Facilitating co-creation of environmentally sustainable healthcare solutions

A co-creation tool for healthcare workers at the Cardiology Department

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Abbreviations

CAG - Coronary angiogram

Cath lab - Cardiac catheterization laboratory

CSA - Centrale Sterilisatie Afdeling (Central Sterilisation Unit)

ECG - Electrocardiogram

EMC - Erasmus Medical Center

FFR - Fractional flow reserve

PCI - Percutaneous coronary intervention

TAVI - Transcatheter Aortic Valve Implantation

Executive summary

The healthcare sector is one of the major contributors to negative effects on the environment. The healthcare sector is responsible for 7% of the total CO2 emission in the Netherlands (Milieuvoetafdruk rapportage, n.d.), 4% of waste, and 13% of use of resources (Green Deal Duurzame Zorg, n.d.). The emissions produced in, amongst others, the healthcare industry have a negative effect on the public health of the Dutch population. This paradox shows the growing need to make the healthcare sector more environmentally sustainable.

Project goal

This project aims to have a positive impact on the sustainability of the Interventional Cardiology department at Erasmus Medical Centre. The goal of the project is to:

" Design a co-creation tool that provides a general approach for making medical products or protheses used at the Interventional Cardiology at Erasmus MC more environmentally sustainable. "

Based on literature research and context research, multiple barriers and opportunties for co-creation of sustainable initiatives were found. These barriers were translated into opportunties for the design of the co-creation tool.
In the ideation phase, brainstorming sessies were held, and how-to questions were answered to find concepts for elements of the co-creation tool. The concepts were evaluated in multiple test sessions with people that work in the medical field and stakeholders from the Interventional Cardiology department. Iterations were made based on the insights from these test sessions.

Outcomes

A co-creation tool was designed for healthcare workers at the Interventional Cardiology department.
The tool consist of two different elements: The Sustainability Space, and the Co-creation toolkit.

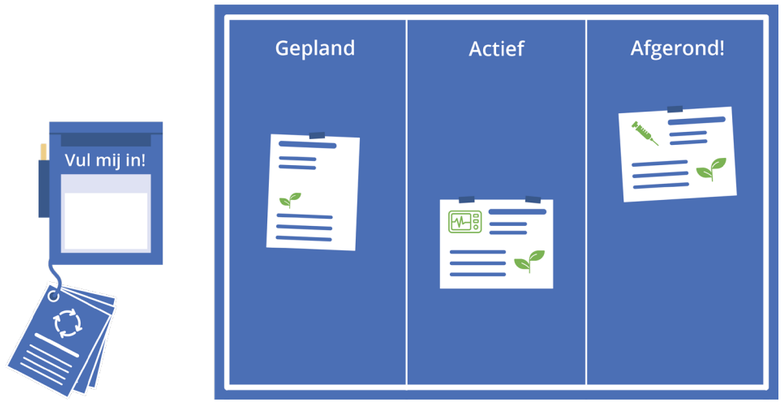

Figure 1. An illustration of the Project Space, consisting of the Project Board, Project Box, Sustainability Cards, Project Initiative forms, and forms to show the progression or results of the projects.

The Sustainability Space (see figure 1) serves as a basis for sustainability by raising awarenes and increasing the motivation for environmental sustainability amongst stakeholder at the Interventional Cardiology department. The Project Board provides a physical space for sustainabilty that attract attention, hereby raising awareness about the sustainability initiatives. The transparent presentation of the planned, active, and completed sustainability projects might help reduce the resistance to change, as this might be a consequence of unawareness of the need for sustainable improvements.

The co-creation toolkit (see figure 2 for examples of different elements of the toolkit) provides a general approach for the initiation of sustainability projects. The steps in the proces help to establish or strengthen the relationships between stakeholders by creating mutual understanding. The collaborative goal setting activity helps to create goals that aim to align with the values and requirements of all stakeholders. This can create the feeling of a shared responsibility and ownership of the sustainability projects. Defining the goal (with a time-bound element) will improve the change of a succesful completion of the project.

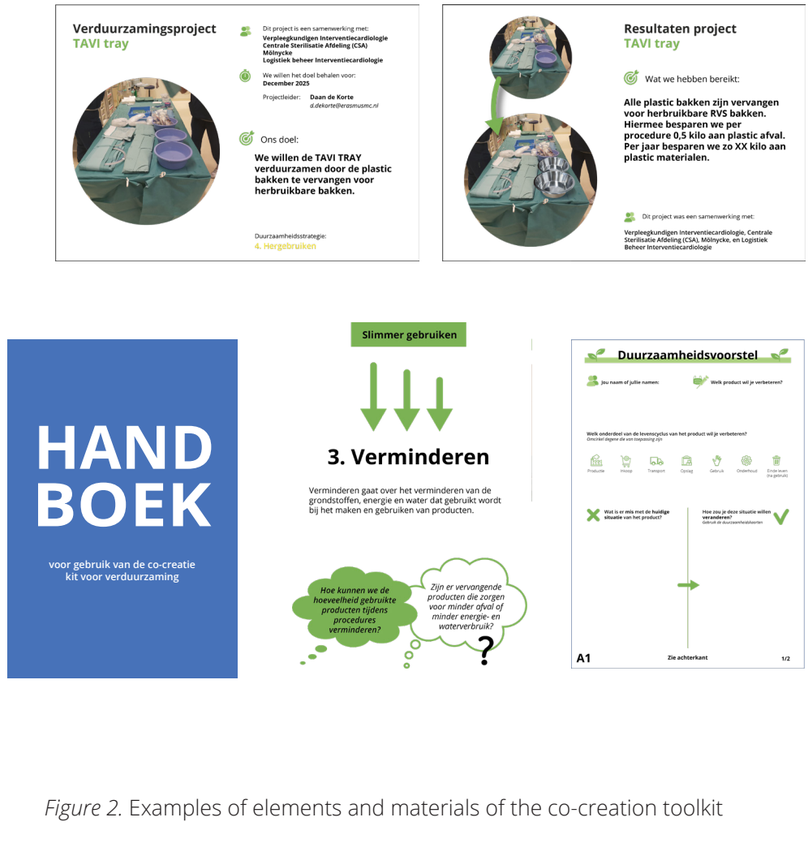

Figure 2. Examples of elements and materials of the co-creation toolkit

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1

Project Introduction

This chapter introduced the project by exploring the topics of sustainability in the Healthcare sector, at the Interventional Cardiology Department at Erasmus MC, and sustainability goals at Erasmus MC. The relevance of co-creation in the healthcare sector is explained, and the project's scope, approach and structure is illustrated.

1.1
Sustainability in the Healthcare Sector

Healthcare in Netherlands is seen as one of the top-performing healthcare systems in the world, based on factors including access to care, the care process, administrative efficiency, equity, and healthcare outcomes (Schneider et al., 2021). This is a positive statement, but current healthcare provision also has negatives effects on the environment.

The healthcare sector is responsible for 7% of the total CO2 emission in the Netherlands (Milieuvoetafdruk rapportage, n.d.), 4% of waste, and 13% of use of resources (Green Deal Duurzame Zorg, n.d.). Each year, the healthcare sector produces a total of 328 million kilos waste (Gupta Strategists, 2022). The emissions produced in, amongst others, the healthcare industry have a negative effect on the public health of the Dutch population (see Figure 1.1.1). Climate change and environmental pollution are the cause of an increase in health problems, including cardiovascular disorders (Green Deal Duurzame Zorg, n.d.). This decline in the populations' health in turn increases the strain on healthcare provision. When this process remains uncontrolled, it can spiral and lead to more severe negative effects. This paradox shows the growing need to make the healthcare sector more environmentally sustainable.

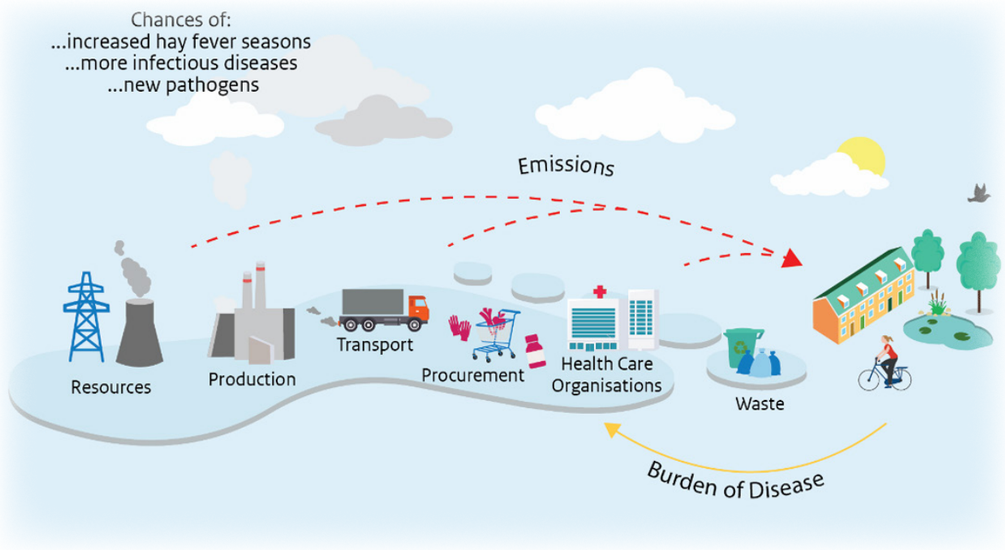
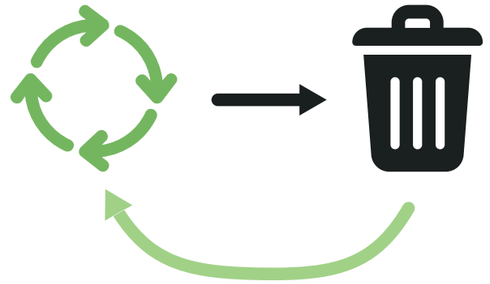


Figure 1.1.1. Illustration of the negative effects of emissions created by the healthcare sector on public health, resulting in growing pressure on healthcare providers. Retrieved from Steenmeijer Et Al. (2022)

1.1.1
Reusable vs single-use products

Since the 1980's, most medical and surgical products were reusable and sterilized within hospitals (Greene, 1986). However, since the "plastics" revolution, the products used in the healthcare industry have changed from reusable to single-use products (Greene, 1986; Tielbeke, 2023). This transition has been a gradual process influenced by various factors. While reusable products were once common in medical settings due to their cost-effectiveness and reduced environmental impact, the shift towards single-use items gained momentum primarily due to concerns surrounding infection control and patient safety (BMP Medical, 2021). Currently, about 60 % of medical products are disposable products (Hofmann, 2023). These single-use products offer a convenient and hygienic solution, minimizing the risk of cross-contamination and ensuring consistent quality. Due to the high costs of single-use items, some single-use products are sterilised and reused (Das et al., 2020). This is done especially in resource poor economies. Single-use products are not designed for sterilisation, and will therefore not maintain



the same quality as was originally intended. The shift from reusable to single-use products has raised concerns about the environmental impact of healthcare waste. Single-use items contribute significantly to the generation of medical waste. For most products, switching from disposable, single-use products to a reusable alternative will reduce most negative impacts on the environment, except for water usage (Keil et al., 2022). On average, this switch could reduce between 38% and 50% of global warming effects. The shift towards single-use products has also occured within the context of Interventional Cardiology at Erasmus MC (Personal Communication, 2024).

Earth overshoot day

In the last decades, there has been a vast increase in the global use of resources. At our current consumption rate, we would need approximately 1.75 planets to provide the resources we need, and to absorb the waste that is created in the process (The World Counts, n.d.). It is estimated that in 2024, the Earth Overshoot Day for the Netherlands will be on April 1st (Footprint Data Foundation, n.d.). If all countries in the world would consume like we do in the Netherlands, it would mean that already at the start of the fourth month

Figure 1.1.2. Illustration of the required "Earths" to keep up with the current demand of ecological resources and services of the Netherlands

of the year, we would have exceeded the supply of ecological resources and services that the Earth can generate in a year. To keep up with our current demand, we would need about four Earths.

1.2
The need for a circular Interventional Cardiology Department

Interventional cardiology is a specialty that diagnoses and treats diseases to the heart and blood vessels. It performs non-surgical procedures that use catheters that are inserted into the vein. About 640 people are hospitalized due to cardiovascular disease (CVD) in the Netherlands each day.

Over the last decades, an increase of people with CVD is found. This rise can be attributed to multiple factors, such as the aging population, but more even so to unhealthy lifestyles (Rijksinstituut voor Volksgezondheid en Milieu, n.d.). High blood pressure, high cholesterol, obesity, lack of exercise, and smoking play an important role in the development of CVD. Nowadays, it is estimated that about 1,9 million Dutch citizens suffer from CVD (Rijksinstituut voor Volksgezondheid en Milieu, n.d.). It is expected that this number will rise to 3 million. This will result in a vast increase in the need for cardiovascular interventions.

1.2.1
The footprint of Interventional Cardiology

Even though the demand for cardiac procedures is growing, there are limited initiatives that tackle the waste generation and the reduction of the carbon footprint of the treatment of cardiovascular diseases (Szirt et al., 2023). When searching PubMed until April 1, 2022 for search terms related to interventional cardiology and environmental sustainability, no results come up (Szirt et al., 2023).

Erasmus Medical Centre (EMC) has mapped its organization wide emission, where they determined their scope 1, 2, and 3 emissions (see 1.2.1.1) for the year 2021 (Erasmus MC & Metabolic Consulting, 2021). From the data gathered in this research, the following data is found on the cardiology department at EMC:

- The Cardiology Department at Erasmus MC produces about 5,520.1 ton CO2-eq (Carbon footprint of Erasmus MC, 2021). This is around 4.41 percent of EMCs total carbon footprint.
- Within the THORAX centre, 55.29% of its total carbon emissions is produced by the cardiology department.
- When examining the use of goods and services, most of the emissions at the Thorax Centre stem from protheses and implants, medicine, and medical products (see Figure 1.2.1.1).

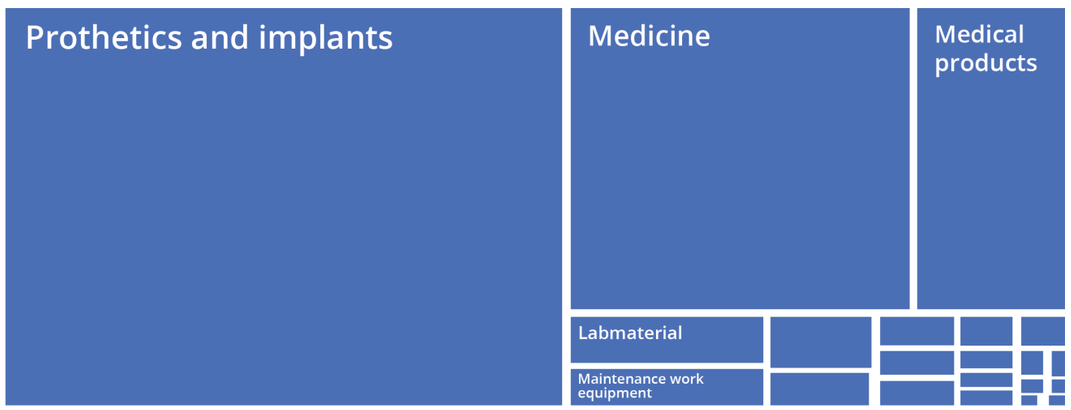


Figure 1.2.1.1 Illustration of the relative contribution of purchased goods and services to the carbon footprint of the hospital theme THORAX. Adapted from Erasmus MC & Metabolic (2021).

Observation at the cath labs at Erasmus MC shows that most protheses, implants, and medical products used at the Interventional Cardiology Department are one-use, disposable products. The amount of waste that one procedure can produce is shown in Figure 1.2.1.2. During the progression of this project, some sustainability initiatives have been installed by the Green Team of the Interventional Cardiology Department, such as seperate waste collection of plastics and paper.

Due to the growing demand for treatment of cardiovascular diseases, and the current unsustainable way of operating, the need for a circular Interventional Cardiolgy practice is growing.

Figure 1.2.1.2 Part of the waste collected after one intervention

1.3
Sustainability goals and initiatives at Erasmus MC

The data of this research on sustainability conducted by EMC and Metabolic (2021) shows the need for change towards a more sustainable practice hospital-wide. To work towards a more sustainable EMC, Erasmus MC has signed the Green Deal 3.0. The Green Deal 3.0 is an updated version of the European Union's plan to transition towards a sustainable, climate neutral healthcare. The goals stated in this agreement aim to promote health, raise awareness, reduce CO2 emissions, reduce the consumption of primary raw materials, and to reduce the environmental harm caused by medication (see figure 1.3.1.).

1. **Promote health** among patients, clients and employees
2. **Raise awareness** and understanding of the impact of healthcare on climate and vice versa
3. **Reduce CO^2 emissions** by 55% by 2030 and to be **climate neutral** by 2050
4. **Reduce the consumption of primary raw materials** by 50% by 2030 and maximise circularity in healthcare by 2050
5. **Reduce environmental harm** caused by (use of) medication

Figure 1.3.1. Green Deal 3.0 goals. Retrieved from Green Deal Duurzame Zorg (n.d.).

To work towards these goals defined in the Green Deal 3.0, EMC has started up initiatives to create a more sustainable hospital. 'Een Duurzaam Erasmus MC' is a program that contains multiple projects to reduce their impact. More than 30 Green Teams are already installed at different departments within the hospital, including Green Teams at both Interventional Cardiology and Electrophysiology (EFO). These Green Teams consist of one or more individuals that are motivated to positively influence the sustainability at their departments. Their projects include raising awareness, installing initiatives, and organising events (Erasmus MC, n.d.). The projects are concrete and accessible initiatives that stimulate environmental sustainability locally (at the department, group, or sector wide).

1.4
The value of co-creation in the healthcare sector

The healthcare system is a complex adaptive system, due to its complicated design and dynamic and unpredictable nature. It involves many diverse stakeholders, such as patients, healthcare providers, insurers, policymakers, and manufacturers. Each of these stakeholders have their own interests and challenges. Due to this complexity, it is often difficult to predict how interventions or changes will affect the system (Lipsitz, 2012; Ratnapalan & Lang, 2020).

An important aspect of co-creation in the healthcare sector is the acknowledgement of the difficulty for stakeholders to work together (Halkes, 2014). Co-creation can add value in this respect, as it fosters collaboration, and ensures that the diverse perspectives of the different stakeholders are included in the process (Sarri & Hartevelt, 2024). By engaging stakeholders in the process, relevant and effective interventions can be designed (Voorberg et al, 2014), whilst creating trust amongst the participants (Koning, n.d.), and creating the feeling of collaborative ownership (Grissemann & Stokburger-Sauer, 2012). It is important that in the process, participants learn each other's perspectives (Halkes, 2014). The co-creation approach can lead to innovative solutions, aiming to meet the needs of and add value for all involved stakeholders.

