential Practices Every Strategic Designer Must Master. Laurence King Publishing.

Capelleveen, D. van (2019). Opvallend culinair paviljoen The Traveller geopend. Architectuur.nl https://www.architectuur.nl/project/opvallend-culinair-paviljoen-the-traveller-geopend/

Cradle to cradle products innovation institute (C2C Pii) (n.d. a). Product certification. Retrieved from https://www.c2ccertified.org/get-certified/product-certification

Cradle to cradle products innovation institute (C2C Pii) (n.d. b). Levels. Retrieved from https://www.c2ccertified.org/get-certified/levels

Cradle to cradle products innovation institute (C2C Pii) (n.d. c). Cradle to Cradle Certified™ Banned List of Chemicals. Retrieved from https://www.c2ccertified.org/resources/detail/cradle-to-cradle-certified-banned-list-of-chemicals

Cristoni, N., & Tonelli, M. (2018). Perceptions of Firms Participating in a Circular Economy. European Journal of Sustainable Development, 7(4), 105-105.

Delmas, M. A., & Burbano, V. C. (2011). The drivers of greenwashing. California management review, 54(1), 64-87.

Design Council (2015). What is the framework for innovation? Design Council's evolved Double Diamond. Retrieved from https://www.designcouncil.org.uk/news-opinion/what-framework-innovation-design-councils-evolved-double-diamond

Dorée, A., Holmen, E., & Caerteling, J. (2003). Co-operation and competition in the construction industry of the Netherlands. Greenwwod and D.(Eds)," ARCOM, 817-826.

Ministerie van Algemene Zaken (2016). A Circular Economy in the Netherlands by 2050. Government.nl. https://www.government.nl/documents/policy-notes/2016/09/14/a-circular-economy-in-the-netherlands-by-2050

Edmondson, B. (2020). What Is Corporate Social Responsibility? The Balance. https://www.thebalance.com/corporate-social-responsibility-csr-4772443

Ellen MacArthur Foundation. (2013). Towards the Circular Economy – Part 1; Economic and business rationale for an accelerated transition. Retrieved from https://www.ellenmacarthurfoundation.org/assets/downloads/publications/Ellen-MacArthur-Foundation-Towards-the-Circular-Economy-vol.1.pdf

Ellen MacArthur Foundation, & McKinsey Center for Business and Environment. (2015). Growth within: a circular economy vision for a competitive Europe. Retrieved from https://www.ellenmacarthurfoundation.org/assets/downloads/publications/EllenMacArthurFoundation_Growth-Within_July15.pdf

European Council (2019) Sustainable finance: EU reaches political agreement on a unified EU classification system. Retrieved from https://www.consilium.europa.eu/en/press/press-releases/2019/12/18/sustainable-finance-eu-reaches-political-agreement-on-a-unified-eu-classification-system/

Frow, P., Nenonen, S., Payne, A., & Storbacka, K. (2015). Managing co-creation design: A strategic approach to innovation. British Journal of Management, 26(3), 463-483.

FSC (n.d). FSC principles. Retrieved from https://www.fsc-uk.org/en-uk/about-fsc/what-is-fsc/fsc-principles

Hekkert, P., Dijk, M., & van Dijk, M. (2011). Vision in Design. Van Haren Publishing.

Holliday, C. O. (2001). Sustainable growth, the DuPont way. Harvard Business School Publishing Corporation.

Interface (n.d. a). Lessons for the future. Retrieved from https://www.interface.com/EU/en-GB/sustainability/our-journey-en_GB

Interface (n.d. b). Climate take back. Retrieved from https://www.interface.com/US/en-US/sustainability/climate-take-back-en_US

Kerr, C., & Phaal, R. (2015). Visualizing roadmaps: A design-driven approach. Research-technology management, 58(4), 45-54.

Kim, E. (2016). Design roadmapping: Integrating design research into strategic planning for new product development. University of California, Berkeley.

Kirchherr, J., Reike, D., & Hekkert, M. (2017). Conceptualizing the circular economy: An analysis of 114 definitions. Resources, conservation and recycling, 127, 221-232.

