DESIGN FOR our future

TU Delft

# IDE Master Graduation

## Project team, Procedural checks and personal Project brief

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

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

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

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

### STUDENT DATA & MASTER PROGRAMME

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

family name: van Wolfswinkel 6498

initials: L.H. given name: Lars

student number: 4664035

street & no.:

zipcode & city:

country:

phone:

email:

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

IDE master(s): ★ IPD ○ DfI ○ SPD

2nd non-IDE master:

individual programme: - - (give date of approval)

honours programme: ○ Honours Programme Master

specialisation / annotation: ○ Medisign ○ Tech. in Sustainable Design ○ Entrepeneurship

### SUPERVISORY TEAM **

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

** chair: Conny Bakker dept. / section:

** mentor: Karlheinz Samenjo dept. / section:

2nd mentor: Cédric Gysel

organisation: Janssen-Cilag AG

city: Neuhaussen am Rheinfall country: Switzerland

comments (optional)

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

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

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

## APPROVAL PROJECT BRIEF

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

chair Conny Bakker date 07 - 05 - 2023 signature Conny Bakker Digitally signed by Conny Bakker Date: 2023.05.07 22:27:05 +02'00'

## CHECK STUDY PROGRESS

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

Master electives no. of EC accumulated in total: 33 EC

Of which, taking the conditional requirements into account, can be part of the exam programme 30 EC

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

★ YES all 1st year master courses passed

NO missing 1st year master courses are:

name Robin den Braber date 10 - 05 - 2023 signature Robin den Braber Digitaal ondertekend door Robin den Braber Datum: 2023.05.10 15:16:16 +02'00'

## FORMAL APPROVAL GRADUATION PROJECT

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

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

Content: ★ APPROVED NOT APPROVED

Procedure: ★ APPROVED NOT APPROVED

comments

name Monique von Morgen date 16 - 05 - 2023 signature



Initials & Name L.H. van Wolfswinkel 6498 Student number 4664035

Title of Project Towards circular self-injectors

Towards circular self-injectors

project title

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

start date 11 - 04 - 2023

06 - 10 - 2023 end date

## INTRODUCTION **

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

In recent years, global concerns regarding life-threatening climate change continue to escalate, which has led to the formation of international agreements and goals for net-zero emissions by 2050 (United Nations, 2023). To meet these goals, serious action is required. Around the world, the healthcare sector is notorious for the great amount of waste that it produces and according to calculations accounts for around 4.4% of global greenhouse gas emissions (Lenzen et al., 2020). Of these emissions, 71% percent are attributed to scope 3 emissions and it is therefore crucial to aid in decarbonizing the medical supply-chain(Karliner et al., 2019). One of the significant contributors to these emissions are the industry wide normalization of single-use medical products (often multi-material) that due to various reasons are often incinerated or deposited in landfill (Heinemann et al., 2021).

However, as new goals are being set by healthcare world leading countries such as the NHS in the UK and new regulation is starting to come out (for example the MDR in the EU) there are now clear incentives to reduce this waste stream (NHS, 2023; Heinemann et al., 2021). The reasons that the healthcare sector has been so hesitant to step away from single-use products is that they are immensely convenient and often cheap as materials are always sterile and once contaminated are easily disposed of (Gibbens, 2019). However, this linear economy of make, use, dispose is incredibly wasteful not only for the environment but actually also leads to a lot of value being lost.
With their vast catalogue of consumable medical products, this project has been set up in partnership with

Johnson&Johnson to investigate how one of their single-use self-injectors can be redesigned to fit within a more sustainable circular system. Every year hundreds of millions of single-use self-injectors are sold and used worldwide to deliver lifesaving medicine to patients. This is currently done through use of a injection-needle and therefore special care is required to handle the product once it is used to prevent accidental cross contamination. Johnson&Johnson have already been looking into setting up a system to collect and carefully dismantle and recycle these self-injectors but further development is required.

This projects involves many different influential stakeholders, ranging from the patient, the healthcare practitioner, hospitals, Johnson&Johnson, waste management, law makers, regulatory boards and the environment. All of who's, wishes and requirements need to be weighed and balanced making for a highly challenging yet also highly rewarding project.