1.5
Project scope and approach

1.5.1
Scope and problem definition

This project aims to investigate opportunities for environmental sustainability initiatives via co-creation with stakeholders at the specialism of Interventional Cardiology at Erasmus MC. The Interventional Cardiology specialism is part of the Cardiology Department, which includes the other specialism of EFO, Echocardiography, and Heart Transplants (see figure 1.5.1.1). In turn, the cardiology department is part of the Thorax Centre at EMC.

This project will look at medical products and prosthetics used at procedures performed at the Interventional Cardiology specialty.

Changing medical products is a process that is difficult, time consuming, and often expensive, as there are many safety and quality regulations that medical products need to comply with, and certifications that these products need to have in order to sell their products on the European market. Co-creation with stakeholders gives the opportunity to analyse the product's lifecycle, and find opportunities for sustainable improvements along the whole product chain. Co-creation can help stakeholders work together to create a new product/business plan or redesign the product to be more sustainable in such a way that the added value for all stakeholders is kept in mind. This project aims to:

" Design a co-creation tool that provides a general approach for making medical products or protheses used at the Interventional Cardiology at Erasmus MC more environmentally sustainable. "

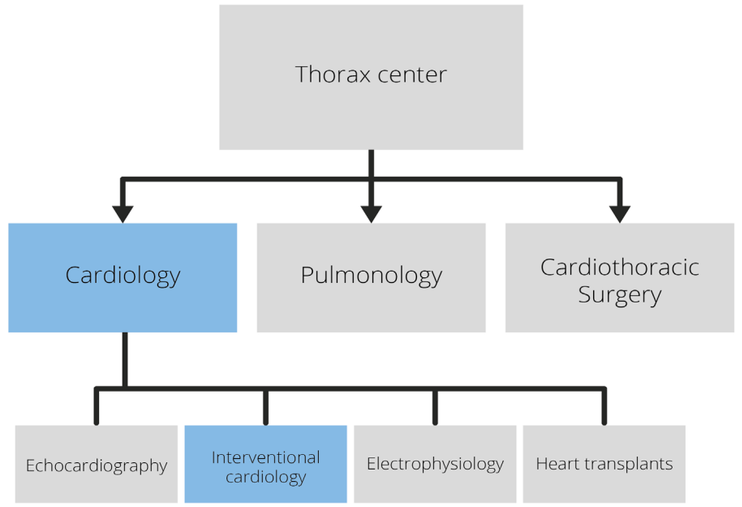


Figure 1.5.1 .1 Organisational chart of the Thorax theme in Erasmus MC. Highlighted are the Cardiology Department and the Interventional Cardiology specialism.

1.5.2
Relevance for project stakeholders

A co-creation approach specifically tailored to the context of interventional cardiology can help Green Team members and other initiators in their journey to change their current way of operating to a more sustainable one. Some initiatives are already recently implemented successfully at the interventional cardiology, such as waste separation and the switch from a disposable to a reusable X-ray protection mat. Members of the Green Team are confident that for so-called low-hanging fruit initiatives that involve few stakeholders, solutions can be readily found and implemented. However, when more stakeholders from different specialties or external partners are involved, a clear approach is missing and desired. With co-creation, perspectives from the different stakeholders are shared, and the product's whole lifecycle can be analysed, hereby opening the door for the implementation of higher sustainability strategies (see section 2.1.3 and 2.1.4) than waste management and recycling. As time is often a limited resource in the healthcare sector, it could therefore be desired to have a co-creation tool that accommodates the stakeholders in carrying out the co-creation process.

1.5.3
Project approach and structure of the report

The design process of this project is divided into four phases, inspired by the double-diamond approach (Design Counsil, 2019). In the double-diamond model there are four phases, namely; Discover, Define, Develop, Deliver.

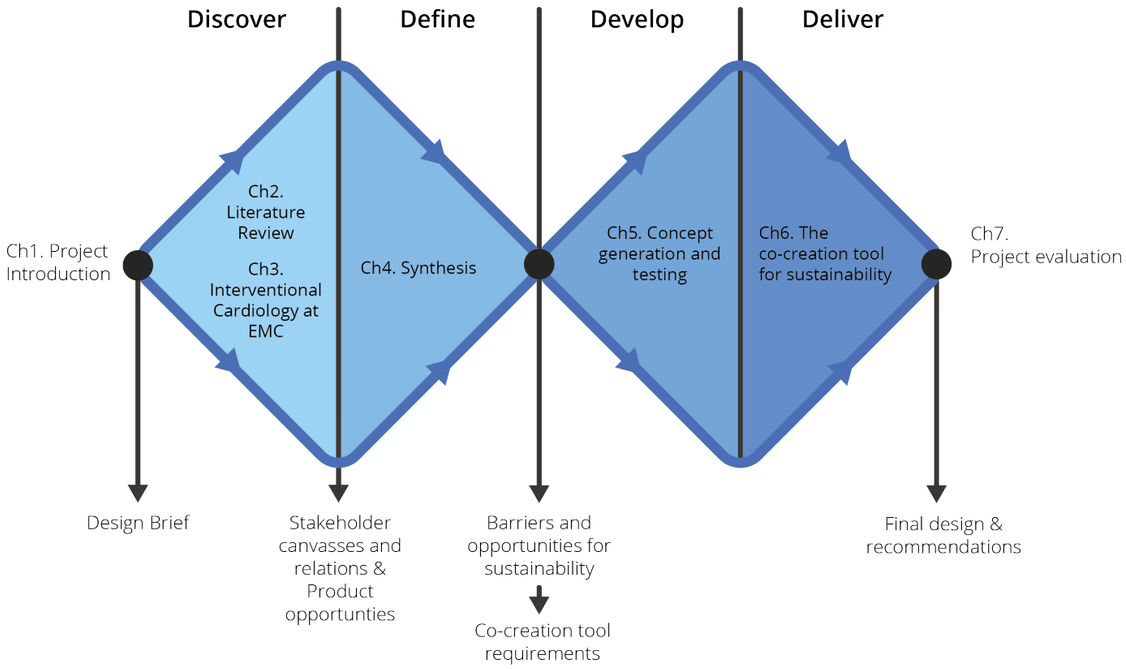


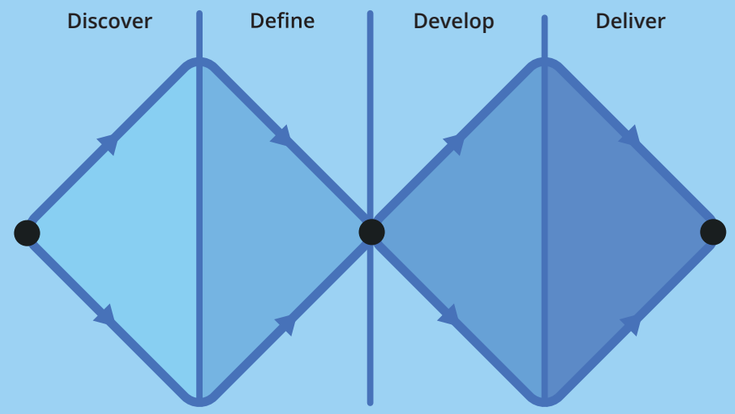
Figure 1.5.3.1 Illustration of the project approach and structure of the report, based on the Double Diamond model.

1. Discover
The aim of the discover phase is to gain understanding of environmental sustainability, co-creation, the context of interventional cardiology, and opportunties and barriers for sustainability in the healthcare sector. Chapter 2 explores these topics by means of literature research. Chapter 3 explores the stakeholders of the interventional cardiology department. Through interviews, each stakeholder is analysed and stakeholder canvasses are made. An overview of the workflow in the cath lab, and an overview of the most commonly used products is shown. Opportunities for and opinions on improving the sustainability of different products are identified.

2. Define
The aim of the define phase is to translate the found barriers and opportunities from chapter 2 and 3 into opportunities and requirements for the co-creation tool. Chapter 4 synthesises these findings into recommendations for the co-creation tool for sustainability.

3. Develop
Chapter 5 details the ideation and conceptualisation process of the co-creation tool. Multiple templates were designed and iterated upon with input gathered from multiple test sessions.

4. Deliver
Chapter 6 introduced the final concept for the co-creation tool.
In chapter 7, the final design is evaluated, and recommendations are given.



2

Literature Review

To better understand the context of the project, a literature review has been conducted to answer research questions on the topics of Environmental Sustainability and Co-creation. This research provides input for elements of the design of the co-creation tool.

Chapter overview

This chapter will answer the following research questions:

Environmental sustainability

RQ1. What are different aspects of environmental sustainability in the healthcare sector?

RQ2. What are the different strategies for environmental sustainability, and which models exist that include these strategies?

Co-creation

RQ3. What is co-creation?

RQ4. What are benefits and barriers of co-creation?

RQ5. How can these characteristics of co-creation be translated into a tool for co-creation?

Interventional Cardiology

RQ6. What is Interventional Cardiology and what does it treat?

RQ7. What are the current sustainability efforts within the sector of Interventional Cardiology?

RQ8. What are the opportunities and barriers to sustainability within the field of Interventional Cardiology?

2.1 Environmental sustainability

RQ1. *What are different aspects of environmental sustainability in the healthcare sector?*

2.1.1 The six levers of sustainable healthcare

To successfully transition to a sustainable healthcare sector, it is important to take into account all the different aspects of environmental sustainability. According to Gupta Strategists (2022), there are six levers that constitute the transition plan for a sustainable healthcare sector (see figure 2.1.1.1). For each lever, initiatives have been implemented by different initiators that work towards environmentally sustainable healthcare practices. However, a complete, comprehensive plan that encompasses all six pillars does not exist (Gupta Strategists, 2022).

To be able to succesfully implement sustainable changes, it is therefor important to keep in mind all six levers. The co-creation tool should aim to facilitate these different aspects.

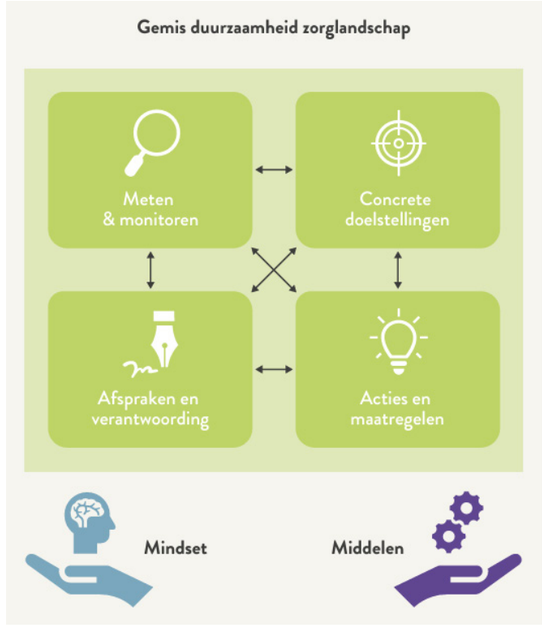


Figure 2.1.1.1. The six levers for sustainable healthcare. Retrieved from Gupta Strategists (2022).

1. Concrete goals
Clear goals help players in the healthcare sector to measure their progress, and have a clear aim (Gupta Strategists, 2022). The Green Deal 3.0 offers these goals.

2. Measure and monitor
To reach the goals for sustainability, healthcare organisations need to have insights on their current practices. Regular monitoring of the sustainability progess is important to determine how the organisation is doing, and if the sustainability efforts are on the right track of reaching the goals (Gupta Strategists, 2022).

3. A concrete list of actions and measures
An overview of possible interventions that contribute to sustainability helps to see which interventions have the most impact on sustainability, and thus which actions should be prioritised. There are many platforms that share sustainability initiatives, but a concrete list of the most valuable interventions is missing (Gupta Strategists, 2022).

4. Agreements and accountability
There are many organisations and actors in the Dutch Healthcare industry that have signed the Green Deal 3.0. However, there is no obligation to actually comply with these goals. On national level, there is a commitment for sustainability which is obligatory (Gupta Strategists, 2022).

5. Mindset
A change in mindset might be the basis for changing the sustainability in the healthcare sector. There needs to be an increase in awareness, feeling of urgency, knowledge, and support towards sustainability initiatives. There already has been an increase in sustainability initiatives in the field, and the emergence of knowledge platforms.

6. Resources
To make these (radical) essential changes, additional resources may be necessary, such as funds, knowledge, expertise, and capacity (Gupta Strategists, 2022). It is important to think about where and how to obtain these resources.

2.1.2
Scope 1, 2, and 3 emissions

There are many companies that are seeking to reduce greenhouse gas (GHG) emissions. A way to measure and assess GHG emissions is via the Scope 1, 2, and 3 emissions method (see figure 2.1.2.1). This is a method defined by the Greenhouse Gas Protocol, and is globally used for managing and measuring emissions (National Grid, 2023). This holistic approach addresses not only the direct emissions, but also the emissions associated with their supply chains and product usage.

The total emissions of healthcare providers vary between the different scopes, with scope 1 and 2 ranging between 15% to 50% of the total emissions, whilst scope 3 ranges between 50% and 75% of the total emissions (Rodríguez-Jiménez et al., 2023). Most of the emissions of scope 3 can be attributed to disposables, equipment (both medical and non-medical), and pharmaceuticals. Most studies have found that disposables or consumables were accountable for more than 20% of the emissions (Rodríguez-Jiménez et al., 2023).

The data found by Rodríguez-Jiménez et al (2023) is supported by EMC's own research about their CO_2 emissions. This research on EMC's Scope 1, 2 and 3 emissions has shown that 72% of EMC's CO_2 emissions stem from scope 3 activities (Erasmus MC & Metabolic Consulting, 2021). The different aspects of the scope 3 emissions include both activities from EMC, as well as activities from external stakeholders.

To make a positive change towards environmental sustainability, it is therefor important to collaborate with these external stakeholders to reduce the carbon emissions that result from the Scope 3 activities.

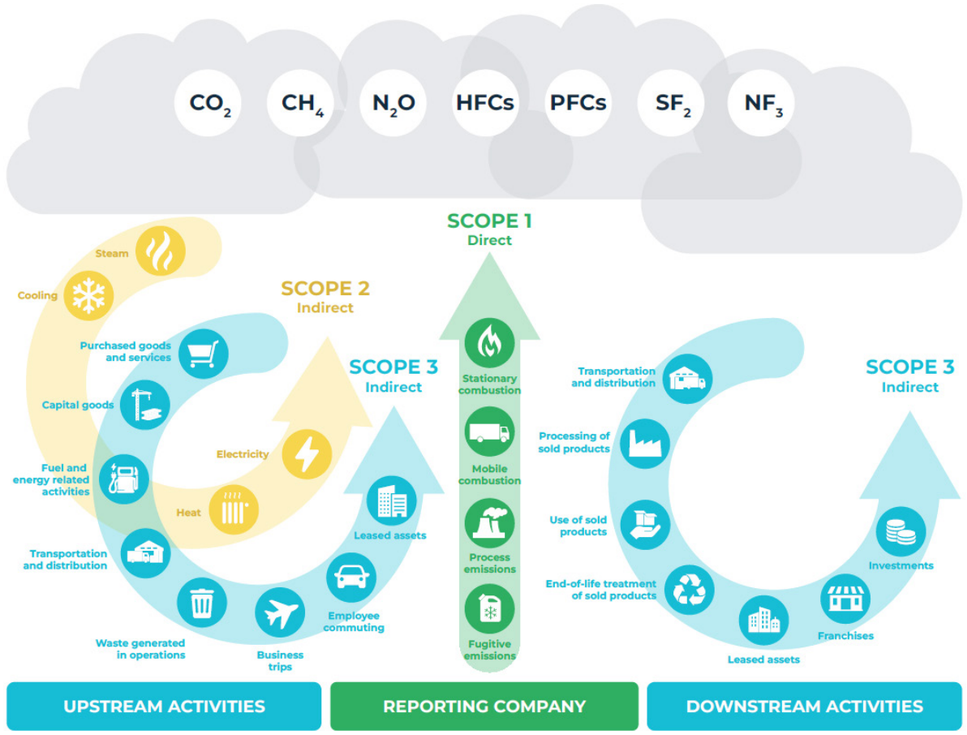


Figure 2.1.2.1. Visualisation of the Scope 1, 2, and 3 emissions. Retrieved from Erasmus MC & Metabolic Consulting (2023).

Scope 1
Scope 1 includes the direct emmissions from goods and services that the company owns or controls directly.

Scope 2
Scope 2 includes indirect emissions from the generation of purchased electricity, steam, heating, and cooling consumed by the company.

Scope 3
Scope 3 includes all the other indirect emmissions that occur in the value stream, both upstream and downstream. This includes buying, using, and disposing of products from a supplier.

RQ2. *What are the different strategies for environmental sustainability, and which models include these strategies?*

R-strategies are strategies for environmental sustainability. They are called R-strategies, as all the names of the strategies start with the letter R. Depending on the model, a different amount and variety of circular strategies are used.

It is important that the users of the co-creation tool understand the different strategies, know how to use them, and know how to prioritise the strategies based on the value that is retained. It is therefor important to chose a model that illustrates the different strategies and their values in an understandable way.

2.1.3
The Value Hill model

The current healthcare system is based predominantly on the linear economy. Products are produced, used, and then disposed of (see figure 2.1.3.1a). The value hill model is based on the model of the circular economy. Here, the product is produced and used. After the initial use period, the product's value is retained and circulated back into the product's lifecycle (see figure 2.1.3.1b).

The path of the value hill is divided into three phases; the pre-use phase, the use phase, and the post-use phase. Each phase has its own set of sustainability strategies (see figure 2.1.3.2).

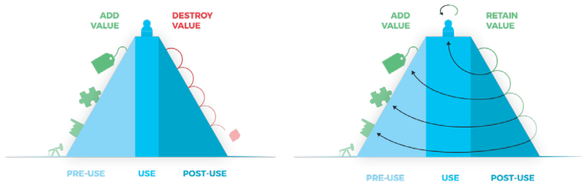


Figure 2.1.3.1. Visualisation of the value hill model. Retrieved from Akkerman (2019).
a *b*

The value hill clearly illustrates that the higher values retain the most value. In this way, it shows that these higher strategies are prefered above the lower loop strategies.