Lacy, P., Keeble, J. & McNamara, R. (2014). Circular Advantage. Accenture. Retrieved from https://www.accenture.com/t20150523T053139__w__/us-en/_acnmedia/Accenture/Conversion-Assets/DotCom/Documents/Global/PDF/Strategy_6/Accenture-Circular-Advantage-Innovative-Business-Models-Technologies-Value-Growth.pdf

LBP Sight (n.d.). Nationale Nederlanden Workspace 2020: Circulair op de Werkvloer. Retrieved from https://www.lbpsight.nl/projecten/nationale-nederlanden-workspace-2020-circulair-op-de-werkvloer

Lieder, M., & Rashid, A. (2016). Towards circular economy implementation: a comprehensive review in context of manufacturing industry. Journal of cleaner production, 115, 36-51.

Ludema, J., & Johnson, A. (2018). Six CSR Strategies That Are Good For Business. Forbes. https://www.forbes.com/sites/amberjohnson-jimludema/2018/08/15/six-csr-strategies-that-are-good-for-business/#2ab2e6c550a8

Maas, K., & Boons, F. (2010). CSR as a strategic activity. Louche, C./Idowu, SO/Leal Filho, W.(2010)(Hrsg.): Innovative CSR. Sheffield: Greenleaf Publishing. S, 154-172.

MarketingTribune (2020). [onderzoek] Consument houdt bedrijfsleven verantwoordelijk voor verduurzaming. Retrieved from https://www.marketingtribune.nl/algemeen/nieuws/2020/01/onderzoek-consument-houdt-bedrijfsleven-verantwoordelijk-voor-verduurzaming/index.xml

Meadows, D. H., Meadows, D. L., Randers, J., & Behrens, W. W. (1972). The limits to growth. New York,

102(1972), 27.

Mentink, B. (2014). Circular Business Model Innovation: A process framework and a tool for business model innovation in a circular economy. Delft: Delft University of Technology & Leiden University. Retrieved from https://repository.tudelft.nl/islandora/object/uuid:c2554c91-8aaf-4fdd-91b7-4ca08e8ea621?collection=education

Miller, R. (2018). What Does Sustainable Growth Really Mean? Forbes. https://www.forbes.com/sites/rickmiller/2018/08/16/what-does-sustainable-growth-really-mean/#56c0d7ae7a98

NEN (n.d. b). ISO 14001 en ISO 14004. Retrieved from https://www.nen.nl/NEN-Shop/ISO-14001-en-ISO-14004-1.htm

NEN (n.d. b). ISO 26000. Retrieved from https://www.nen.nl/NEN-Shop/Nieuws-over-ISO-26000-duurzaamheid/Wat-is-ISO-26000-De-MVOrichtlijn.htm

Nielsen (2018). The Evolution of the Sustainability Mindset. Retrieved from https://www.nielsen.com/us/en/insights/report/2018/the-education-of-the-sustainable-mindset/

PEFC - Programme for the Endorsement of Forest Certification (n.d.). What we do. Retrieved from https://www.pefc.org/what-we-do

Rijksoverheid (2020). Bouwbesluit. Retrieved from https://rijksoverheid.bouwbesluit.com/Inhoud

Rochlin, S., Bliss, R., Jordan, S., & Kiser, C. Y. (2015). Defining the Competitive and Financial Advantages of Corporate Responsibility and Sustainability. Babson.edu. Retrieved from https://www.babson.edu/media/babson/site-assets/content-assets/academics/centers-and-institutes/the-lewis-institute/project-roi/Project-ROI-Report.pdf

Seijlhouwer, M. (2020). Transportbedrijven slaan handen ineen en vragen EU om duurzaam vervoer. Retrieved from https://www.duurzaambedrijfsleven.nl/logistiek/34221/transport-duurzaam-eu

Simonse, L. (2017). Design Roadmapping. BIS.

Simonse, L. W., Hultink, E. J., & Buijs, J. A. (2015). Innovation roadmapping: Building concepts from practitioners' insights. Journal of product innovation management, 32(6), 904-924.

Slot, N. A. (2019). The transition of Circular Economy in the Dutch housing industry (Master's thesis, University of Twente).

Schwartz, P. (2012). The art of the long view: planning for the future in an uncertain world. Crown Business.

