

The circular supermarket brief.

Reflection



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While approaching the last few weeks for the graduation, it's important to reflect on the whole research. Two questions are important for this. The first question examines how and why the approach did or did not work, and to what extent? The second question examines the societal impact, how relevant is the research for a sustainable future? These two questions are the two main parts within the reflection, the first is on the methodology the second on the societal impact. The questions can be divided into four topics:

1. Relation between research and design
2. Relation between graduation topic and the studio and the master programme
3. The method used and its scientific relevance
4. Relationship between the graduation topic and the societal relevance.

Summary and background

The Lidl approached the TU Delft to help the Lidl to develop a sustainable strategy for the future of their supermarket chain. This strategy required a broad analysis of their current position on sustainability and a possible strategies to apply to the supermarket chain. A part within the strategy is the recommendation to examine the future for circular supermarket building design. While the strategy is being developed, the Lidl enabled students to do in depth research into their current supermarket designs and strategies. Nick ten Caat was the first student to do his graduation research on the Lidl, his focus was on energetic circularity. I chose to also partake in a graduation with the Lidl, it allowed for a practical application of a theoretical model, grounding it more in reality.

As the second student to partake in this collaboration, there are still many topics to research. The relative new nature of the Circular Economy makes it an interesting and broad subject, it contains many subjects which can be researched. After a preliminary study into the sustainability of supermarket chains, it showed many topics which could benefit of the circular approach.

This research explores the implementation for the principles of the Circular Economy into the design strategy of the Lidl. It uses two assessment methods, the Material Circularity Indicator and the Disassembly Potential, to examine the current level of circularity within the Lidl's Bestek. The results from this analysis show on which parts it is possible to improve the Lidl's current supermarket design. With these results, two redesigns are made to show what is currently possible. The redesigns will show what has to be rewritten within the Specification, and which extra grading methods need to be added.

Relation between research and design.

The main question the graduation aims to answer is:

Which changes have to be made to Lidl's 'Bouwkundig Bestek' to make it circular, with an emphasis on materials and assembly?

The aim for the research changed slightly over the course of the graduation. The initial research showed possibilities for in depth research on the Circular Economy on many aspects. This had to be narrowed to avoid too broad of a scope. The setup of research first and design to explore the possibilities were the setup from the start. The whole research can be described in six steps. These steps relate directly to the sub-questions asked.

Step1: Determine the definition and the principles for the Circular Economy in the built environment through literature.

Step2: Examine the current assessment methods of circular designs.

Step3: Determine how the Specification is currently implemented within the Dutch legislation and its implementation.

Step4: Analyse the Lidl's current Specification on the principles of the Circular Economy, through the assessment methods.

Step5: Case study on a non-circular system in the Lidl's Specification.

Step6: Redesign an outlier to show what is currently possible and how to use the assessment methods.

Step7: Rewriting and showing how the Specification can enable for these redesigns.

This relates to the following methodology.

For the first sub-question, the core principles for circularity in the built environment have to be determined. Through a literature study into current reports on circularity, the current definition for circularity will be formulated along with the principles for the Circular Economy. The application of these principles in the built environment, along with the consequences, will be examined. The same has to be done for the Specification. Before we are able to look in-depth into the Lidl's Specification, we have to examine how the current Specification is used and defined in the Netherlands. This will be examined through government sources, books, and further literature. For the assessment method, multiple papers and thesis reports into currently used assessment methods will be consulted. These will be used to examine assembly methods and materials used. The NIBE database will be consulted as the database for material properties.

With these assessment methods and the current use of the Dutch Specification in mind, the Lidl's own 'Bouwkundig Bestek' will be graded and where needed Lidl sources will be interviewed for additional information. It will result in one of three grades, a part is circular enough to be sufficient for the time being, a part can be made circular with few changes, or a part has to be redesigned completely with different materials and connections. Where needed, any material suppliers will be interviewed on material lifecycles. The NIBE database will be used to find circular solutions for materials. As a final step the redesigns will be re-implemented into the Specification, along with additions on circular grading method and policy to make them persistent.

As shown within the paragraphs above, the emphasis in the graduation has been on the research. The research forms the basis for the assessment methods and the analysis. Design is used to show how the research and the assessment methods can be applied. Both the design and research are needed to reach the conclusion for the paper. All decisions made within the research have literature or hand calculations at their basis. The pre-existing methods are combined and applied to the specific case of the Lidl.

Relation between graduation topic, the studio and the master programme.

Within Building Technology, there is just one studio. All graduation topics fall under this one studio, namely: Sustainable Design. In the Building Technology master program sustainability is constantly addressed and discussed. This happens in specific subjects, like the course Architecture and Innovation, or the project Buckeylab where a sustainable disassemblable paper structure had to be designed. Sustainability is a broad topic, it can be difficult to apply because there are so many possible solutions and interpretations. We are also made watchful for greenwashing, ideas presented as sustainable solutions, which are not sustainable at all.