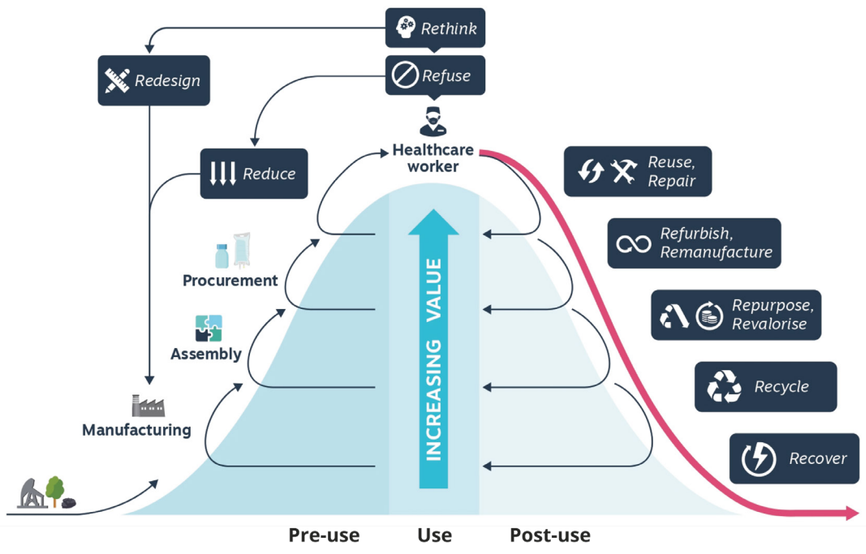


Figure 2.1.3.2. Visualisation of the value hill model. Retrieved from https://www.metabolic.nl/projects/leading-sustainable-transformation-in-healthcare-the-case-of-erasmus-mc/

2.1.4
The R-ladder

The R-ladder, or R-hierarchy, is another model used to visualise the different stages of the circular economy. It contains ten different R-strategies, divided into three different phases, illustrated by the colors green, yellow, and orange (see figure 2.1.4.1). The strategies highest on the ladder require fewer materials, and are therefor more circular (Malooly & Daphne, 2023).

The design phase
The strategies in this phase focus on responsible use and manufacturing (Malooly & Daphne, 2023).

Consumption phase
This phase focusses on optimal use of products, by preserving and extending the life of products (Malooly & Daphne, 2023).

End-of-life phase
This phase is focussed on capturing and retaining value out of waste, by using it as a resource (Malooly & Daphne, 2023).

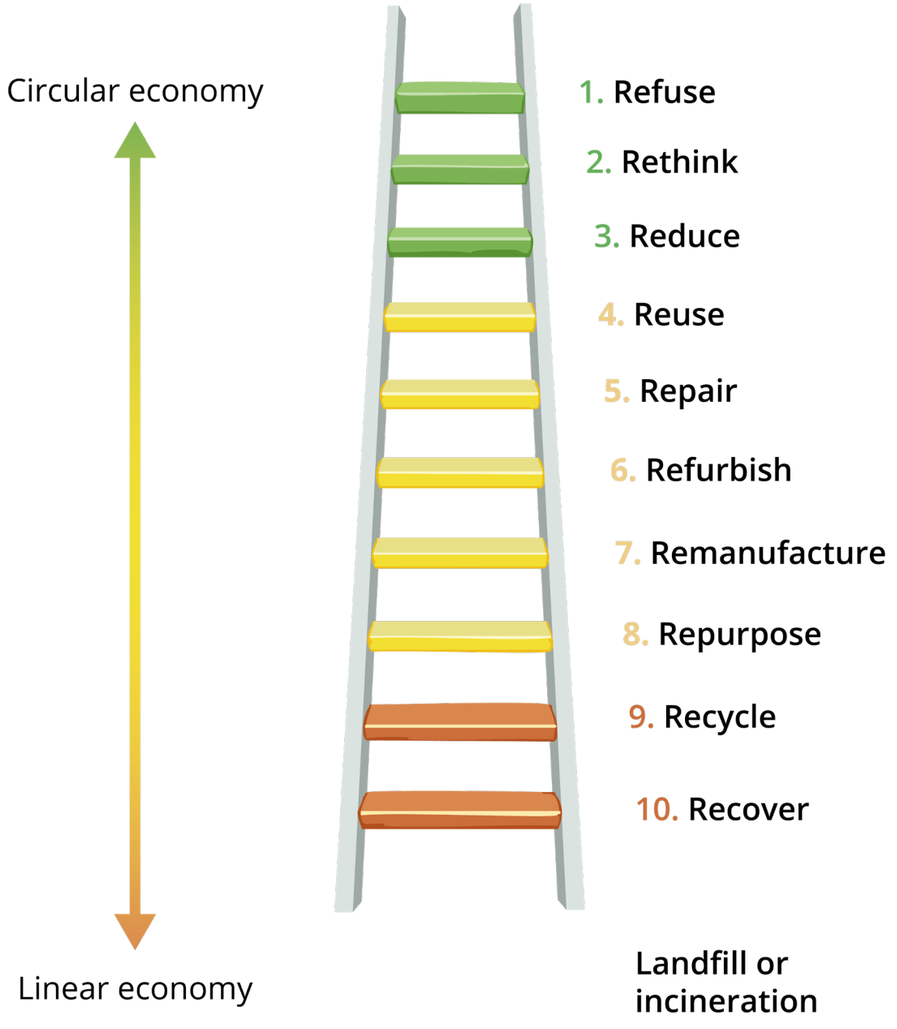


Figure 2.1.4.1. Visualisation of the R-Ladder. Adapted from www.circularise.com/blogs/r-strategies-for-a-circular-economy

2.2
Co-creation

RQ3. *What is co-creation?*

2.2.1
The definition of co-creation

Co-creation is a creative act between two or more stakeholders, where all stakeholders give and get value out of the process (Koning, n.d.). Its results can range from physical to the metaphysical, and from the material to the spiritual (Sanders & Stappers, 2008). An important aspect of co-creation is that all participant should be considered equal (Koning, n.d.), working together towards the same goal (Galvagno & Dalli, 2014). To establish this, an atmosphere of openness and trust should be created (Halkes, 2014). Co-creation can be used along all stages of the product development proces. When used at the early front end, it can result in positive, long-range consequences (Sanders & Stappers, 2008).

2.2.2
The goal of co-creation

The goal of co-creation can vary. Depending on the context and problem space, different goals are identified:

- The proces of co-creation in itself can be the goal (Voorberg et al., 2014).
- Change the relationship, position and rules between the involved parties (Voorberg et al., 2014). It can help build a deeper understanding between stakholders (Koning, n.d.).
- Create a collaborative feeling of ownership for all involved stakeholders (Voorberg et al., 2014).
- Improving the effectiveness and efficiency of the designed concept or solution (Voorberg et al., 2014).
- Create a concept or product that has positive, long-range consequences (Sanders & Stappers, 2008) that will fit the needs and values of all involved stakeholders (Koning, n.d.).

" Co-creation is a facilitated process of authentic and respectful interactions of people striving for a shared vision on a desired situation and/ or outcome with commonly endorsed actions to realize them. "

(Halkes, 2014).

RQ4. *What are benefits and barriers of co-creation?*

2.2.3
Benefits of co-creation

According to multiple sources, there can be many benefits to co-creation:

- Increase the number of generated ideas and creating different angles for problem solving by envolving more parties in the process (Koning et al., 2016). This can create better solutions to existing problems (Koning, n.d.), that have positive, long-range consequences (Sanders & Stappers, 2008).
- Enable better understanding of the user (Koning et al., 2016).
- Increase the effectiveness and efficiency of the designed solution (Voorberg et al., 2014).
- Reduce the speed to market and reduce the risk of innovation (Koning et al., 2016).
- Improve creativity and increase enthusiasm for innovation (Koning et al., 2016).
- Increase customer loyalty and satisfaction (Koning et al., 2016; Voorberg et al., 2014).
- Create relationships between the participants, and create a deeper understanding of the other stakeholder's values (Koning, n.d.).
- Create a sense of joint responsibility and ownership (Koning et al., 2016; Grissemann & Stokburger-Sauer, 2012).

2.24
Barriers of co-creation

According to multiple sources, there are multiple barriers to co-creation:

- Facilitating the proces might be difficult. It requires different skills, such as playing different roles and providing the right tools at the right moment.
- There is often a lack of time
- The direct value for (some of the) participants may be low
- It might be difficult to find motivated participants, or motivate the stakeholders to participate
- The business-driven hierarchy might threaten the co-creation proces because of the idea that only "lead" people can be co-designers. The power-structure can be threatened by the idea that all participants are equal (Sanders & Stappers, 2008).
- Facilitators and participants have to believe that everyone is creative (Sanders & Stappers, 2008).
- It may be difficult to see the usefulness of co-creation. It is therefor important to have clear incentives for using co-creation activities, and to show how the project might benefit from these activities (Voorberg et al., 2014).

2.2.5
The co-creation process

Steps in the co-creation process
There is no one approach to co-creation. Koning et al. (2016) describes different steps in the co-creation process (see figure 2.2.5.1). A distinction is made between co-creation as an approach or method:

- Co-creation as an approach refers to an overall mindset throughout the whole process (Koning et al., 2016).
- Co-creation as a method includes a combination of different tools, techniques or other materials that will facilitate the participants in addressing defined goals (Koning et al., 2016).

The development phase
According to Koning (n.d.), it is important to consider the phase of the development that the co-creation process or activity is aiming for. The four phases are; the ideation phase, concept development, testing phase, and product launch.

Collaboration medium
It is important to consider where the co-creation session will take place. This can be face-to-face, or in a digital environment, which can be either direct or indirect contact.

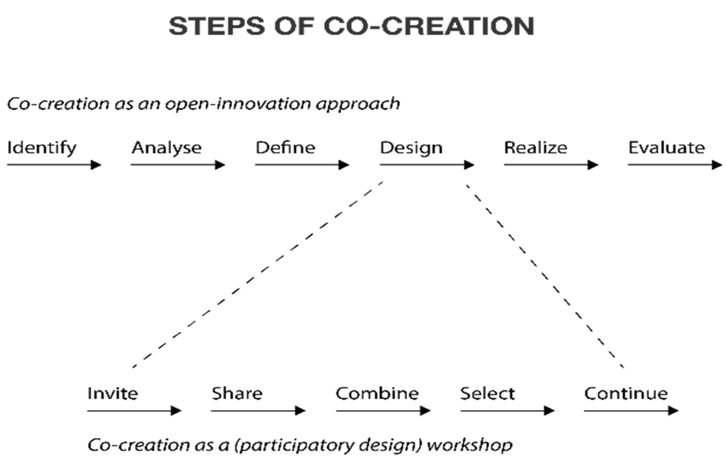


Figure 1.3.3.1. Steps of the co-creation process. Retrieved from Koning et al. (2016).

RQ5. *How can these characteristics of co-creation be translated into a tool for co-creation in the context of the healthcare sector?*

2.2.6
Key takeaways

As the sustainability project at the Interventional Cardiology department might often be based on improving or changing already exisiting products or processes, a sustainability goal for the project needs to be formulated.
By collaboratively defining the goal of the project and engaging all the relevant stakeholders in the proces, it ensures that the needs and values of all stakeholders are considered, and a sense of ownership can be created for all involved stakeholders. Additionally, participating in this collaborative activity can create or strenghten the relationship between the stakeholders.
It is important to create an atmosphere that invites people to share their ideas; an atmosphere where there are no bad ideas. As there might be a (perceived) difference in hierarchy amongst the stakeholders, this might be even more important. The co-creation tool should include activities and materials that help the different stakeholders to connect and collaboratively define the goal of the sustainability project. As the facilitator of the session will be someone related to the healthcare sector (and not a designer), it is important that the co-creation tool includes generalised activities that can be used for all projects. Next to this, it should be made as easy as possible to organise and facilitate the session(s).

2.3 Interventional Cardiology

RQ6. *What is Interventional Cardiolgy and what does it treat?*

2.3.1 Cardiovascular diseases in the Netherlands

Cardiovascular diseases are the second most killing disease in the Netherlands (De Nederlandse Hartstichting, 2023). In 2021, it was estimated that approximately 1.7 million Dutch citizens were affected with cardiovascular diseases, which include coronary heart disease, stroke, heartfailure, cardiac arrhythmia, cardiac arrest, and heart valve abnormalities (VZinfo et al., 2022). According to Hans Snijder, director of the Hartstichting, without interference of the government on prevention and early detection, the patients affected with coronary diseases will grow from 1.7 million to 2.6 million patients (De Nederlandse Hartstichting, 2023). High blood pressure, high cholesterol, obesity, lack of exercise, and smoking play an important role in the development of CVD.

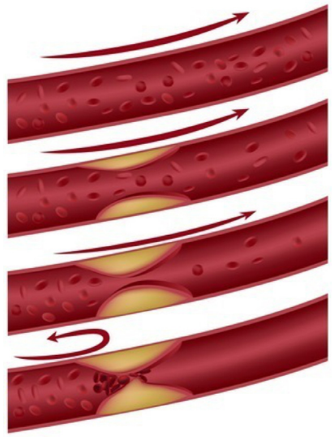


Figure 2.3.1.1. Illustration of the different stages of arteriosclerosis, or calcificaton of the artery. Adapted from Stadia Van Slagaderverkalking (2022)

Cardiovascular diseases can show in many different conditions. Coronary artery disease is the most common type of heart disease. Coronary heart diseases occur due to arteriosclerosis, or “hardening of the arteries” (see figure 2.3.1.1), or due to abnormalities in the coronary arteries. In coronary heart disease, plaque will stick to the walls of the coronary arteries, causing them to narrow, and when untreated, the artery can get blocked completely. This will cause a reduction in blood flow, which in turn can lead to chest pain, shortness of breath, heart burn, and in some cases a heart attack.

RQ7. *What are the current sustainability efforts within the sector of Interventional Cardiology?*

2.3.2 Sustainability in the field of Interventional Cardiology

Even though the demand for cardiac procedures is growing, there are limited initiatives that tackle the waste generation and the reduction of the carbon footprint of the treatment of cardiovascular diseases (Szirt et al., 2023). When searching PubMed until the first of April 2022 for search terms related to interventional cardiology and environmental sustainability, no results come up (Szirt et al., 2023). This is reflected in the opportunities found for sustainability in the field of Interventional Cardiology.

Recycling and waste seperation

It is generally less energy consumptive to recycle than to use new products (McGain et al., 2012). However, it is not always more cost-effective to recylce waste than to send to incineration or landfill (Hutchins & White, 2009). To reduce environmental and financial costs, expensive infectious waste should be separated from general waste.
According to Doshi et al. (2023), an average of 0.75 kilograms of recyclable, non-contaminated of paper and plastic waste is collected per procedure at the cath lab. The PCI procedure has shown to produce the most paper and plastic waste, at 1.41 kg of waste per procedure. This average may be on the lower side, as some procedures like TAVI were excluded from this research. The packaging of catheters, consisting of cardboard and plastics, usually are many times the weight and volume of the product itself. It might be worthwhile to look at the packaging of these products.

Unused products

There are products that are never or rarely used at the cath lab. These products unneccesarily contribute to waste production, without any additional benefits for patient care (Szirt et al., 2023).
Next to this, there are large amount of products that are disposed of because they expired (Jochem Oosting, personal communication).

Reusable products

Relatively simple changes can be made to the staffs clothing items, like wearing reusable caps and clothing (McGain et al., 2012). However, LCAs should clarify if the use of these reusable alternatives are in fact more economically and environmentally sustainable.

RQ8. *What are the opportunities and barriers to sustainability within the field of Interventional Cardiology?*

2.3.3 Sustainability challenges in the field of Interventional Cardiology

Product safety
All procedures performed at the cath lab are intravenous. Thus, products are expected to be of high-quality, and need to be completely sterile because of the infection risks. The prioritisation of product quality and safety is reflected in the market for medical devices (Hinrichs-Krapels et al., 2022). There are extensive safety regulations that products need to comply with, such as the Medical Device Regulation (MDR). The products in the field of interventional cardiology are mainly single-use products (SUDs). The use of SUDs minimise cross-contamination risks and increase the manufacturers profits (Hoveling et al., 2024).
In some resource-poor countries products like catheters and stents are reused (Crawford & Eagle, 2018). This is not accepted in the Netherlands due to the potential risk of reusing these products. Studies on reprocessing of catheters and other products used at the Cardiology specialism show that there are multiple quality aspects of the products that are affeceted due to the sterilisation proces (Crawford & Eagle, 2018; (Myrna et al., 2018)), such as loss of mechanical integrity and function. A study showed that reprosessing the catheters resulted in damages of the integrity of the product (Myrna et al., 2018). Next to this, catheters are hollow tubes, and because of this the sterilisation proces can not guarantee a completely sterile product, as it cannot be tested without destructive tests (Crawford & Eagle, 2018). The current design of single-use catheters do not seem suitable for reuse. This may prove the same for other products, and therefor products might need to be redesigned before they are suitable for reuse.

Lack of motivation for sustainability
The current single-use device (SUD) industry is very benificial to manufacturers. This single-use industry might be resistant to change toward a more sustainable use of products (McGain et al., 2012), as this might result in less revenue. The use of SUDs minimise cross-contamination risks and increase the manufacturers profits (Hoveling et al., 2024).

Lack of stakeholder interactions
There might be little to no interaction between stakeholders on the topics of environmental sustainability (Hoveling et al., 2024).

Unawareness of unsustainable practices
Healthcare workers and other stakeholders might not be aware of the negative environmental impact of their own practices, or practices elsewhere in the product chain (Hoveling et al., 2024).

Regulatory barriers
There are multiple barriers related to medical product regulations (Hoveling et al., 2024) and certification, such as the European MDR. Regulations might complicate the proces of improving product's environmental sustainability, as certain regulations might restrict the solution space.

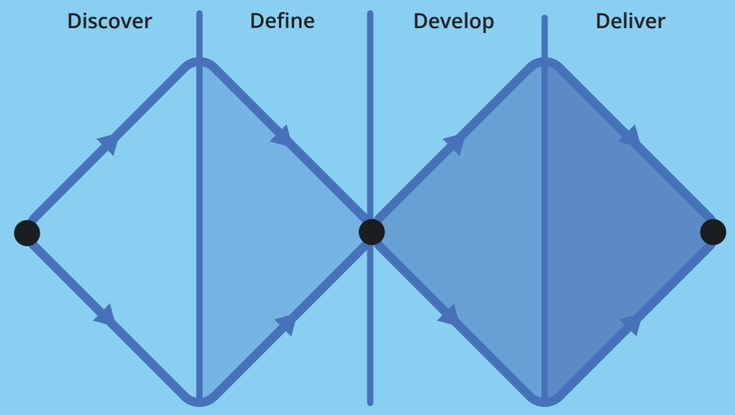
Staff shortage
The healthcare sector is facing staff shortages that will only grow in the future. This is due to the increase for the need of medical attention, whilst the number of people working in the healthcare sector cannot grow at the same pace (Ministerie van Volksgezondheid, Welzijn en Sport, 2024).

Behaviour change
Behaviours, habits, and protocols can be a barrier for environmental sustainability (Hinrichs-Krapels et al., 2022). This can be the case for the use of the product, as well as the disposal of the used products. It is therefor important to motivate staff in supporting environmental sustainability initiatives.

2.3.4 Key takeaways

Although the demand for cardiac procedures is growing, there are limited initiatives that aim to make the procedures more environmentally sustainable. The few suggestions for sustainability that can be found sugggest effort relating to the less circular strategy, such as waste management (waste seperation and recycling), or refer to changing back to products that were used before the trend toward SUDs. Some test have been done on treusabililty of cardiac catheters, but the current design of these single-use products are not suitable for mulltiple uses, as the reuse and sterilisation process affects the quality and integrity of the product too much.