APPENDIX 10 - PROJECT BRIEF

DESIGN FOR our future

TU Delft

IDE Master Graduation

Project team, Procedural checks and personal Project brief

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

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

USE ADOBE ACROBAT READER TO OPEN, EDIT AND SAVE THIS DOCUMENT

Download again and reopen in case you tried other software, such as Preview (Mac) or a webbrowser.

STUDENT DATA & MASTER PROGRAMME

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

family name: Dijkhuizen

initials: M.S. given name: Micha

student number: 4289919

street & no.:

zipcode & city:

country:

phone:

email:

Your master programme (only select the options that apply to you):

IDE master(s): ( ) IPD ( ) DfI (★) SPD

2nd non-IDE master:

individual programme: - - (give date of approval)

honours programme: ( ) Honours Programme Master

specialisation / annotation: ( ) Medisign ( ) Tech. in Sustainable Design ( ) Entrepeneurship

SUPERVISORY TEAM **

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

** chair: Dr. Ir. Simonse, L.W.L. dept. / section: PIM

** mentor: Ir. Berge, R.B.R. van den dept. / section: DOS

2nd mentor: Ir. Bovenkamp, M. van den

organisation: Derako International BV

city: 't Zand country: The Netherlands

comments (optional)

Chair should request the IDE Board of Examiners for approval of a non-IDE mentor, including a motivation letter and c.v..

Second mentor only applies in case the assignment is hosted by an external organisation.

Ensure a heterogeneous team. In case you wish to include two team members from the same section, please explain why.

APPROVAL PROJECT BRIEF

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

chair Dr. Ir. Simonse, L.W.L. date - - signature

CHECK STUDY PROGRESS

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

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

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

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

YES all 1st year master courses passed

NO missing 1st year master courses are:

name date - - signature

FORMAL APPROVAL GRADUATION PROJECT

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

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

Content: APPROVED NOT APPROVED

Procedure: APPROVED NOT APPROVED

comments

name date - - signature

A Sustainability Roadmap for Derako — project title

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

start date 22 - 06 - 2020 — 28 - 12 - 2020 end date

INTRODUCTION **

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

Derako is a company creating bespoke and custom made suspended ceilings, wall panels and façade panels. Derako offers two types of products, both fitting for wall and ceiling. The first product line is their 'Lineair' product line, constructed of steel railings and wooden slats mounted flat with metal clips (see image 1). Their second product line uses a slightly different principle, the wooden slats are connected by a dowel, which is mounted to the steel railing (see image 2). As Derako says, their products are solely used to create a visually pleasing environment and do not in any way add to structual integrity of the building.

Derako makes these wooden slats from various types of raw wood, ranging from pine to ceder and cherry. The customer decides on the kind of wood, the size of slats, the overall size of the project and so on. Derako purchases the raw wood project specific. This means for each project they will decide how much wood they need of a specific type and size, namely by taking into account dropout of raw wood due to quality, losses in processing and accounting for a small amount of remnant slats. This method prevents keeping large amounts of woods in storage, which reduces costs and prevents wood laying around of a long period of time. However, as the wood is purchased project specific, it is difficult to reuse the same wood for a different project due to the differences in type and size of the raw wood. This often results in batches of raw wood, smaller pieces of partly processed wood or finished product that remain unused.

Currently, Derako already makes an effort trying to maintain the value of the wood by selling it on to other industrial uses, such as carpenters or furniture makers, sheltered workshops and so on. However, these parties are often demanding on the quality, for example only wood of a specific size, and quantity, for example small amounts. Meeting these requirements costs a lot of manual labour while the financial gains are limited. Moreover, it has proven to be difficult to find enough parties to sell the large amount of redundant wood Derako has.

In conversation with the director of the company, Derako has shown a strong urge to practice what they preach. There is a strong desire to be a sustainable company, proven by a silver Cradle to Cradle (C2C) certification on all of their products.

There is a variaty of stakeholders included in the operations of Derako. First of all, the company itself and its employees are the main stakeholders. Down the line, the first stakeholders are the tree cutting companies, as they decide what trees are put to the market. The first operation with the wood is cutting it in raw slats, which is done by either the same company as cutting or a new stakeholder. Next, the wood is imported and sold to a wholesaler, which is the next stakeholder. After this, Derako buys the raw wood.