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introduction (continued): space for images

image / figure 1: Single-use injectors aka Sharps waste

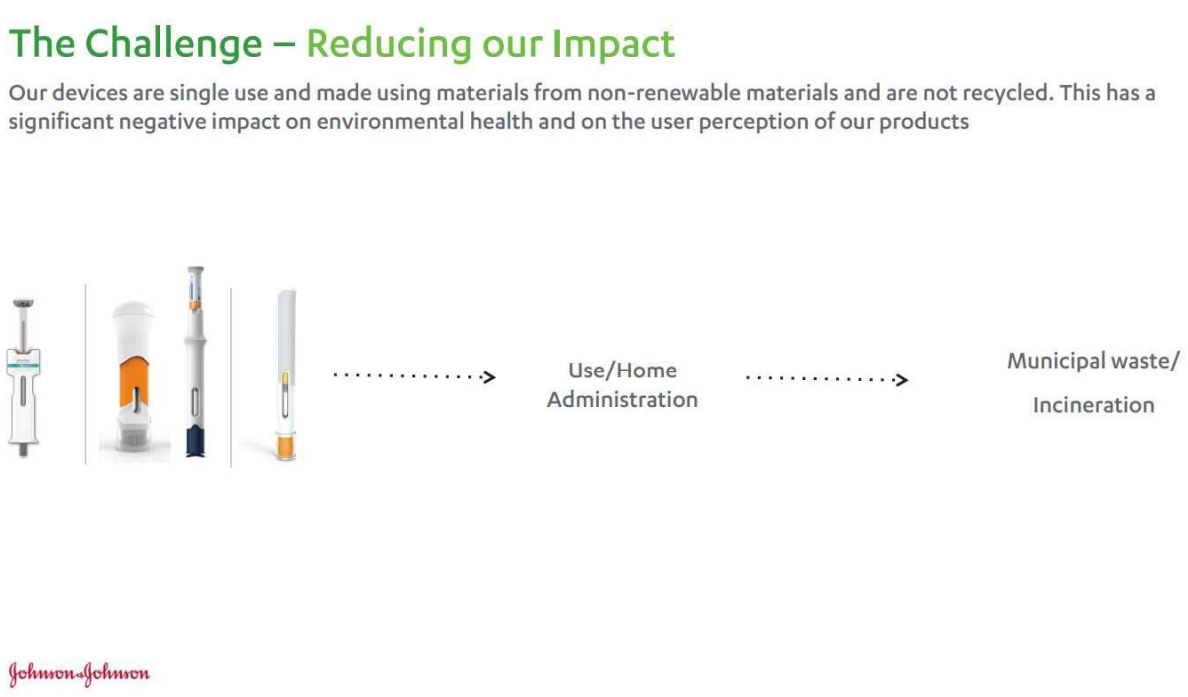



image / figure 2: The current problem

## PROBLEM DEFINITION **

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

Self-injectors are currently largely part of a linear product economy. They are made, used and disposed of, ending up either in landfill or incinerated. As such a lot of energy and value in these delivery systems for life-saving medicine is wasted. From an environmental and economic perspective, this can and needs to be done better. This is, however, a problem with many stakeholders each with their own wishes and requirements. An incredibly influential one of which includes the bodies responsible for creating the regulations and policies surrounding the provision of care and waste treatment. The question then becomes how can a product or system be redesigned to reduce its impact the most while satisfying all stakeholders.

The problems to be addressed in this project are
• How to extend the product-life of J&J self-injectors.
• How to compare the impact of current injectors to possible future redesign.
• How to enable value retention through circular design:
-> keeping products in the loop longer by enabling (partial) reusability.
-> keeping materials in the loop longer, upcycling materials by enabling material separation through the J&J disassembly robot.
-> Focus should be on keeping the value loops as small as possible such that re-usability of products/components is prioritized and material recovery is seen as a fallback option.

## ASSIGNMENT **

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

For this project, I set out to redesign one of the Johnson&Johnson self-injectors through means of circular design principles. This redesign may also involve envisioning how this product fits within a larger system.

This project should set an example in the healthcare sector for how applying circular design not only reduces impact on the environment but from a value perspective also makes business sense. Hopefully, this project can help inspire others as well and create a snowball effect for the implementation of a circular mentality in the sector as a whole.

The deliverable for this project will include the exploration of three circular self-injector concepts.
• A fully re-usable (needleless) concept
• A hybrid concept (Nespresso model) with replaceable syringes + needles
• An optimal recyclable concept (closing + reducing material loops)
One concept will be chosen to work out further into an exemplary redesigned concept for a circular self-injector. This redesign will start from a product level (incl. device, general material choices, packaging, accessories) but will also envision the holistic system that is needed for the product to operate as intended (incl. the value chain, material chain). As a bonus, perhaps key take-aways can be used to formulate some specific circular design principles and/or guidelines to be used for other future circular injection devices.
To achieve this, I will create an overview of the current product journey and identify opportunities and limitations for circular material flows. These circular flows together with a thorough understanding of the product will be assessed and used to guide the design of the 3 circular injector concepts. An effective redesign will only be possible through a good understanding of material flows and of the product itself.