Many barriers can be found for sustainability in the healthcare sector. The biggest barrier seems to be the product safety, infection and contamination risks (Hoveling et al., 2024). This makes that, for the field of Interventional Cardiology, changing to reusable products might not be very welcomed, as the intraveneus procedures can come with high infection risks.
The barriers of unawareness, staff shortage and behaviour change should be adressed in the co-creation tool. The tool should facilitate easy and efficient activities to use the time of the stakeholdes as optimally as possible. The tool could aim to raise awareness about the sustainability of the procedures and practices at the department, hereby motivating staff to support environmental sustainability initiatives.
There is a lack of stakeholder interactions on the topic of environmental sustainability. The co-creation tool and activities can facilitate the starting conversation about these topics.



3

Interventional Cardiology at Erasmus MC

This chapter will explore different aspects of the interventional cardiology department at Erasmus MC. First, different stakeholder are analysed through semi-structured interviews. Multiple topic were discussed to find opportunities and barriers for participating in sustainability projects. To identify stakeholders that are important to involve in the sustainability projects and co-creation sessions, a power-interest matrix was filled in including the identified stakeholders.
Next, an analysis of commonly used products and the general workflow in the cath lab was analysed through observations of various procedures. For multiple product groups, opinions on possibilies for sustainability initiatives were gathered.

3.1 Stakeholder analysis

This qualitative research was conducted using semi-structured interviews. Stakeholders of the Interventional Cardiology department (see figure 3.1.1) were interviewed. Interviews were held with the strategic purchaser of products used at the Cardiology Department, an interventional cardiologist, nurses, and management. All interviews were transcribed, and key insights were highlighted. For each stakeholder, a stakeholder canvas was made (see figures on the following 4 pages).

The following topics were discussed in the interviews:

Tasks and challenges
Questions about their day to day work were asked to gain understanding of their work activities, motivation and challenges in their day to day work.

Environmental sustainability
To gain understanding about the current situation surrounding environmental sustainability, question were asked on:

- Sustainability practises in daily work activities
- Mindset regarding environmental sustainability
- Barriers and challenges for environmental sustainability
- Desired results of working on sustainability projects

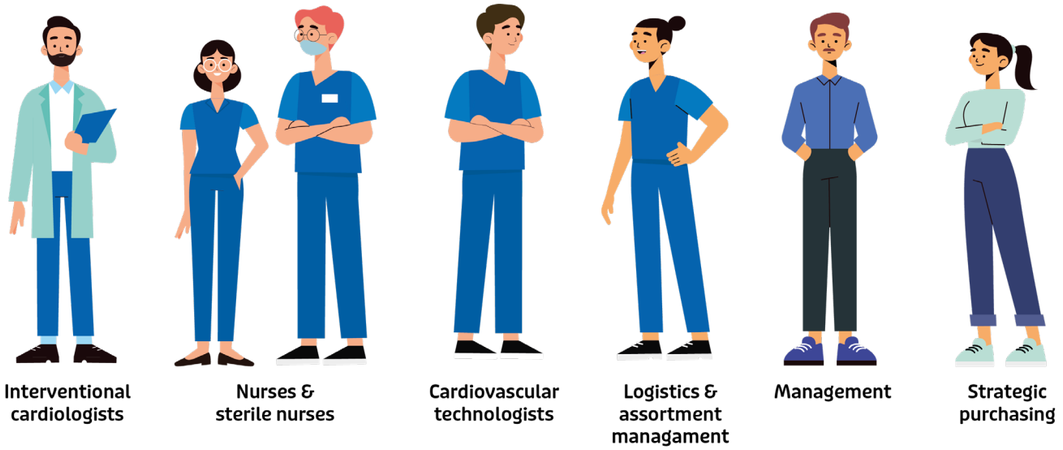


Figure 3.1.1 Illustration of the different identified stakeholders of the Interventional Cardiology Department

Interventional Cardiologists

Tasks at the cath lab
- Decide on and perform procedures, such as CAGs, PCIs and TAVIs
- Monitor the costs per procedure

Motivation
- Provide the best quality care and comfort for the patient

Challenges
- Try to keep to the daily schedule to prevent or minimalize the growth of the patient waitlist
- Monitor costs and try to keep costs as low as possible, to keep healthcare affordable

" Alles wat we doen bij zo'n procedure, alles wat we uit de kast pakken heeft een kostenplaatje. Je wil wel altijd het beste voor de patiënt betekenen. Maar je moet aan de andere kant ook rekening houden met de kosten van de gezondheidszorg in het algemeen. "

Interventional Cardiologist - Personal Communication

Environmental sustainability
- Environmental sustainability is not a part of their activities or topics of discussion
- Currently, there are very little product alternatives that are both cost-effective and more environmentally sustainabile

Barriers
- The current pressure on the team is already high. Every additional task or change in the process needs to be worth the effort

" Elke extra belasting die je opwerpt voor het team, een extra handeling, gedachtegang, dingen waar je rekening mee moet houden, die moet wel echt de moeite waard zijn. Die moet wel dusdanig zode aan de dijk zetten dat het het waard is om het team extra te belasten, en ook het risico dat de patiënt niet zijn volwaardige, optimale behandeling krijgt. "

Barriers
- The interwovenness of the industry in healthcare. Scientist, including cardiologist, have a lot to gain from working with companies in the industry

Desired results
- Research opportunity that can be publicised.
- Proof of improvement with regards to current way of operating

Nurses

Tasks at the cath lab

Prepare the room and gather the required materials

Asssist the cardiologist in the sterile environment, gather additional products

Check the patient's blood pressure and heart monitor. Make sure the patient is comfortable by checking in with the patient and administering medication

Challenges

There is a tight daily schedule, with little time in between patients to prepare and clean the room and table.

There are already many tasks that the nurses have to devote their full attention to.

" En dat soort kleine dingetjes pakken we nu al zelf op, niet teveel poespas, maar meer gewoon; "Dit doen we nu zo, en we denken dat dit zo beter kan, dus dat gaan we gewoon doen." "

Nurse at Interventional Cardiology - Personal Communication

Environmental sustainability

Sustainability initiatives that are relatively easy to implement are already tackled hands-on.

There is a division in opinions about environmental sustainability.

Barriers

There is little time outside work activities and personal life to work on sustainability initiatives

People do not like change. There might be resistance from nurses that are not invested in environmental sustainability or that do not see why there is need for a change

Barriers

There is limited to no space for extra storage at the cath lab or on the department floor.

Desired results

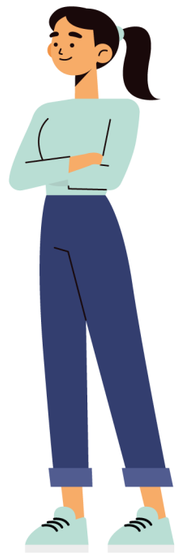
Proof of improvement with regards to current way of operating

An overview of potentially interesting products to improve

An overview of the product timeline

An overview of initiatives that have already been looked into (at different departments) that work or do not work

Strategic Purchasing



Tasks

Decide on the procurement rules and regulations, lead and guard the process

Evaluate environmental sustainability scores of every enrolled manufacturer

Set-up contracts with manufacturers or suppliers of the tendered products

Discuss products, opportunities and shortages with management and healthcare staff

Motivation

Try to get the best prices for the tendered quality products, hereby reducing costs

" Wij kunnen niet zoveel, want als er iets moet veranderen dan gaat het eerst naar Amerika, en vanuit daar gebeurt het eigenlijk. En Europa hobbelt er, omdat we nu een Europees MDR hebben, achter aan.

Strategic Purchaser - Personal Communication

Challenges

Erasmus MC needs to be completely neutral and objective in the tendering process

Products that are more environmentally friendly are often more expensive.

Environmental sustainability

Environmental sustainability is not a priority, but it is a welcome extra if the products are more sustainable.

Barriers

Keeping in mind environmental sustainability brings a lot of extra work and energy, which is experienced as a burden.

Barriers

Unsure if manufacturers in the industry are willing to invest time, effort, and money to create more environmentally friendly products

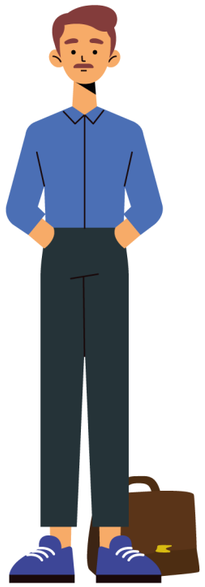
" Want als je iets gaat veranderen, dan moet het opnieuw gekeurd worden. En heeft men dat er voor over ja of nee. Want het zijn gewoon keihard commerciële bedrijven. "

The interventional cardiology at EMC is a relatively small customer. Is the industry willing to change the product solely because EMC is setting standards for environmental sustainabilty?

Desired results

A process with an open registration, where no manufacturers are excluded, but can join on a voluntaire basis.

Management



Tasks (environmental sustainability)

Score environmental sustainability goals and efforts of every enrolled manufacturer

Challenges

There is already a high workload put on the management team with current work activities.

" Wat ik vooral als een probleem zie is dat wij als organisatie eenzijdig zeggen: "Wij gaan eisen stellen aan de duurzaamheid". En dan vervolgens tegen de leverancier zeggen: "Ga jij dat maar voor ons regelen". Ja dat kan natuurlijk niet. Dat zul je echt in co-creatie moeten doen."

Sector Manager - Personal Communication

Environmental sustainability

As a manager, I am currently a facilitator for sustainabilty initiatives. This role should eventually evolve to initiator or driving force.

Barriers

The management team already a lot on their plates with supervising and managing. Therefor, it is difficult to find time to invest on environmental sustainability

The interventions that will be implemented should still be viable when different products are used. The Vanguard initiative that initially started with a certain cable, does not seem to be viable or cost-effective for another, less expensive, cable

Desired results

Proof of improvement with regards to current way of operating

A process that stimulates collaboration and collaborative problem solving

A more environmentally sustainable product, that is of a certain quality that the required quality standard of care can still be provided

3.1.1 Key takeaways

Interest in environmental sustainability

There is a division on the level of interest toward environmental sustainability amongst the different stakeholders. For the interventional cardiologist, the focus lies mostly on financial sustainability, whilst environmental sustainability is not really a topic that is discussed (yet). The main objective of the strategic purchaser is similar; to keep the cost as low as possible, whilst making sure that the tendered products are of high quality. Recently, environmental sustainability is added as one of the scoring aspects of the tendering process. As most product are really comparable on both price and quality, environmental sustainability seems to be one of the more influential aspects, whilst the relative scoring is low. Nurses seem to have the highest motivation for environmental sustainability. However, also amongst the nurses, a division can be seen. There might be resistance from nurses who are not invested in environmental sustainability or that do not see why there is need for a change.

Perceived barriers to environmental sustainability

For all stakeholders, lack of time seems to be one of the greatest barriers. The daily schedules are filled with patients. The need for cardiac procedures is growing, and with that the waitlist of patients, and the pressure on the staff, is increasing. For the healthcare workers working in the cath lab, every additional task or every change in the protocols needs to be worth the effort. It is therefor important to provide proof that the sustainability initiatives have positive effects on environmental sustainability. Showing data of improvement can help motivate the healthcare workers to adopt the changes. There are already many tasks that require the full attention of the stakeholders.

For the interventional cardiologists, the main focus is on providing the best quality care for the patients, whilst having to monitor the cost. For the strategic purchasing department, the focus lies on tendering the best quality products, whilst keeping the costs as low as possible. Their main focus is reducing costs. It is often believed that when taking environmental sustainability into account, there is a related rise in costs. This tension between the two is seen as a barrier, as an improvement in environmental sustainability might go against their goals of reducing costs.

Humans are naturally resistant against change. According to Rehman et al. (2021), one of the most influential aspects on if a implementation succeeds is the employee's attitude towards change. When the healthcare workers are not invested in environmental sustainability, or do not see the need for a change, they might be resistant to changing their current way of working. A solution might be to create awareness amongst the healthcare workers about the sustainability projects, and provide opportunities for all employees to provide input and help in moving the project forward.

A lack of a basis for sustainability

The Green Team has just recently been installed at the department. In the interview, members of the Green team, two nurses working in the cath labs, illustrated that there is not yet an approach for tackling sustainability projects. Next to this, they miss an overview of the initiatives and their benefits to environmental sustainability. The co-creation tool could provide materials that serve as a basis for the activities surrounding environmental sustainability at the department.

Motivation and desired results

This question seems to result in different answers per stakeholder. The nurses already have a higher motivation regarding sustainability, and this is reflected in the desired results. Next to the proof of sustainable improvement, they wish to gain an overview of both potentially interesting projects to work on, as well as an overview of projects that have already been done both within and outside of the department. This overview can help the different specialties work together, and makes sure that the Green Teams do not spend time on projects that have already been tested.
For the interventional cardiologist, it is desired that the project is a research opportunity that can be publicised and is proven to be effective.

3.2 Stakeholder interest in and power over sustainability

This section can be found in the confidentional appendix.

3.2.1 Key takeaways

The stakeholders that have the most influence on the sustainabilty of the practices at the Interventional Cardiology department are not neccessarily the stakeholders that are the most interested in environmental sustainabililty. It is important to try to motivate these stakeholders to participate in projects that aim to improve the environmental sustainability of products or processes. For the stakeholder with high motivation but low power, it is important to try to create an environment in the co-creation session(s) were all stakeholders are treated as equals, and where all ideas are treated with the same respect.

3.3
Stakeholder relationships

During the interviews, questions were asked about the relationships between different actors within the Interventional Cardiology Department:

- How is the relationship perceived between stakeholders?
- How regular is the contact between stakeholders?
- What are the topics that are discussed between stakeholder?
- How does the contact take place?

The information resulting from the interviews is illustrated in figure 3.3.1.
The connections between the different stakeholders directly connected to the Interventional Cardiology department were all perceived as positive relationships, where some interactions were more frequent than others (indicated by the thickness of the arrows). However, there seems to be little interaction between actors of the Interventional Cardiology and other departments. Inter-departmental collaboration on sustainability initiatives seems to be little or non-existent. It might therefor be interesting to focus on co-creation of sustainbility initiatives that involve different departmental stakeholders within Erasmus MC.

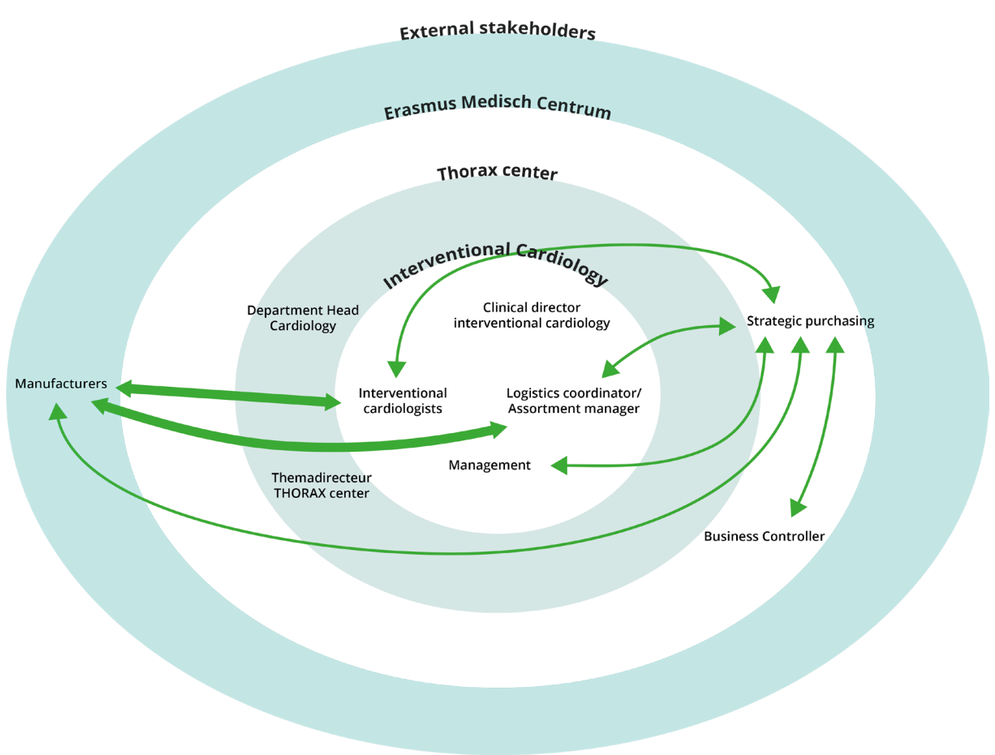


Figure 3.3.1 Illustration of the relationships between identified stakeholders of the Interventional Cardiology Department.

3.4
Procedure workflow at the Interventional Cardiology

In this section, the general workflow for every procedure is visualised. The information is based on observations of the different types of procedures, such as PCIs, CAGs, and TAVIs. The workflow is divided into four sections (see figure 3.4.1). Per section, the different activities are described, as well as which stakeholder performs these activities. Next to this, pictures of the general products that are used are provided, as well as an example of the waste that is generated per section. For a more elaborate description of the four different sections, see appendix A.

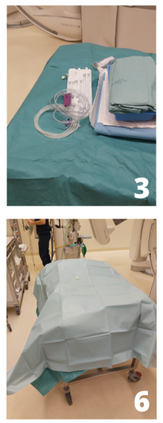
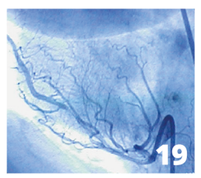
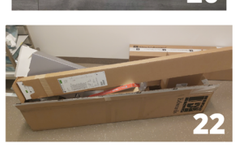
3.4.1
Key takeaways

At the start of the project, no real initiatives for waste seperation was in place for the Interventional Cardiology department. At the end of the procedure, all the products were collected and put into bins. At the Electrofysiology department however, more sustainability initiatives were already adopted, such as the seperation of plastics and paper waste, the collection of used catheter tips, and a change in the procedure flow to eliminate the need for cloths for covering the surgical table and keeping it sterile.

Currently, almost all products that are used are single-use devices.

The nurses in the cath lab seemed enthusiastic about reflecting on their way of working and how it could be made more sustainable. Before the procedure, the staff was asked to consider ways to improve the sustainability of their activities. During the procedures, multiple ideas were mentioned when asked where sustainable improvements could be made.

To avoid unneccesary use of products, more and more often nurses will discuss with the cardiologists the need for certain products during procedures. This can result in less product use, as the cardiologist may decide that the product they requested might not be necessary, or instead shortly before used products might be used.