On the other end of the spectrum, Derako sells the wood to the client. Usually, an architect is involved in the design process. This architect is a highly important stakeholder as he or she decides what the product is going to look like. This is a big influence on the wood Derako has to buy, but also on the amount of wood that will be wasted (i.e. large slats in the end product often mean more waste, as there is no way of optimising the amount of slats from one piece of raw wood). The construction company is also a stakeholder, but often plays a small role in the process other than installing it product.

As for many companies, the government plays an important role, for example regulation on energy consumption, waste streams and so on.

space available for images / figures on next page

introduction (continued): space for images

image / figure 1: Derako Lineair product, fit for ceiling and wall

image / figure 2: Derako Grill product, fit for ceiling and wall

PROBLEM DEFINITION **

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

The aim of the project is to define for Derako what their sustainable future will look like. In order to shape this future, a thorough analysis of the company, market and possible opportunities has to be conducted. From this analysis, the first steps towards a future vision can be created.

The goal of the future vision is to set an ambition, created entirely to fit Derako as a company, taken into account the limitations and opportunities that occur from the analysis. The future vision will be the highest goal to achieve in the coming years. The number of years will depend on the developments in the market and the amount of years Derako is able to look in the future. Based on this vision, a strategy will be formed, which will describe a way forward towards the future that takes into account the three main factor of strategic design, feasibility, viability and desirability. This strategy will again align with Derako as a company and how they are able to innovate. Finally, this strategy will be plotted on a timeline and shaped into a roadmap, which will be supported by several horizons that help Derako to concretize the steps that need to be taken.

Part of the solution should focus on the wood waste problem Derako is dealing with. This stream of material is most likely to have a high influence on the overall sustainability of Derako. If this stream can be either reduced or the wood can be given high value elsewhere, the losses and costs associated with this waste stream can be reduced, which is an incentive for Derako to pursue the overall sustainble future vision.

ASSIGNMENT **

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

Together with Derako, create a holistic future vision that provides Derako with concrete steps to improve their sustainablility.

The final deliverable of this project will be a strategic roadmap with clear steps and actions for Derako to execute in order to increase the sustainability of their business. The roadmap should be holistic, covering as many aspects of Derako and their context as possible (i.e. integration of rules and regulations, possible partners or technologies to develop). The roadmap will be based on a sustainability strategy, which will be defined for Derako based on their specific needs, strengths and weaknesses, opportunities and threats. This sustainability strategy should therefore be a perfect for fit Derako and strengthen their business.

The roadmap is a method to convey tangible and actionable steps and solutions for Derako, therefore the roadmap is not a goal in itself. It is the content and steps that build up to the roadmap that create value. In addition, the process of creating the roadmap should focus on a good fit with the company and its employees, creating enough engagement and enthusiasm to embrace such a roadmap.

Furthermore, the roadmap should be inspiring, at best it functions as a guide for the whole company to be inspired by, at least it should be inspiring for the board of the company and the employees that directly work to improve sustainability. Therefore it is important to involve those stakeholders in the complete process.