For the graduation studio, the student can choose out of four pillars for their graduation topic. These pillars represent the major fields within building technology. These pillars aren't mutually exclusive,

they rely on each other. Each building design relies, to a certain extent, on each of these. A student is required to have mentors from two different pillars, this to ensure they spread their focus and don't just examine a single part but look at the context. The four pillars in which Building Technology is divided are:

1. Façade Design
2. Climate Design
3. Structural Design
4. Design Informatics

The topic chosen fell within the pillar of Climate Design, "The supermarket chains as a circular economy". The main mentor for this subject is Andy van den Dobbelen, from the chair Climate Design and Sustainability, as he had done the strategy analysis of the Lidl. Through preliminary research the best approach was sought for the graduation project. The initial research showed that there is still much to analyse and unknown about the supermarket buildings as a whole, especially in combination with the principles of the Circular Economy. Through this reason the second pillar in which the graduation project would fit was chosen at quite a late date.

As it was possible for the project to still fit within each of the chairs. The choice was eventually made to focus on a four step process: Define the principles of the circular economy, define an assessment method to compare designs on their circular approach, analyse a current supermarket and for the last step a redesign would be presented and compared to the original. This showed the research to fit within Façade Design as a second pillar, for this Tillmann Klein was approached, from the chair Building Product Innovation, as his research group has a focus on the circular approach.

During the P2, the consensus showed that the aim of the graduation research was still too vague and broad. This meant narrowing the scope to allow for more in-depth research. This was done by finding a better focus point than just a Lidl supermarket, instead the focus shifted towards the Specification. The Specification shows a theoretical supermarket with all materials and assembly procedures. The same applies to the assessment methods, this meant the research shifted from the climate design more towards the façade design.

With this shift, a clear goal was established, with a clear question: How circular is the Lidl's current Specification? This also allowed for a clearer redesign goal, redesign a system described in the Specification be fully circular. The last step is the reimplementation of the redesign into the Specification. These steps were all done before the P4. Maybe this change would have fit better in a collaboration between Building Technology and Management in the Built Environment. Still the focus from the research is from a building technology viewpoint, though the extra knowledge would have helped during the rewriting of the Specification.

The method used and its scientific relevance

As described in the previous paragraph the research underwent a certain evolution. What started as a broad first question: "How can we implement the Circular Economy in the Lidl's supermarket chain?" ended in a more specific question.

The result is threefold: An assessment method, an analysis of the current Specification and the redesign.

The research made use of scientific sources wherever possible, this was possible especially within the first part of the graduation project, as this went in depth on the Circular Economy and the possible assessment methods. It became more difficult further towards the end, where product

specifications of suppliers and contractors were more important. As the line between theory slowly turned towards the redesign as the materials needed became more specific and reliant on these suppliers.

The assessment method is completely based on scientific sources, after analysing multiple possible solutions the choice is made for the Material Circularity Indicator and the Disassembly Potential. The combination makes the technical side of a circular design almost completely analysable. The biological cycle is still undefined within the models. This leaves a huge gap within the assessment method. A great addition would be the carbon footprint and embodied energy for virgin feedstock and also multiple cycles. I would have liked to include this and looked into the inclusion, but it requires an enormous framework and even for similar materials, this will differ per country, and company, which was scrapped due to time constraints.

The Specification analysis already starts to shift, scientific sources are used to describe materials and their recycling process, but independent sources already become necessary as the circularity of materials is very dependent on their supplier and contractor. The assessment methods are still the basis for the analysis. Though certain choices and grades will differ for whoever analyses, especially for the Disassembly Potential. It enables discussion and shows which extremes would be preferable.

For the redesign the scientific basis are still the assessment methods, though the materials and construction principles are based on suppliers and contractors. The choices made for certain materials are more debatable and based on preference. The same goes for the construction principles applied. As the design is a complex endeavour, each designer will make different decisions.

This is also shown in the reliability and the repeatability of the research. The first step, the analysis method, shows what is currently available to assess circularity, while the results on the second step will be different for whoever analyses the Specification. The same goes for the last step, two designers would make completely different redesigns, as the interpretation of the Disassembly Potential is based on the users knowledge on different materials and assembly methods. This will invoke interesting discussions as many people can have a different interpretation, but this also allows for innovation as new construction methods are needed.

Relationship between the graduation topic and the societal relevance.

The building industry is responsible for 50% of the total waste, recycled, incinerated or landfilled, in the Netherlands. It's time to address the issue and examine the current end-of-life scenarios, of the materials, so we are able to change them. This research provides methods and insight in how to address these issues and how to examine your current level of circularity. If we, as a species, want to be able to keep on constructing and building for the upcoming years, we need to eliminate our waste and ensure our resources don't dwindle. This is especially applicable to the building industry, a lot of materials aren't used to their fullest extent. These materials end up as waste or incinerated, even before their functional life cycle has ended.

The topics addressed within the graduation research are applicable to a wider array than just the Lidl. While circularity is a booming topic it's difficult to grasp, there are so many different definitions in use. While the principles are easy to grasp they are difficult to implement. This report tries to make the principles of the Circular Economy for implementation in contracts more practical. The methods applied to both the Specification and the Redesigns can be applied for other projects as well. To understand how projects can move away from our linear building industry into a circular

one. The guidelines and assessment methods used in the report give insight into the possibilities, but also the difficulties.