	Prepare Room	Prepare Patient	Perform Intervention	Clean Room
Activities	 Prepare the required tray, and gather additional products required for the procedure (1-5). When product table is prepared, cover table with blue wrap to keep the surface sterile (6). Wrap product surfaces in plastic covers (7). Prepare the patient table (8).	 Make sure the patient is comfortable (9) and warm (10). Occasionally, change the elektrodes (11). Clean the skin (12), and place a sheath (13) into the arteries in the groin or wrist, depending on the procedure.	 Interventional cardiologist performs the procedure together with a scrub nurse or a second interventional cardiologist, depending on the procedure. The sheath (14) is used to place catheters (15) , stents (16), and heart valves (17), depending on the procedure. The handpomp (18) is used in procedures to inflate the balloons. Contrast medium (19) is used in every procedure, to visualize the vascular system in the heart.  The non-sterile nurse assists with checking up on the patient, and gathers the required materials from the external storage. The technician monitors the patients vitals and stores data from the procedure.	  Assist the patient off of the table and into the bed or chair. Clean the table and patient table, discard all products in garbage bags. Remove all surface covers. Clean the patient table and other surfaces.
Products*	 1  2  3 4 5 6  7  8	 9  10  11  12  13	 14  15  16  17  18  19	 
Waste	   • Tray packaging and item list • Packaging of additional items	 • Used electrode stickers	   • Product packaging of stents (20), catheters (21), and TAVIs (X, transport packaging and product packaging) • Used stents, katheters, and other used products	 • Contents table • All catheters and stents, and other additional products used during the procedure • Patient table coverings • Patient blanket

**Excluding medicine*

Figure 3.4.1. An overview of the general procedure of different interventions performed at the cath lab, based on observations of multiple different procedures at the cath lab.

3.5 Product use at the Interventional Cardiology

Through observation of various procedures, and conversation with the healthcare staff at the cath lab, an overview of the different, more generally used products is made. A distinction is made between the products that are used throughout the whole hospital, and products that are particular to interventional cardiology.

3.5.1 Hospital wide products

The hospital wide product that are used at the interventional cardiology include clothing items, such as disposable gowns, gloves, face masks, scrubs, hairnets, and overalls (see figure 3.5.1.1 and 3.5.1.2). Next to this, there are products that are used for the comfort of the patient, such as a heating blanked and a pillow cover (see figure 3.5.1.3).

Figure 3.5.1.2. Employee clothing items

Figure 3.5.1.2. Visitor clothing items

Figure 3.5.1.3. Items used for comfort for the patient

3.5.2 Departmental products

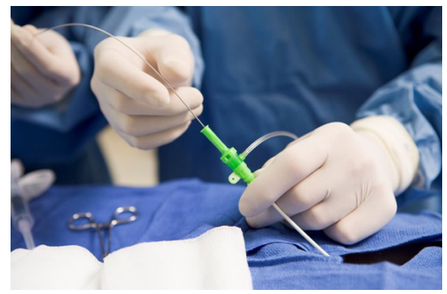
The departmental products are products that are not used throughout the whole hospital, but are most often specific for this specialism of interventional cardiology (see figure 3.5.2.1). There are two trays specifically made for Interventional Cardiology at EMC. Other products that are regulargy used are different types of catheters, stents, TAVIs, other materials such as sheats, inflation devices, contrast medium and ECG electrodes. For a more detailed overview of these products and their use, see Appendix B.

(a) (b)

(c)

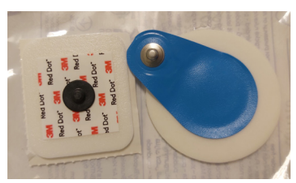
(d) (e

(f)



(g)

(h)



(i)

Figure 3.5.2.1. (a) The TAVI Tray without its outer plastic protection packaging. (b) The TAVI Tray opened up on the table. (c) The Hartkatheterisatie tray, with some additional product, unpacked on the table. (d) An example of different diagnostic cardiac catheters. (e) A guiding catheter in its packaging. (f) A stent and its packaging. (g) An example of a sheath in use. (h) An example of an inflation device. (i) The ECG electrode used at the Interventional Cardiology Department (left) and an ECG electrode used at another department at EMC.

3.5.3
Product sustainability opportunities

Opinions on the opportunities for improvement of environmental sustainability for different selected products were discussed with the different stakeholders. An overview and timeline was made to show the perceived difficulty for improving each product's sustainability based on interviews and online research on existing initiatives.

For hospital wide products, the healthcare workers were confident that these product could quite easily be replaced with more sustainable products, as these were commonly used in the past. However, a lack of an overview of already completed (and successful) sustainability projects at EMC. Because of the limited time available for these kinds of projects, the healthcare workers are hesitant to perform projects that might have already been done elsewhere.

The healthcare workers were also positive about the two different trays, as the contents of the trays have already been modified by the nurses, in collaboration with the supplier. Next to this, they were positive about opportunities, because they could think of solutions to make the tray more sustainable, without putting extra strain on the activities of the nurses.

For the other discussed products, such as catheters, stents, and TAVIs, more barriers can be found for improving the sustainability of these products. Barriers include:

- The believe that the industry has no (financial) benefit of changing towards more alternative solutions.
- The products are not suitable for reuse.

Opportunities include:

- Products that have already been re-evaluated by the healthcare workers elecit more positive opinions about the possibility for sustainable improvements.
- Products that have been used in the past, such as reusable clothing items, are perceived to be relatively easy changes to make.

For a full overview of barriers, opportunities and remarks per product, see Appendix C.

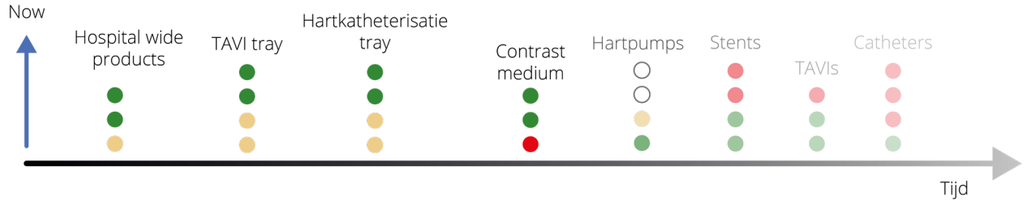
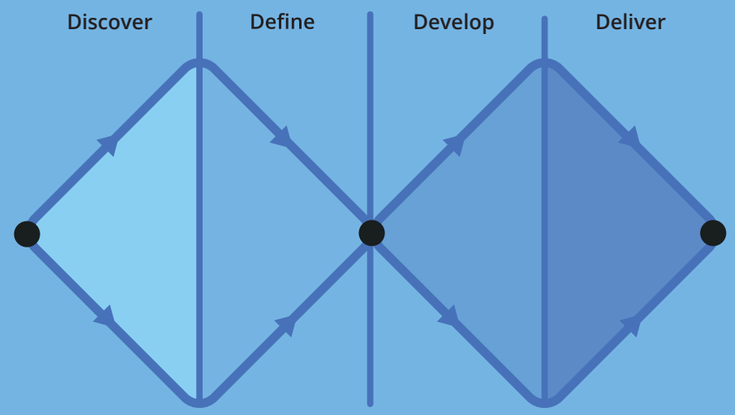


Figure 3.5.2.1. The different products mapped out on a timeline, according to their opportunities or barriers for improving the sustainability of the project, based on interviews with stakeholders and online research on existing initiatives. The products towards the brought up more opportunities than barriers, and are thus perceived as product that are more achievable to improve the sustainabilty of.



4

Synthesis

This chapter converges the results of the literature and context research into different identified barriers and opportunties for sustainability. Next, it is discussed how these different barriers and opportunities can be addressed by the co-creation tool, and how solutions to these barriers and opportunities could be implemented in the co-creation tool.

4.1
Barriers for co-creation for sustainability

In this section, the identified barriers are described. The barriers have been identified based on the literature research and the interviews with stakeholders at the Interventional Cardiology department in chapter 2 and 3. In the next section, these barriers are translated into opportunities and requirements for the co-creation tool.

1. Lack of time

For all stakeholders, lack of time seems to be one of the greatest barrier. The daily schedules of the cardiologists and nurses are filled with patients. For the healthcare workers working in the cath lab, every additional task or every change in the protocols therefor needs to be worth the effort.

2. Voluntary time investment

The time spend by healthcare workers on sustainability efforts has to be done in their own time. Because of this, activities around environmental sustainability might not be high on the priority list.

3. Division amongst stakeholders on level of interest

The level of interest between stakeholders at the interventional cardiology department may vary, both between stakeholders, as well as between individuals within a stakeholder group. Also, the stakeholders in the industry may lack incentives to change their offerings to a more sustainable design or service. In the case of the stakeholders at the Interventional Cardiology department, the stakeholders that seem to have the highest power over sustainability have other concerns. Therefor, environmental sustainability might not be their priority.

4. Resistance to change

Humans are naturally resistant against change. According to Rehman et al. (2021), one of the most influential aspects on if a implementation succeeds is the employee's attitude towards change. When the healthcare workers are not invested in environmental sustainability, or do not see the need for a change, they might be resistant to changing their current way of working. A solution might be to create awareness amongst the healthcare workers about the sustainability projects, and provide opportunities for all employees to provide input and help in moving the project forward.

5. Lack of a foundation for environmental sustainability

No method or approach currently exists that aids the healthcare workers in the proces of sustainability projects. Next to this, no clear overview is present on the different sustainability initiatives.

6. Lack of resources

The interventional cardiology unit has limited space available. There is already a lack in storage space. The need for extra storage space might be connected to the sustainability initiatives, such as changing to reusable products.
Due to the change towards SUDs, the Central Sterilisation Unit at EMC has significantly decreased in size. Because of this, they might not have the capacity to change back to the use of reusable products.

7. Regulatory barriers

Regulations and certification of medical product might make the proces of changing existing products more difficult. The re-certification of products are also paired with high costs, which might be a barrier for the product manufacturers.

9. Lack of conversation about sustainability between stakeholders

Research has shown that there is a lack of or problems with stakeholder interactions on the topic of environmental sustainability. There is also limited conversation about sustainability between different departments at Erasmus MC.

10. Environmentally sustainable products are more expensive

Some healthcare workers may believe that environmental sustainability is directly related to a rise in costs. For both the cardiologists and strategic purchasers, one of their main goals is to reduce costs whilst still providing the best quality care. It is often believed that when taking environmental sustainability into account, there is a related rise in costs. This tension between the two is seen as a barrier, as an improvement in environmental sustainability might go against their goals of reducing costs.

11. Prioritization of product quality and safety

Due to infection risk and quality care provision, healthcare stakeholders usually prioritize product quality and safety over the sustainability of the product.

12. Unawareness of unsustainable practices

Healthcare workers at the Interventional Cardiology department might not be aware of the negative environmental impact of their practices, or the practices elsewere in the product chain.

4.2 Opportunities for the co-creation tool

In this section, different opportunities for the co-creation tool will be discussed. Each opportunity is described, and the different barriers it addresses are mentioned between the brackets.

Transparently sharing of sustainability goals and results

Create awareness amongst employees about sustainability initiatives

Motivate stakeholders/healthcare workers to think about environmental sustainability and participate in sustainability initiatives

The co-creation tool should create awareness about the sustainability efforts at the department (12). In this way, the healthcare workers might be motivated also think about improving the sustainability of their own work activities (3). When there is transparency on the sustainable efforts, and all employees are allowed to contribute and participate in the sustainable projects, there might be less resistance (4). When the goal and positive influence of the projects are clearly stated, there might be less resistance to the implementation of changes to the work processes, as the employees now better understand why it needs to change.

Facilitate the introduction of conversations about environmental sustainability between stakeholders

Create a joint responsibility and ownership over the sustainability projects

Because of the lack of foundation for sustainability projects (5), the little interaction between different departments at EMC, and the lack of conversation of lower environmental impact amongst stakeholders (9), the co-creation tool can stand as a basis for starting the conversation about sustainability. When the start of the project is initiated by all relevant stakeholders, a common sense of ownership can be created, while establishing or strenghtening the relationship between stakeholders.

Facilitate collaborative goal setting

The conversation between stakeholders within the hospital as well as external stakeholders might tackle the barriers of the interwovenness of the industry in the healthcare sector (8), the belief that environmentally products are more expensive (10), and thus not worth it, and the prioritization of product quality and safety (11). The different stakeholders are collaboratively thinking about the goal for sustainable improvements, whilst still keeping in mind all their (shared) values. When the goal is determined together with the different stakeholders, common ground can be found and trade-offs or considerations between the different values and environmental sustainability can be made.

The co-creation tool should facilitate time efficient steps and preparations

Because of the lack of time (1) and the voluntary time investment (2), it is important that the co-creation tool facilitates efficient use of time. The preparation and execution of the co-creation proces should be minimally time consuming. A generalised co-creation plan can help, as the steps and preparation for the co-creation proces are the same for each project. The actions that the user has to take to facilitate the proces should be as few as possible and it should cost little time.

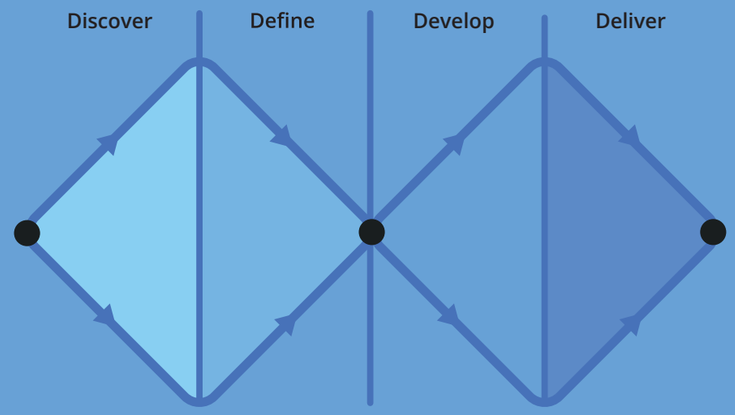
4.3
Reframing the design goal

The design goal as stated in chapter 1 is reframed based on the synthesis of insights gathered in the literature review of chapter 2, and the context research of chapter 3. The design goal as defined in chapter 1 was:

“ Design a co-creation tool that provides a general approach for making medical products or protheses used at the Interventional Cardiology at Erasmus MC more environmentally sustainable. ”

The new defined design goal is as follows:

“ Design a co-creation tool that serves as a basis for sustainability by raising awareness and increasing the motivation for environmental sustainability of stakeholders at the Interventional Cardiology department. The design of the co-creation process should provide a general approach for the initiation of sustainability projects that helps to establish or strengthen the relationships between stakeholders. “



5

Concept generation and testing

This chapter explains the method for concept generation based on the requirements defined in the previous chapters. Next, concepts were tested and validated with fellow students, external healthcare workers, and project stakeholders, and iterations on the insights were made.

5.1 Concept generation

How-to questions and brainstorming sessions

First, how-to questions were formulated based on the different requirements as defined in chapter 4. This resulted in ideas for different activities and materials for the co-creation tool (see figure 5.1.1). In multiple brainstorm sessions, these ideas were further developed into templates and activities (see figure 5.1.2).

TAVI case

With two nurses, a business management consultant who focusses on environmental sustainability, and J.C. Diehl, the case of the TAVI tray was discussed. The discussion led to different insights on the values and requirements of different stakeholders, and the barriers or opportunities of the proposed sustainable intervention. These insights led to a stakeholder relation map (see figure 5.1.3).

Based on the different brainstorm sessions and the case description, multiple templates were designed.

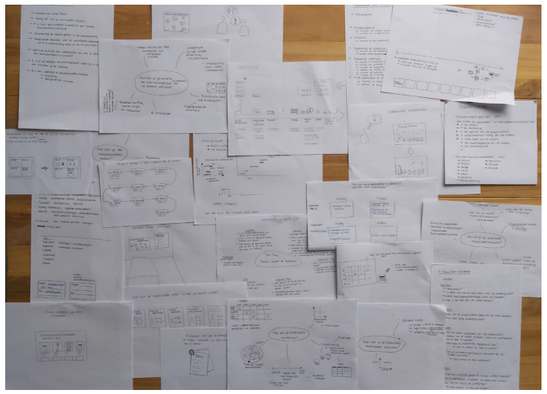


Figure 5.1.1. Results from the how-to questions and brainstorm sessions

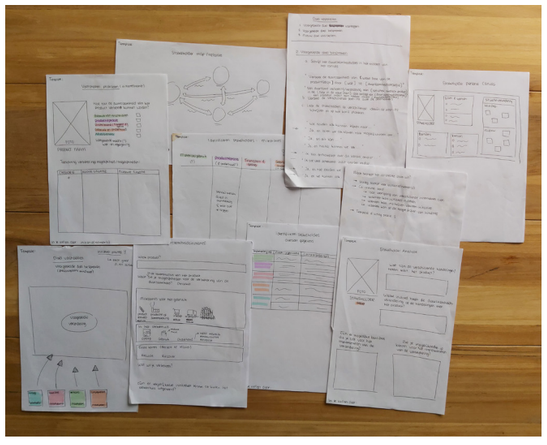


Figure 5.1.2. First iteration of the different designed templates or activities for the co-creation process

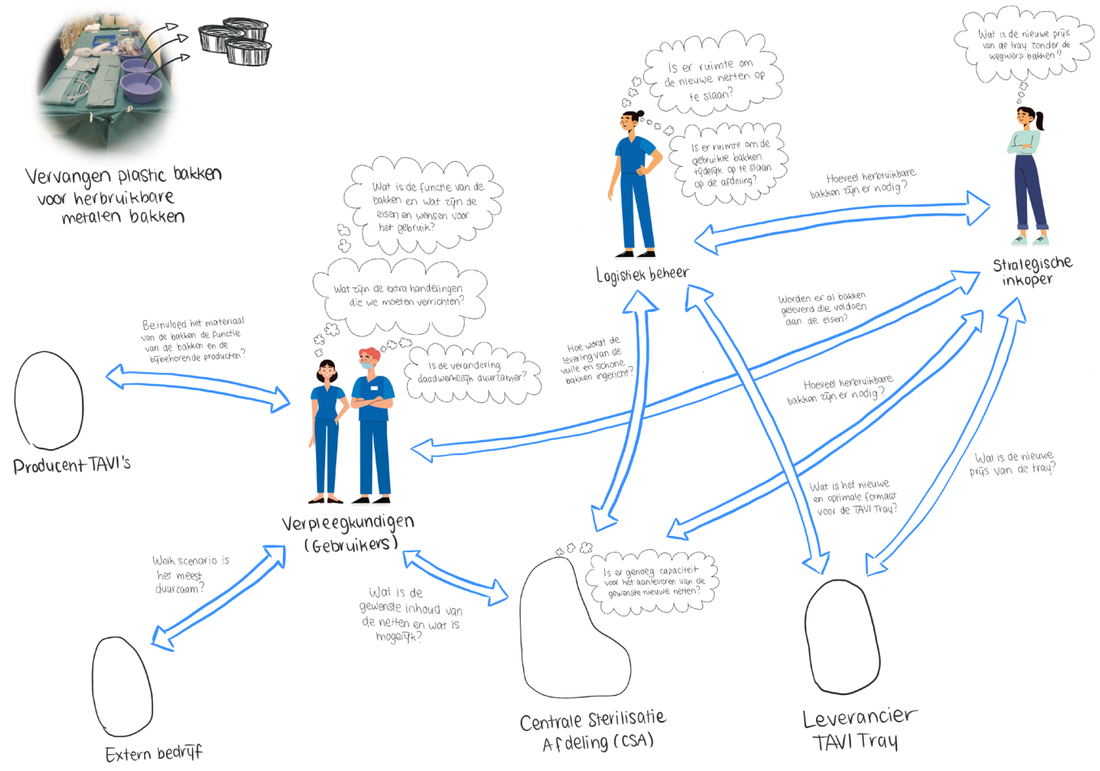


Figure 5.1.3. Stakeholder relation map. This map shows the different values and requirements of the different stakeholders related to the proposed sustainable intervention, illustrated in the think clouds. The blue arrows illustrate the different tensions found between different stakeholders, based on the barriers that came up during the brainstorm session.