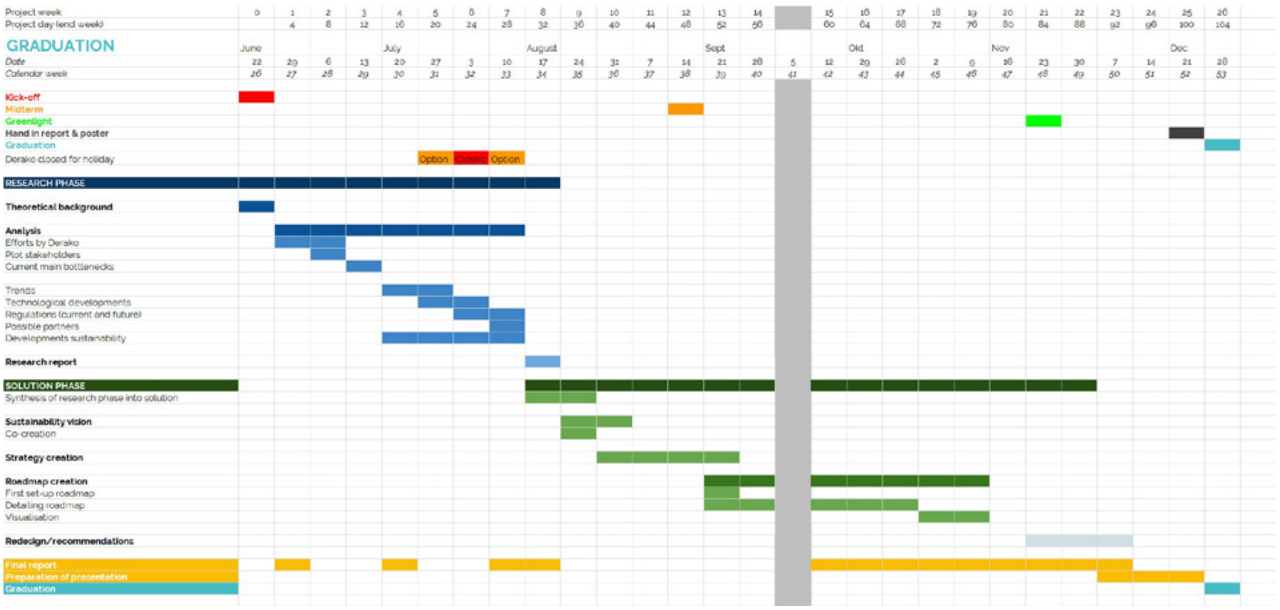
Initials & Name M.S. Dijkhuizen Student number 4289919

Title of Project A Sustainability Roadmap for Derako

PLANNING AND APPROACH **

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

start date 22 - 6 - 2020 28 - 12 - 2020 end date



In the Gantt Chart two main phases have been planned for, the research phase and the solution phase.

Research phase
First of all, Derako indicated it would be valuable to work within production for a week, which I fully agreed with. This has already taken place in week 23.
The research phase there will allow room for exploring the context such as the stakeholders, previous efforts and main areas of issues together with plotting possible gains to be made. Previous experience with such activities has shown the planning and execution is time consuming. The solution analysis accounts for research in the field Derako operates in on trends & values, technological development, regulations and possible partners. During this research, sustainability with be integrated in all factors.

Solution phase
The solution phase starts with synthesising the results from the research phase into the concept space. It will mainly consist of creating a strategy which will be translated to the planned roadmap, including the future vision, horizons. The roadmap will be a visual representation with a document attached with explains and elaborates on this visual.

My planning is based on 4 days/week, because of the job I have next to my studies. It also adds more flexibility for planning in these times, which prove to be slightly more difficult. One week of holiday has been accounted for and is planned in September. This week is flexible and will be planned according to the progress of the project.

MOTIVATION AND PERSONAL AMBITIONS

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

In the search for a graduation project, I was looking to combine three pillars: sustainability, technology and innovation. In this search, I was looking for companies that would benefit from technological innovation to further improve their sustainability, or use this innovation to introduce sustainable activities to their practice.

As I came across the project with Derako, I felt like the challenge was slightly different. Firstly, it attracted to me that the challenge was very concrete, they wanted to reduce their waste streams of wood. However, as a strategic designer I tried to look beyond that challenge and see if I could take it a step further. During the first conversation with Derako I found that, although they might be looking for concrete solutions to their waste problem, they also realise this probably is not that straight forward. It appeared they were open to a more visionary and holistic approach, which I felt like is a challenge I can tackle.

Furthermore I feel like SMEs (Dutch: MKB) offer great opportunities for strategic designers to show the value of strategic design while getting in close contact with the client. SMEs are often eager to improve and as a graduation student there is a higher possibility of having a bigger impact. I feel like the impact of strategic design is often focussed on the big ambitions of multinationals and cooperations, whereas the SMEs often face the same or even bigger challenges, as the field of competition is much more complex.

During my internship I learned how to work in close contact with the client, something I want to continue in my graduation project. I feel like it is even more important to closely involve the client in a project with SMEs as opposed to working with a big multinational.

In previous projects I made use of the Roadmapping methodology, which proved to be a helpful way to organise and visualise the different steps towards a successful future vision. I found the theory behind it to be helpful in touching the most relevant topics in a structured manner, therefore I feel it is a valuable skill to develop further. My ambition is to familiarize myself further with the methodology and successfully apply it in this individually conducted project.

FINAL COMMENTS

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

APPENDIX 11 - CONFIDENTIAL