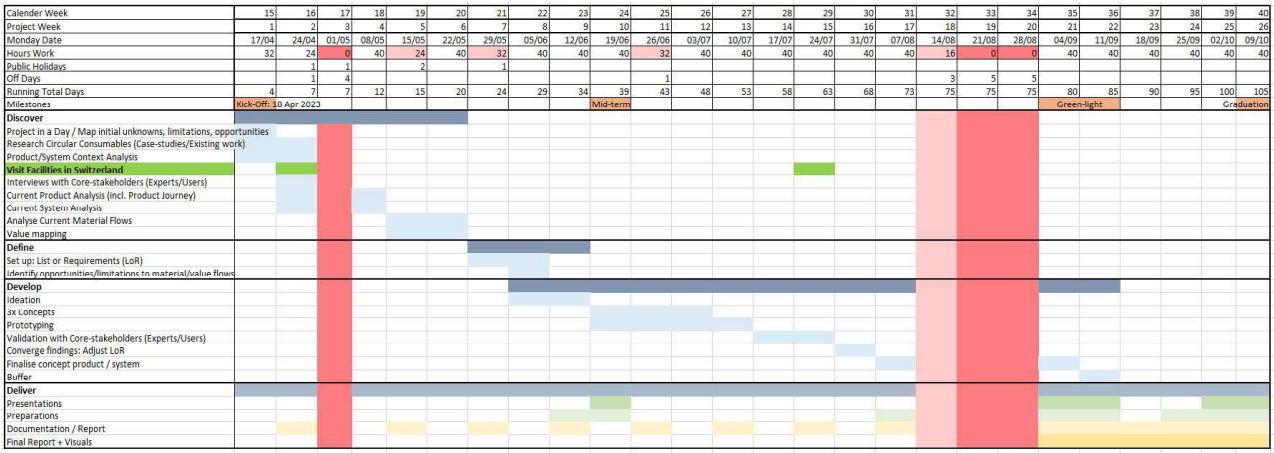
Initials & Name L.H. van Wolfswinkel 6498 Student number 4664035

Title of Project Towards circular self-injectors

## PLANNING AND APPROACH **

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

start date 11 - 4 - 2023 6 - 10 - 2023 end date




Start date: 11 April 2023, Midterm: 15 June 2023, Green-light: 11 August 2023, Graduation: 6 October 2023

II will be applying the methodological delft design process: iterative, human-centered, using reason and validation. In the Discover phase, I will start the project by diving into and understanding the context of the problem. Doing research into the current product and system. I will explore existing literature to quickly get an understanding of the context. I will also be looking at what J&J has already done regarding circularity in their self-injectors by analysing the J&J disassembly system as well as a product teardown analysis to find bottlenecks and opportunities. Next to this, I will be involving and interviewing the core stakeholders to further map hurdles and opportunities and to be able to get an overview of the different party's values and current material chain.

By week 6, in the define phase, I aim to have identified the main opportunities and limitations for material flows that currently exist for both product and system and will start ideating. I will be looking at what the low hanging fruit is as well as what long term directions could be valuable to go down. Ideas will be assessed based on their ability to create positive impact in a manner that is valuable to all stakeholders. Metrics to asses include; potential for closed/reduced material flow, potential for value retention/creation, ease of system implementation. I will then use these to justify which ideas are most worth-while to pursue or tackle and set up a list of requirements for a redesign product and possible system changes. This should be done by the mid-term.

This will be followed by the development phase, where I will be continuing ideating and developing a conceptual prototype in order to validate with stakeholders before the green light meeting. The resulting concept will be delivered and presented along with a report to further clarify the details of the project.



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Title of Project Towards circular self-injectors

## MOTIVATION AND PERSONAL AMBITIONS

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

The reason I chose to pursue this project is that I am deeply fascinated by the "wicked" problems of both sustainability and health care and as an industrial designer, I believe I have a role to play in making a positive impact on people and planet. For me, this is therefore a dream project.

I have had some experience with MedDesign in the past and know how challenging it can be to balance all the wishes and requirements of the many different stakeholders but also enjoy how rewarding it can be to find promising solutions within these design boundaries. This project will really put my design skills to the test in managing these stakeholders and hopefully deliver something highly valuable to all parties.

Another exciting challenge this project poses and something I want to gain experience in is combining product design with product strategy. As an integrated product designer, I think the details of a product are incredibly important but I also can't help but think about the bigger picture on a system level. Learning to combine the ability to think both wide and narrow I believe is paramount to creating successful and impactful products. Again I think this project is therefore the perfect combination of these two fields.

Lastly, throughout my education both in the Masters and Bachelor of Industrial Design Engineering at the Delft University of Technology, I have always really enjoyed the courses and projects surrounding the fields of Circular Design and Design-for-Sustainability. These were often given by Professor Conny Bakker and I am therefore incredibly thrilled to work together with her as my Chair for this project and learn from someone so engaged in the field.

## FINAL COMMENTS

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



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