5.2
Concept testing

Test session 1

The different selected templates and activities were tested during a session with six participants (see figure 5.2.1). Five of these participant work or have worked in the healthcare sector. The session took about 1,5 hours. Multiple materials, activities and templates were tested during this session (see figure 5.2.2). Via roleplaying (the participants were assigned different stakeholders), the activities were played out. Observations were made on the effectiveness of the designed templates, and the required time to complete an activity. Question were asked during and after the session about the understandability of the activities, and if the participants had had enough opportunities to share all the information they desired. The full documentation on this test session can be found in appendix FIXME.
Based on the test ession, iterations on the templates and activities were made.

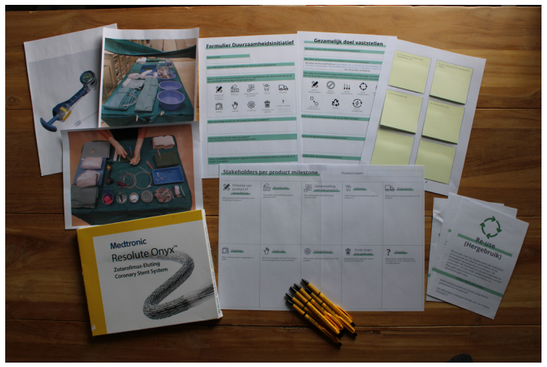


Figure 5.2.2. First iteration of the different designed templates or activities for the co-creation process

Figure 5.2.1. First iteration of the different designed templates or activities for the co-creation process

Testing sessions with healthcare staff at the Interventional Cardiology Department

The different materials, templates, and activities (see figure 5.2.3.) were presented to different healthcare workers of the Interventional Cardiology department in multiple sessions (see figure 5.2.4.). The sessions took around 1,5 hours per session.

The different materials were presented and explained, and the following questions were discussed:

- What do you like about this idea?
- What would you change or remove?
- Do you understand the use and goal of the materials?
- How would you implement and use this?

Iterations were made to the materials, activities and templates based on the insight gained from the testing sessions.

Figure 5.2.2. Picture of the different materials that were tested with stakeholders from the Interventional Cardiology department

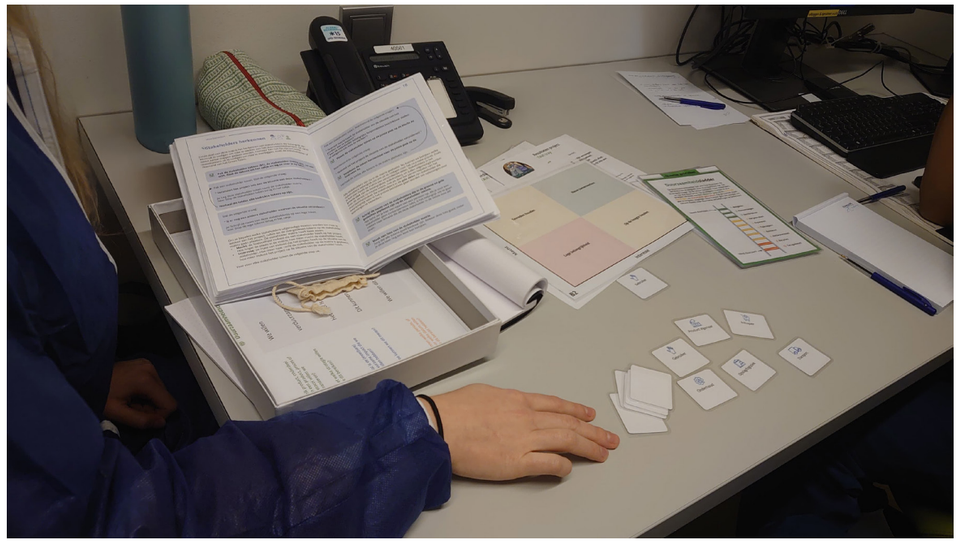
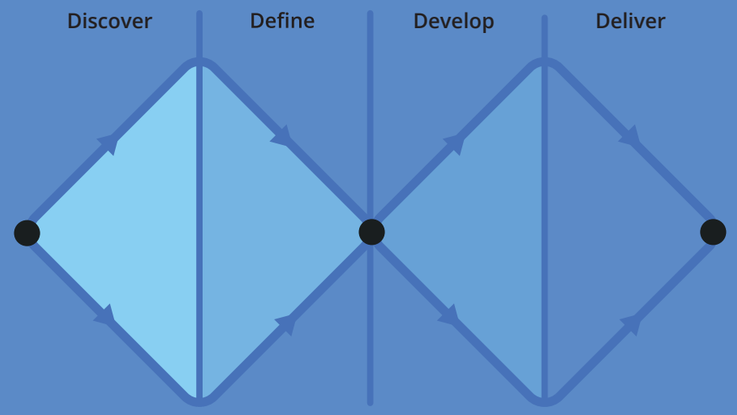


Figure 5.2.2. Picture of the last session held with two healthcare workers, a nurse and a logistics coordinator. Both participants are actively involved in sustainability at the Cardiology Department.



6

The co-creation tool for sustainability

In this chapter, the final concept for the co-creation tool for sustainability will be presented. The co-creation tool provides materials, activities and templates that facilitate sustainability in multiple stages of the process. In this chapter, the different elements, their purpose, and the design choices will be explained.

6.1
The Sustainability Space

The Sustainability Space (see figure 6.1.1) includes multiple elements, that together form the physical point for sustainability on the department floor. This physical, central point for sustainability helps to create awareness by transparently sharing the different sustainabilty projects. The displaying of the goals of the projects, and the positive results towards a more circular Interventional Cardiology department might motivate employees to participate and initiate sustainabilty projects. The Project Box, together with the Project Initiative forms and the Sustainability Cards provide an accessible way of sharing ideas.

The Project Board is the physical representation for different sustainability projects that the department is working on. The board contains three different columns, differentiating between the phase of the project; planned projects, active projects, and succesful projects.

The Project Box facilitates the influence of all healthcare workers on sustainability project, by providing a central point for handing in ideas for sustainable improvements.

Each phase of the project has its own template that show the progression or results of the project (see FIXME).

Project Initiative forms (see FIXME) are placed on the Project Box. These forms can be filled out by employees to suggest ideas for sustainability.

Sustainability Cards (see FIXME) are placed near the Project Board. These cards can be used for inspiration for sustainability initiatives.

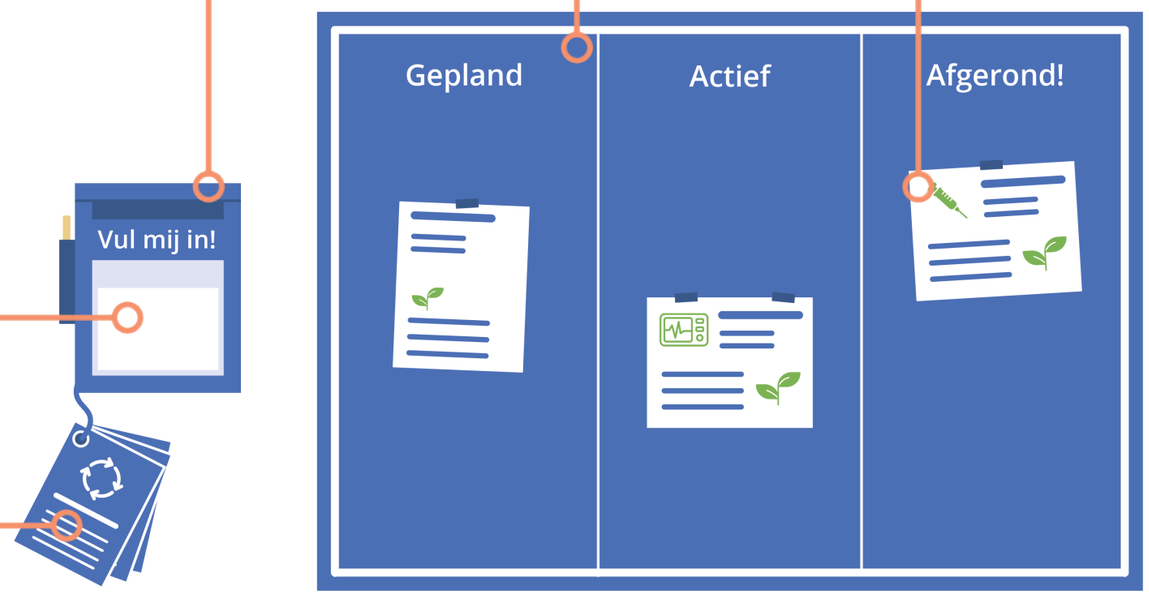


Figure 6.1.1. An illustration of the Project Space, consisting of the Project Board, Project Box, Sustainability Cards, Project Initiative forms, and forms to show the progression or results of the projects.

6.2 Sustainability cards

The Sustainability Cards serve to inspire the employees to find creative, sustainable solutions. Additionally, they aim to educate the users on the difference in circularity of the strategies, and thus provide a scale, indicated by one of the three colors and a number.

A short explanation of the three different categories is given, indicated by the color green, yellow, and orange. The green category include the most circular strategies, whilst the orange category include the less circular strategies.

The ladder symbolises the scale of the 10 different sustainability strategies, where the strategies highest on the ladder are the most circular

A scale for circularity of the strategies is given, indicated by the number that is placed before the name of the strategy

The category is indicated by both name and color

The stategy is illustrated by an icon

Slimmer gebruiken

3. Verminderen

Verminderen gaat over het verminderen van de grondstoffen, energie en water dat gebruikt wordt bij het maken en gebruiken van producten.

Front

A short description of the strategy is given

An example from either the context of Interventional Cardiology or the Healthcare sector is given to show the implementation of the strategy

Een voorbeeld uit de praktijk

In zowel de Hartkatheterisatie Tray als de TAVI Tray zijn er producten uit het pakket gehaald die niet gebruikt werden tijdens de procedures. Zo is onder anderen het aantal spuitjes vermindert, waardoor er minder spuiten ongebruikt blijven.

Back

Questions are asked that might spark ideas on how to use the strategy

6.3
The Handbook

The Handbook guides the user through the co-creation proces by describing the different persons and roles, the different steps, and the required materials. A selection of pages of the Handbook are included to highlight the different elements and design choices. The full Handbook can be found in the Product Package.

Figure 6.2.1. An illustration of the front page of the Handbook for use of the co-creation tool for sustainability projects

The introduction page explains the use of the Handbook, the different phases and activities, and the different elements that are part of each phase.

Hallo!

Dit handboek is gemaakt voor gebruik tijdens de verschillende fases in het co-creatie traject. Het handboek zal je helpen bij het opstarten van een project, de voorbereidingen, het uitvoeren van de co-creatie sessie, en het maken van een actieplan.

Bij elke fase zullen de bijbehorende stappen van het co-creatie traject uitgelegd worden. Bij elke stap zal uitgelegd worden welke aanwezigen, welke rollen, en welke materialen nodig zijn. Elke stap heeft zijn eigen stappenplan, wat je zal helpen bij het snel en doelgericht uitvoeren van de activiteiten. Deze stappen staan beschreven in de blauwe vlakken. Tips en andere hulpmiddelen zijn aangegeven in de vlakken met omlijning.

Aanwezigen | Materialen | Stappen | Tips en voorbeelden

Veel succes!

The different elements of the co-creation kit are described on this page, devided in the elements of the Sustainability Space, and the Co-creation toolkit

Onderdelen van de co-creatie kit

In de co-creatie kit zitten verschillende onderdelen. Hieronder zijn het nut van de verschillende onderdelen uitgelegd. Deze tools kun je gebruiken voor het voorbereiden en uitvoeren van de co-creatie sessie.

Duurzaamheidsmuur

Projectenbord

Het projectenbord laat de verschillende actieve, geplande en afgeronde duurzaamheidsprojecten op de afdeling zien.

Projectenbus

In het vakje op de voorkant van de projectenbus zitten formulieren voor duurzaamheidsvoorstellen. Na het invullen kunnen deze in de projectenbus ingeleverd worden.

Duurzaamheids-kaarten

Deze kaarten leggen de 10 verschillende strategieën voor duurzaamheid uit, en kunnen gebruikt worden bij het bedenken van nieuwe duurzaamheids oplossingen.

Co-creatie stappenplan

Handboek

Het handboek legt de verschillende fases van het co-creatie proces uit. Voor elke stap wordt het doel, de aanwezigen, en de materialen beschreven. Voor elke stap is een checklist aanwezig, waardoor je makkelijk kan controleren of je alle taken hebt uitgevoerd.

Ondersteunende materialen

Er zijn verschillende pakketten voor verschillende stappen in het proces. Elk pakket bevat materialen zoals formulieren, templates, en andere materialen.

Overzicht ondersteunende materialen

De co-creatie kit bevat ondersteunende materialen die op verschillende momenten gebruikt zullen worden. Hieronder zie je de pakketen, aangeduid met een letter. Een korte uitleg van de onderdelen in een pakket wordt gegeven. De materialen kunnen gedownload worden via de USB-stick.

Pakket A 

A1 Duurzaamheidsvoorstel

Het duurzaamheidsvoorstel wordt gebruikt voor het verzamelen van ideeën voor verduurzaming. Het lege formulier hangt aan de projectenbus. Het ingevulde formulier wordt ingeleverd in de projectenbus. Wanneer een project gekozen wordt om uit te gaan voeren, zal het ingevulde formulier op het bord opgehangen worden.

A2 Projectposter

De projectposter geeft informatie over het duurzaamheidsproject. Deze projectposter wordt opgehangen op het bord als een project gestart is.

A3 Resultaatposter

De projectposter geeft een kort overzicht van het resultaat van het duurzaamheidsproject. Deze poster wordt opgehangen op het bord bij

Pakket B 

B1 Stakeholderbord

Het stakeholder bord helpt bij het herkennen en indelen van de stakeholders die verbonden zijn aan een duurzaamheidsproject.

Pakket C 

C1 Presentatie template

Deze template wordt gebruikt als basis voor het inleiden van de co-creatie sessie en het kort presenteren van het voorgestelde duurzaamheidsdoel

C2 Ideeën delen template

Deze template wordt gebruikt tijdens de co-creatie sessie voor het bespreken en aanvullen van het voorgestelde doel.

C3 Voorbeeldzinnen

Op dit document staan een aantal voorbeeldzinnen die gebruikt worden tijdens de co-creatie sessie, in combinatie met de post-it notes.

C4 Post-it notes

De post-it notes worden gebruikt tijdens de co-creatie sessie. Elke stakeholder krijgt eigen post-it notes waar ideeën opgeschreven kunnen worden.

C5 Doelstelling template

De doelstellingstemplate zal helpen bij het gezamelijk vaststellen van het doel, zodat alle stakeholders het eens zijn over het duurzaamheidsdoel van het project.

An overview is given of the different supportive materials. There are three different packages, denoted by a letter. Each package contains one or more materials, indicated with the corresponding letter and number

Personen en Rollen

In het co-creatie process zal je verschillende personen tegenkomen. Deze personen kunnen tijdens het proces één of meerdere rollen spelen. Een persoon kan ook één of meerdere rollen hebben. Zo kan een Green Team member bijvoorbeeld de projectleider zijn, en een manager kan de rol van de notulist en tijdbewaker op zich nemen. De verschillende taken van de verschillende personen en rollen worden hieronder uitgelegd.

Personen

Green Team lid

Het Green Team lid is iemand uit het Green Team van de afdeling. Het Green Team is samen met de manager verantwoordelijk voor het **kiezen en opstarten van de interessante projecten**.

Manager

De manager is samen met het Green Team verantwoordelijk voor het **kiezen en opstarten van de interessante projecten**.

Deelnemer

De deelnemer is een **stakeholder die invloed of interesse heeft in het project**. Dit kunnen mensen van bijvoorbeeld een organisatie, of een andere afdeling of beroep uit het ziekenhuis zijn. De deelnemers worden uitgenodigd om deel te nemen aan de co-creatie sessie.

Throughout the co-creation proces, different persons are expected to facilitate or participate in different phases or steps. Here the different persons and their contribution to the proces are described.

Each person has its own recognizable color

Rollen

Initiatiefnemer(s)

Als initiatiefnemer bedenk je een idee om een product of productgroep te verduurzamen. Iedereen, van elke specialiteit of beroep, kan een project voorstellen.

Project leider

Als project leider ben je **hoofdverantwoordelijk** voor het **organiseren** van het co-creatie proces. Je bent verantwoordelijk voor het **voorbereiden** en **begeleiden** van de co-creatie sessie(s). Het is belangrijk dat je hier tijd voor vrij kan maken, en dat je genoeg kennis hebt van het product of procedure. Als projectleider vind je het niet erg om voor een groep te spreken. Ook ben je het **contactpunt voor deelnemers**. Het is prettig dat de projectleider geen hoge positie in leiderschap heeft, zodat iedereen zijn of haar mening tijdens de sessies durft te delen.

Notulist

Als notulist heb je de taak om **aantekeningen te maken** van de belangrijke en interessante resulaten die tijdens de co-creatie sessie besproken worden. Een notulist is goed in luisteren, en snel maar gedetailleerde notities maken.

Tijdbewaker

Als tijdbewaker ben je verantwoordelijk voor het **bijhouden van de tijd**, zodat alle activiteiten uitgevoerd kunnen worden. Daarnaast ben je flexibel en kan je het tijdschema aanpassen als dit nodig is.

There are four roles that need to be assigned to people that are going to organise the co-creation session. Each role's function and desired characteristics are described.

Each role has its own recognizable attribute, that relates to the role's function.

Stappenplan duurzaamheids-project

Installeren ____ p. 13
0. Ophangen duurzaamheidsmuur
1. Onderhouden duurzaamheidsmuur

Project starten ____ p. 15
2. Project(en) voorstellen
3. Project kiezen
4. Rollen verdelen

Voorbereiden ____ p. 18
5. Herkennen stakeholders
6. Uitnodigen stakeholders
7. Materialen voorbereiden
8. Ruimte voorbereiden

Uitvoeren ____ p. 23
9. Openen co-creatie sessie en voorstelronde
10. Introduceren duurzaamheidsvoorstel
11. Ideeën delen
12. Het doel vaststellen
13. De sessie afsluiten

Actieplan maken ____ p. 29
14. Spanningen herkennen
15. Vervolgstappen en planning

An overview of the different phases with corresponding steps is given

The different steps have been given a number, and the goal of the step is described in the title.

For each steps, the different persons and roles that are part of the activity are indicated

Each step has is own actions. Each action is described step by step

Uitvoeren

9. Openen co-creatie sessie
(15 minuten)

- **Verwelkom de deelnemers**
  Wijs alle deelnemers naar de ruimte waar de sessie plaats zal vinden. Laat zien waar drinken gepakt kan worden. Vraag iedereen plaats te nemen.
- **Leg het doel en schema van de sessie uit (C1)**
- **Stel jezelf voor, en laat iedereen zich kort voorstellen**

10. Introduceren duurzaamheidsvoorstel

- **Geef een korte presentatie over het voorstel voor de duurzame verbetering (C1) (2 minuten)**

11. Ideeën delen

Doel van de activiteit:
Het doel van deze activiteit is dat de deelnemers hun ideeën kunnen delen over het voorgestelde duurzaamheidsproject. Zo kunnen ze bijvoorbeeld delen wat ze goed vinden aan het voorstel, maar ook hoe het voorstel veranderd of uitgebreid kan worden. Als projectleider heb je de taak om te proberen de gesprekken die ontstaan positief te houden. Mensen denken vaak aan hindernissen, wat er voor kan zorgen dat het een negatieve discussie ontstaat, terwijl je juist wil kijken naar de mogelijkheden om een uitgebreid project op te zetten. Je kan dit doen door deze hindernis op het vel te schrijven en aan te geven dat dit een goed punt is om later in het project op te lossen.

When certain materials are needed, the required material is indicated with the corresponding letter and number

Aanwezigen

Project leider | Notulist | Tijdbewaker | Deelnemers

Materialen

C

The start of each phase refers to the required attendees and materials

The goal of the step is described when the activity requires more explanation

For certain steps, tips are given per role

Tips voor de projectleider:

Op het canvas is ruimte om belangrijke punten op te schrijven die genoemd worden tijdens de discussie. Probeer deze opmerkingen kort op te schrijven. Dit kan belangrijke informatie zijn voor het plannen van de vervolgstappen.

Tips voor de notulist:

Probeer de volgende informatie die tijdens de sessie gedeeld wordt op te schrijven:

- Toevoegingen aan het voorstel
- Hindernissen die opgelost moeten worden
- Kansen voor verduurzaming
- Gevolgen (positief en negatief) van het voorstel

Tips voor volgende sessies

Schrijf hier dingen op die je geleerd heb in de sessie die je volgende keer anders zou doen, of dingen waar je beter rekening mee moet houden:

After some steps, some space is given to note down insights from preparing or organising the activities, which might be useful for future projects

6.4
Supportive materials

This section describes the different supportive materials that are used during activities in the co-creation proces.

6.4.1
The Project Intiative form

As mentioned before, the Project Initiative form (see figures 6.4.1.1 and 6.4.1.2) provides a way for employees to share their ideas for sustainability initiatives. The form is structured in a way that guides the user through the proces of describing the idea, starting with the easier questions, and moving on to more difficult ones. The form offers enough space at every question for creative freedom.

The different stages in the lifecycle of the product are illustrated here. This might help the user to think outside the box, by informing them of stages other than the use of the product.

The user is asked to describe the current situation and what is “bad” about this, and how this situation can be changed to improve the sustainability.

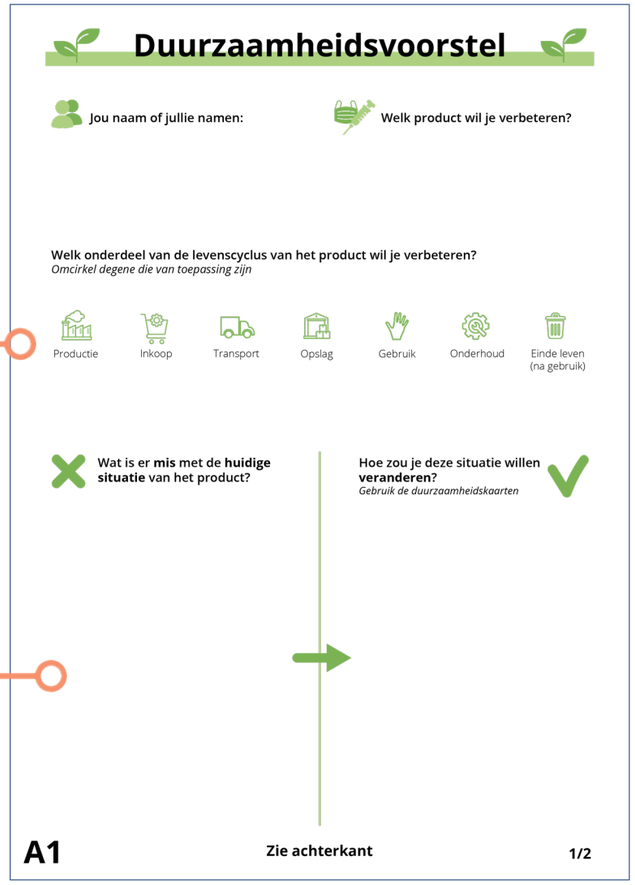


Figure 6.4.1.1. The front side of the Project Initiative form (Duurzaamheidsvoorstel formulier) (A4 format)

The user is asked if he or she knows any existing, similar projects. This might help the Green Team members in selecting feasible projects.

Figure 6.4.1.2. The back side of the Project Initiative form (Duurzaamheidsvoorstel formulier) (A4 format)

6.4.2
Project posters

Figure 6.4.2.1 shows an example of an active project poster, and figure 6.4.2.2 shows an example of a poster for a completed project. The template for the posters are made in PowerPoint. The PowerPoint template is designed in a way that the titels, information and photos can be added without having to worry about the graphic design of the poster. In this way, the posters can be easily and quickly filled in.

The goal of the project is described in both the measurable goal and the deadline for the project.

The name of the project leader is included, so that employees can contact the project leader to ask about details of the project when they are interested.

Verduurzamingsproject
TAVI tray

Dit project is een samenwerking met:
Verpleegkundigen Interventiecardiologie
Centrale Sterilisatie Afdeling (CSA) Mölnycke
Logistiek beheer Interventiecardiologie

We willen het doel behalen voor:
December 2025

Projectleider: **Daan de Korte**
d.dekorte@erasmusmc.nl

Ons doel:

We willen de TAVI TRAY verduurzamen door de plastic bakken te vervangen voor herbruikbare bakken.

Duurzaamheidsstrategie:
4. Hergebruiken

The sustainability strategy is indicated, so that it is easily understood how big the environmental benefits of the project might be.

Figure 6.4.2.1. Example of a filled out poster template for active projects (A5 format)

The two pictures illustrate the change from the previous situation to the more environmentally sustainable designed situation

The templated is designed to show only the most relevant and interesting information. Here, the sustainable results are described.

Resultaten project
TAVI tray

Wat we hebben bereikt:

Alle plastic bakken zijn vervangen voor herbruikbare RVS bakken. Hiermee besparen we per procedure 0,5 kilo aan plastic afval. Per jaar besparen we zo XX kilo aan plastic materialen.

Dit project was een samenwerking met:

Verpleegkundigen Interventiecardiologie, Centrale Sterilisatie Afdeling (CSA), Mölnycke, en Logistiek Beheer Interventiecardiologie

Figure 6.4.2.2. Example of a filled out poster template for completed projects (A5 format)

6.4.3
Identifying stakeholders

When starting up the project, the relevant stakeholders need to be identified. This is done with an activity based on the Power-Interest Matrix (Berger, 2023). The Power-Interest matrix contains 4 different quadrants, that are included in the stakeholder board (see figure 6.4.3.1). The four different categories are described in the handbook. Insights from the test sessions showed that the standard visualisation of the stakeholder matrix (see figure 6.4.3.2) might be too complicated to understand, and it was perceived as too many actions. The proposed activity reduces the steps in the proces, by simply letting the user choose for each stakeholder in which category it should be placed.

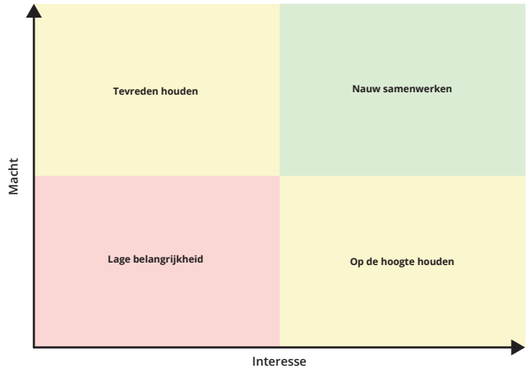


Figure 6.4.3.2. The standard visualisation of the stakeholder matrix

The characteristics of each category is visually described

The main stakeholders are printed on the tokens. This eliminates the steps of thinking about which stakeholders might be relevant, and eliminates the need for writing the name of the stakeholder on the token

The stakeholder tokens are magnets, thus reducing the action of retrieving the stakeholder tokens and placing them on the board. The stakeholder tokens can easily and quickly be moved to the right category

If there are any stakeholders missing from the printed tokens, the user can write the missing stakeholder(s) on the empty tokens

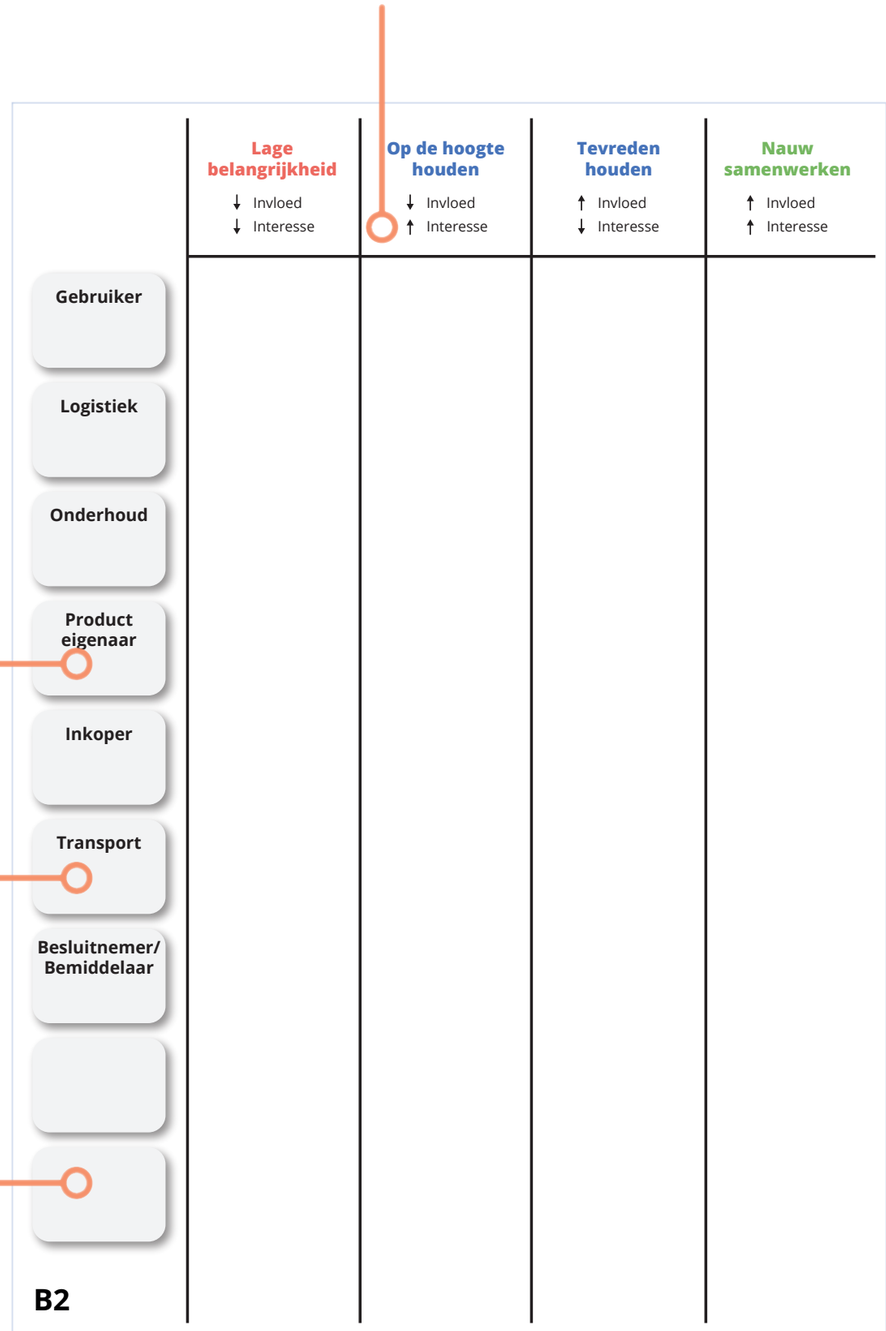


Figure 6.4.3.1. Stakeholder board and tokens for identifying relevant stakeholders.

6.4.4
The brainstorming activity

The brainstorming activity aims to invite the participants to share their ideas on the proposed initiative. There are a few materials that are used for this activity, namely; The idea sharing template (see figure 6.4.4.1), the example sentences (see figure 6.4.4.2.), and post-it notes.

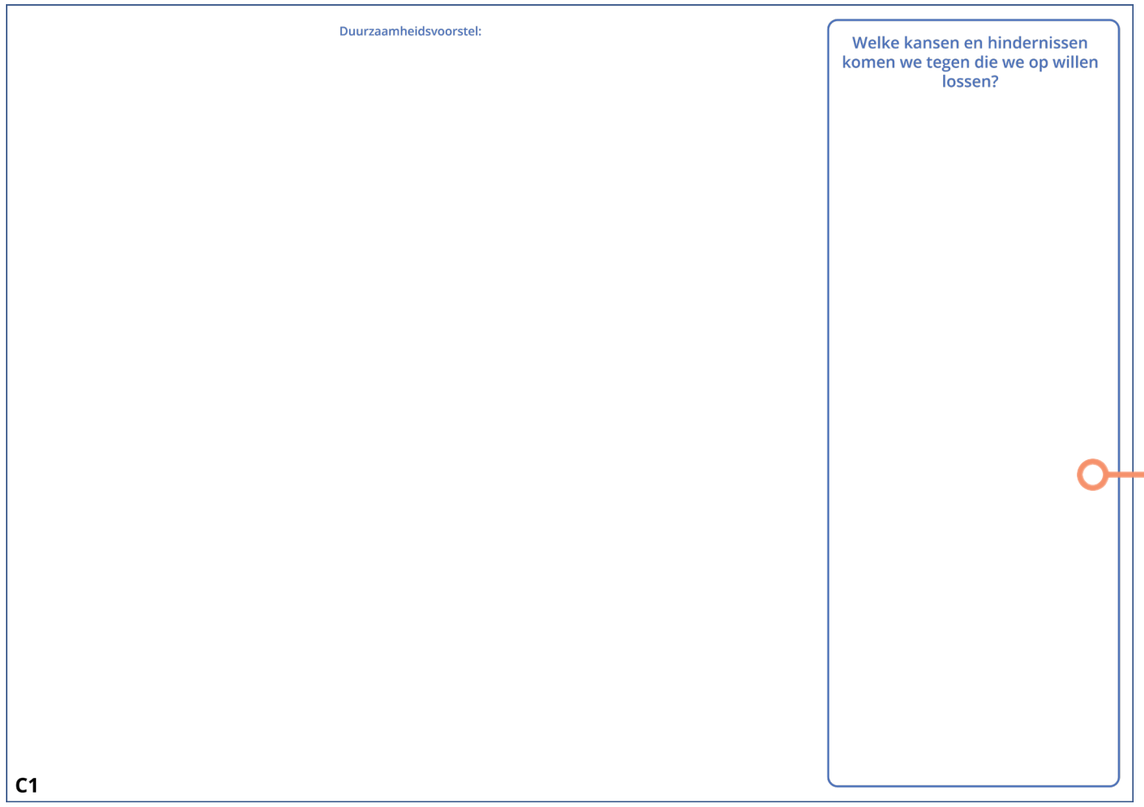


Figure 6.4.2.1. Example of a filled out poster template for active projects

The example sentences are positively formulated. This way, the participants are motivated to think in opportunities rather than barriers.

During the discussion, opportunities or barriers might come up that need to be addressed later in the project. When talking about barriers, the conversation might quickly turn into a “too” negative one.
This frame offers space to write down barriers that might come up in conversation. This shows the participants that the barrier is important, while offering a way to continue the conversation on different topics.

6.4.5
Setting the goal

The last activity in the co-creation session is to determine the goal for the project. To do this, the form for the sustainability goal is used (see figure 6.4.5.1.). The goal is divided into smaller sections, based on three of the elements of the SMART goal method (Boogaard, 2024): Specific, Measurable, and Time-bound. The other two elements, achievable and relevant, are excluded, as these topics are most likely already discussed in the previous brainstorming session (see section 6.4.4). By writing down the goal in front of all the participants, every stakeholder gets the change to provide ideas, and respond to the ideas of others. By writing the goal down, it can create a sense of commitment amongst the stakeholders (Murphy, 2018).

The questions help to guide the participants to decide on a completely formulated goal

The answers to the questions to the left of the frame can be written down to complete the sentence in the frame.

The questions in green relate to the “Specific” part of the SMART goals. The participants are asked to specify the precise product, part of the product, or proces that the project tackles. They are then asked to specify which circular strategy is used.

The questions in blue relate to the “Measurable” part of the SMART goals. These questions make sure that the goal is tangible, and actual numbers can show if the intervention is actually more sustainable relating to the orignal situation.

A time-bound question is added, to increase commitment and the raise the chance of succesful completion (Schmitz, 2023).

Duurzaamheidsdoel

Welk product, onderdeel van een product, proces of protocol willen we veranderen?

Met welke strategie willen we dit bereiken?

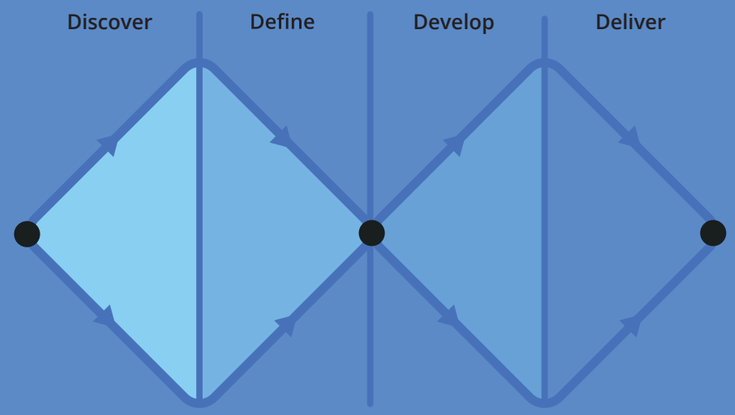
Wat is de (meetbare) duurzame impact die we willen hebben?

Hoe kunnen we dit meten?

Binnen welke periode, of voor welke datum willen we dit bereikt hebben?

We willen
verduurzamen door
Het doel is
Dit kunnen we meten door
We willen dit doel bereiken

C4



7

Project evaluation

This chapter aims to evaluate the co-creation tool based on its desirability, feasibility and viability. Recommendations for further research are provided.

7.1 Evaluation & Validation

In this subsection, the final concept is evaluated based on its desirability, feasibility and viability.

7.1.1 Desirability

The final concept can be seen as a basis for sustainability at the Interventional Cardiology department. The physical materials of the Sustainability Space offers a transparent way of sharing sustainabilty efforts. The physical presence of the Sustainability Space creates awareness amongst healthcare workers at the department. The accessibility of the Project Initiative forms combined with the Project Box might motivate the healthcare workers to think about environmental sutainability intiatives.

The co-creation process, the steps described in the Handbook, serve as a basis for starting a conversation with stakeholders about improving the environmental sustainability of products or processes. The activities in the co-creation session stimultate conversation between stakeholders. They are stimulated to share their values and requirements, hereby creating understanding between stakeholders, and establishing or improving the relationships between stakeholders. The collaborative goal setting activity helps to create goals that aim to align with the values and requirements of all stakeholders. This can create the feeling of a shared responsibility and ownership of the sustainability projects.

Defining the goal (with a time-bound element) will improve the change of a succesful completion of the project.

The concept facilitate project stakeholders by guiding them through the proces of co-creation in clearly described steps. Because of the generalisation of the proces, and the design materials for the different activities, minimal preparation is required from the project leader. As stakeholders in the healthcare sector often have little time in their schedules, the designed preparation and activities of the co-creation session aim to ask as little time investment as possible, whilst still making sure that the engagement in conversation and goal setting receives enough attention to motivate the stakeholders, and create a shared responsibility and ownership of the project.

Sessions held with stakeholders at the Interventional Cardiology department confirm the need for a basis for sustainability project. The materials from the Sustainability Space, the Project Board, the Project Box, the Project Initiative forms, the Sustainability Cards, and the project posters were receives with great enthusiasm. Some of the products were already ordered to install and start the use of it immediately, and the Project Initiative form and Sustainability Cards have already been used at sessions on sustainability.

7.1.2 Feasibility

The final concept is based on existing methods (co-creation), and models (Power-Interest matrix for identifying stakeholders, and the SMART goal model). These methods and models are widely used and have been proven to be effective.

The materials designed for the final concept are all easily obtainable products. The templates can be printed. The Sustainability Space consists of adapted designs of existing products, and should thus be easily acquired and installed. The implementation of the final concept does not require many resources. Because of this, the barrier for implementation is low.

7.1.3 Viability

The start of the project started with ambitious ideas of designing a co-creation approach for radical sustainability projects with industry stakeholders. However, due to the lack of a basis for sustainability in the field of Interventional Cardiology, based on both literature research and context research, this ambition was scaled down. Because of the lack of an approach towards sustainability, the lack of conversation with industry stakeholders about sustainability, and a lack of interaction between different departments at EMC on the topic of environmental sustainabilty, the goal of the project and the design of the co-creation tool was adapted to facilitate the more attainable projects. The project aims to build a basis for awareness, motivation, and open collaboration for sustainability projects. Next to this, the aim of the co-creation process was to establish or stengthen the relationships between stakeholders within EMC, and with industry stakeholders. The steps in the co-creation proces stimulate conversation between the stakeholders, hereby sharing their values and requirements, and hereby creating understanding between the different stakeholders.

It should be validated if the final concept is viable in the long-term. The concept is aimed for the use of projects that are collaborations between stakeholders that are relatively closely related. In the long-term, more ambitious projects with industry stakeholders need to be addressed to reach the sustainabilty goals set by the Green Deal 3.0 and EMC. As the values and motivation of these stakeholders in these project might be different and more difficult to motivate to participate in environmentally sustainable solutions, it should be tested if the designed activities and materials for the co-creation session prove to be effective for these more ambitious projects.

7.2
Recommendations

The design of the co-creation tool focusses on the initiation of sustainability projects. More research should be done on the generalisation of the steps after the goal setting activity in the co-creation session. More elaborate description of steps or activities in the action plan can be added to the concept.

This design facilitates collaborations between stakeholders for sustainability projects without many great barriers. Research can be done on the iusefullness of succsefulness of the use of the tool for more radical and ambitious projects.

The designed tool is made for Green Team members and other healthcare workers. It might be interesting to do research on the scalability of the concept to the context of other department at EMC.

7.3
Project reflection

The objective of the project at the start of the project started with ambitious ideas of designing a co-creation approach for radical sustainability projects with industry stakeholders. Howerver, due to different barriers, the goal of the project was adapted. Because of the lack of an approach towards sustainability, the lack of conversation with industry stakeholders about sustainability, and a lack of interaction between different departments at EMC on the topic of environmental sustainabilty, the goal of the project and the design of the co-creation tool was adapted to facilitate the more attainable projects. The aim of the project was redefined as:

"Design a co-creation tool that serves as a basis for sustainability by raising awareness and increasing the motivation for environmental sustainability of stakeholders at the Interventional Cardiology department. The design of the co-creation process should provide a general approach for the initiation of sustainability projects that helps to establish or strengthen the relationships between stakeholders."

The use of methods in the ideation phase could be improved. In this project, concepts were created by the designer based on the insights gathered from literature research and context research. For future research, it might be interesting approach the ideation phase from a co-design perspective, by involving the intended user of the project in the creation of ideas. However, it should be taken into consideration that healthcare workers have limited time available, so planning meeting might prove to be difficult, as unexpected events can have effects on the schedule of the healthcare workers.

The different element of the co-creation tool were discussed and tested with stakeholders at the Interventional Cardiology department. More research could have been conducted on the implementation of the designed co-creation tool within the context. Some aspects of the implementation of the tool were discussed with the stakeholders, but before the end of the master project, there was not yet a complete implementation plan.

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Appendix A
Procedure workflow at the Interventional Cardiology

In this section, the general workflow for every procedure is visualised. The information is based on observations of the different types of procedures, such as PCIs, CAGs, and TAVIs. The workflow is divided into four sections (see figure FIXME). Per section, the different activities are described, as well as which stakeholder performs these activities. Next to this, pictures of the general products that are used are provided, as well as an example of the waste that is generated per section.

A.1
Preparation of the cath lab

At the start of every procedure, the room needs to be prepared for the specific procedure that is to be performed. Depending on the procedure, one of the two trays is needed. The nurses prepare the room, together with the technical staff. The table is prepared by one or two nurses. The tray is placed on the table and unfolded. The products are placed on the preferred position on the table. The bowl are prepared by filling them with the right fluids or medication. Sharps are safely placed on a designated piece of fabric on the table. Additional products that are needed for the procedure are already unpacked and placed on the table. Machines and other products around the operating table are covered with the plastic covers. The patient table is prepared and covered with drapes. Once the table and room is prepared, a drape is placed over the table to keep the products sterile whilst waiting for the procedure to start. Simultaneously, the cardiovascular technologist prepares the technical equipment by ensuring that all necessary equipment, such as monitors, defibrillators, contrast injectors, ECG machine, is functioning correctly.

A.2
Preparing the patient

Once the patient is brought into the cath lab, the patient is placed on the operating table. The patient is then prepped for the procedure by the nurses. To make the procedure as comfortable as possible for the patient, a pillow and a warming blanked is provided. Next, the correct ECG stickers are applied to the thorax of the patient, and the ECG machine is connected. The patient is covered with an angiography drape, which covers the body of the patient, but provides access to the wrist and/or groin area. The area of access to the blood vessel is properly cleaned, and an incision to the artery is made. Depending on the procedure, the incision is made in the wrist, or multiple incisions are made into the wrist and both sides of the groin. This is either done by the nurse or (one of) the interventional cardiologist(s). A sheath is placed in each incision. Once the patient correctly prepped, the procedure can start.

A.3
The intervention

Depending on the intervention, the procedure varies. With the PCI, CAG, and FFR procedures, the team present is smaller than when a TAVI procedure is performed. The team of the prior mentioned procedures consists of an interventional cardiologist, whom is working at the patient table. A sterile nurse assist the interventional cardiologist in providing the right products, as well as assisting the cardiologist in guiding the catheters and/or stent into the blood vessel of the patient. Another nurse is present to gather additional products from the storage room, as well as to monitor and check in with the patient. Usually one or two technical staff members are assisting the cardiologist from behind the sterile glass window barrier, by monitoring the patient and recording and storing data from the procedure. For the TAVI procedure, a larger staff is present in the cath lab. Two interventional cardiologist are present to perform the intervention, more than two nurses are present, and there are two technical staff members.

A.4
Cleaning the room

After the intervention is completed, the patient is removed from the table and escorted out of the cath lab. The nurses and technicians clean the table and patient table by folding the blue wrap around all the remaining products. The plastic covers are removed from the different surfaces. All products used in the procedure are discarded in either the blue garbage bags, or the grey garbage bins, depending if the products are sharps or infected. Paper packaging and plastic packaging is collected separately.

A.5
Sustainability in the procedure workflow

Through observations and conversation with nurses in the cath lab, different aspects of environmentally sustainability in the workflow were analysed and discussed.

At the start of the project, no real initiatives for waste seperation was in place for the Interventional Cardiology department. At the Electrofysiology department however, more sustainability initiatives were already adopted, such as the seperation of plastics and paper waste, the collection of used catheter tips, and a change in the procedure flow to eliminate the need for cloths for covering the surgical table and keeping it sterile.

Currently, almost all products that are used are single-use devices.

The nurses in the cath lab seemed enthusiastic to think about their way of working and how it could be more sustainable. Multiple ideas were mentioned when asked where sustainable improvements could be made. These ideas usually tend to stay close to their work FIXME.

To avoid unneccesary use of products, more and more often nurses would discuss with the cardiologists the need for certain products during procedures.

Appendix B
Departmental products

The departmental products are products that are not used throughout the whole hospital, but are most often specific for this specialism of interventional cardiology.

Trays

The interventional cardiology department at Erasmus MC uses two different trays for their procedures, namely the "Hartkatheterisatietray" (see figure B1) and the "TAVI Tray" (see figure B2). These trays contain the standard products used for a variety of procedures. Additional products specific to the type of procedure are added by the nurses. The Hartkatheterisatietray is used for procedures such as CAGs, FFRs, and PCIs. The TAVI Tray is used for the TAVI procedures. Both trays are supplied by one supplier, and are specifically composed for Interventional Cardiology at EMC. Collaboratively, the supplier and nurses from the Interventional Cardiology department have composed the trays to eliminate waste as much as possible, by removing products that were standardly unused after the procedures.

(a)

(b)

Figure B1. (a) The TAVI Tray without its outer plastic protection packaging. (b) The TAVI Tray opened up on the table

Figure B2. The Hartkatheterisatie tray, with some additional product, unpacked on the table.

Catheters

A catheter is a thin, flexible tube that is inserted into the blood vessel (see figure B3 a), often either via the wrist or groin. There are many different types of catheters with different functions, such as coronary catheters, diagnostic catheters, and guide catheters (see figure B3b for a guide catheter in its storage packaging). The catheters come in different sizes and shapes. Depending on the type of catheter, they serve as a way to inject contrast fluid, provide the passage for other products such as stents, or are used for different types of diagnostics such as measuring aortic and arterial pressure differences.

(a) *(b)*

Figure B3. (a) An example of different diagnostic cardiac catheters. (b) A guiding catheter in its packaging

Stents

Stents are small, mesh-like tubes that are inserted into blood vessels to keep them open, and provide long-term support to the structure of the vessel. Coronary stents are inserted in the coronary arteries. The stents are guided to the right position through an already placed catheter. The stents that are placed within the arteries of the patient remain there for the rest of the patient's life. The stent is placed on the tip of a thin metal wire. Figure B4 shows a catheter and its packaging.

Figure B4. A stent and its packaging

Sheath

A sheath is a medical device that facilitates access to the blood vessel (see figure B5). It is a short, hollow tube that is inserted into the artery of vein, providing a stable pathway though the incision in the skin to the blood vessel, through which various instruments, such as catheters and guidewires can be introduced into the vascular system.

Figure B5. A sheath (green product) in use

Inflation devices

Inflation devices (see figure B6) are used to inflate and deflate balloons that are part of balloon catheters. Balloon catheters are used to place stents. The balloon is inflated to open up narrowed or blocked arteries, or to deploy the stent. The device allows for precise control of pressure and volume of the inflation, which is essential for the safe and effective insertion of stents.

Figure B6. Example of an inflation device

Contrast medium

Contrast medium is used to enhance the visibility of the coronary arteries, heart chambers, and other vascular structures by enhancing the contrast (see figure B7). Contrast medium is a liquid that often contains iodine or barium, which are both highly radiopaque.

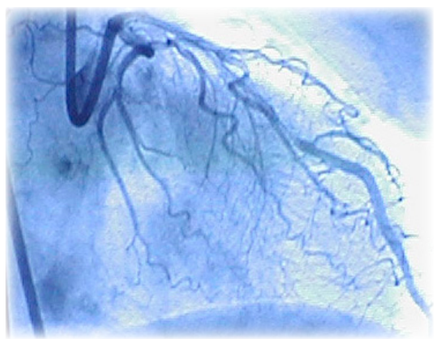

Figure B7. Visualisation of how contrast fluid highlights the coronary arteries

ECG electrodes

ECG electrodes are small adhesive patches that are attached to the patient's skin during an electrocardiogram (ECG) test. The stickers detect the electrical activity of the heart and transmit this information to the ECG machine. Via the ECG, the patient's heart activity is continuously monitored by the staff in the cath lab. As the ECG stickers are used in procedures where constant X-ray visioning is used, it is essential that the ECG stickers that are used consist only of materials that do not show up on the X-ray imaging. At the interventional cardiology, they therefor use stickers that have plastic connection points for the wires (see figure FIXMEa). Sometimes patients arive at the cath lab with ECG stickers with metal connection point (see figure B8b). These have to be replaced, as they would be visible on the X-ray imaging.

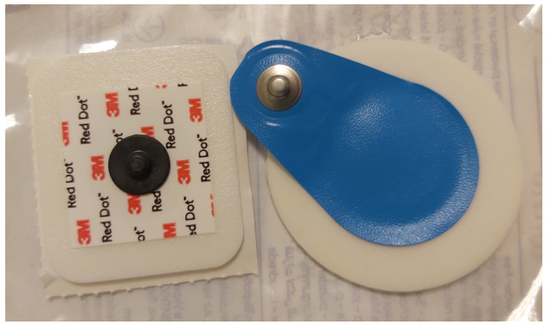

Figure B8. (a) A ECG sticker used at Interventional Cardiology at EMC. (b) ECG sticker that is used in other departments at EMC.

TAVI

As mentioned before, TAVI stands for Transcatheter Aortic Valve Implantation. The products used for a TAVI is a package consisting multiple products, which may vary depending on the supplier. Erasmus MC has different suppliers for the TAVI products.

Appendix C
Opinions on product opportunties for sustainability

Product groups: TAVIs

- De hartklep zelf is niet te recyclen, omdat het in de patient blijft. (interventiecardioloog, persoonlijke communicatie)
- Hetzelfde als bij de hartpomp, is de TAVI een duur pakket. Het bestaat uit meerdere producten. Mogelijk zijn hier producten die hergebruikt kunnen worden.
- Het is een product waar voor de producent (hoogstwaarschijnlijk) enorm veel winstmarge op zit

Product groups: TAVI Tray

- Er is in het verleden al veel door verpleegkundigen veel aan het pakket aangepast, zoals het verminderen van het aantal producten in het pakket om verspilling te voorkomen.
- De verpleegkundigen zijn positief over het vervangen van wegwerp producten door herbruikbare producten. Ze verwachten geen extra druk of tijdsverlies door het gebruiken van herbruikbare producten.
- Er is onzekerheid over de capaciteit van de CSA, aangezien de CSA bij de verhuizing flink verkleind is.
- Er zal ruimte gevonden moeten worden op de afdeling of in de kamers voor het plaatsen van de gesteriliseerde producten, en het verzamelen van de gebruikte producten

Product groep: ziekenhuis brede producten

- Personeel is positief dat producten zoals kleding en andere ziekenhuis brede producten vrij gemakkelijk te vervangen zijn door duurzamere alternatieven, omdat dit in vele gevallen vroeger al gedaan is (verpleegkundigen, persoonlijke communicatie)
- Er mist een platform/overzicht waarin iniatieven beschreven worden die al onderzocht zijn. Hierdoor worden er soms projecten meerdere keren onderzocht, zonder initieel te weten dat er al onderzoek naar gedaan is (verpleegkundigen, persoonlijke communicatie)
- Er zal aangetoont moeten worden dat de alternatieven daadwerkelijk duurzamer zijn, en het waard zijn de eventuele extra handelingen uit te voeren (verpleegkundigen, persoonlijke communicatie)

Product groups: katheters

- De industrie is gebaat bij zoveel mogelijk producten verkopen. Winsttechnisch is het niet interessant voor producenten om deze producten herbruikbaar te maken
- Hergebruik van katheters en ballonnen wordt al gedaan in arme landen. Dit kan tot problemen lijden wat in onze samenleving onacceptabel is.
- Sterilisatie van katheters: Interventionele katheters zijn moeilijk te inspecteren zonder destructief onderzoek vanwege de smalle lumina. Daarnaast dient het contrastvloeistof verwijdert te worden voordat het kristaliseert. (Crawford & Eagle, 2018)
- De meeste testen die gedaan zijn op het gebied van hergebruik van katheters zijn gedaan in de jaren 1980, 1990 of begin 2000. Mogelijk heeft de verandering van de materialen invloed op de levensduur en kwaliteit. (Crawford & Eagle, 2018)

Product groups: contrastvloeistof

- Uit onderzoek blijkt dat 5% van het aangeleverde contrastvloeistof ongebruikt weggegooid wordt. Wereldwijd wordt 18% hiervan al opgevangen en gerecycled. GE Healthcare is een Noors bedrijf dat de opvangcontainers levert en het iodine uit de vloeistof recycled. (GE Healthcare, 2022)
- Recentelijk is het initiatief opgezet om ook bij de interventiecardiologie dit contrastvloeistof op te vangen. De mensen op de afdeling lijken dus gemotiveerd om dit probleem aan te pakken.
- Het initiatief is stukgelopen omdat duidelijk werd dat het opgevangen contrastvloeistof niet het ziekenhuis opnieuw mocht verlaten. (verpleegkundige, persoonlijke communicatie)

Product groups: stents

- De industrie is gebaat bij zoveel mogelijk producten verkopen. Winsttechnisch is het niet interessant voor producenten om deze producten herbruikbaar te maken
- Hergebruik van katheters en ballonnen wordt al gedaan in arme landen. Dit kan tot problemen lijden wat in onze samenleving onacceptabel is. Zo hebben al gebruikte ballonnen over het algemeen niet dezelfde strakke vorm, en kan het organisch afval bevatten (Crawford & Eagle, 2018).
- De handleidingen leest niemand, en dit zit bij elk device, dat zorgt voor erg veel papierverspilling (Personeel interventiecardiologie, persoonlijke communnicatie).
- De balonnen worden in hard plastic spiralen aangeleverd. Hier zou winst te behalen kunnen zijn