REFLECTION ON REDESIGNING WASTE

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After following the Buckylab Course in my master 2 I was intrigued by the possibilities of plastic as a building material. I realized that I needed a lot of freedom in my research to find the full potential of this relatively untouched subject. Explorelab offered me the space to find my own mentors, pose my own questions and gave me a lot of freedom, not just for design but also for research. I believe that these factors would give me the platform I needed to bring this project to a successful end.

Research question

Waste has occupied civilizations for thousands of years but most recently waste concerns have grown exponentially (Letcher, 2011). Annually over 87 million tonnes of plastic are being produced and only 14% is currently being recycled. The rest of this plastic is landfilled, burned or leaked into the environment. (Ellen Macarthur Foundation, 2016)

Traditionally, materials were mostly reused and recycled in society. With the start of the industrial revolution, mass production reduced the costs of materials, attention to recycling decreased as recycling became economically less viable (Worrel, 2014). Since the building industry is responsible for the largest use of raw materials in the world (WEF, 2016) couldn't there be a possibility to implement the re-use of materials in the way we build?

One of the biggest obstacles in re-using waste is our way of thinking. We move materials into the 'waste stream' when we can no longer find use for them (Robertson, 2014). By branding a material as waste it receives an unwanted or unusable connotation. The idea of a product made out of waste has the possibility to trigger negative emotions. This makes it difficult to think of waste as a building material of the future (Hebel, 2014). So one of the biggest problems to overcome within the recycling industry is the emotional response people have to waste as a material. This, together with the alleged responsibility of the building world and the problem plastic poses in our current society, brought me to the research question I focused on during this graduation project.

"How can the negative perception of recycled plastic waste as a building material be changed?"

The first part of my research focused very much on giving a clear description of certain problems. This description was necessary because the issues discussed in this thesis are part of the public debate and are (often) used without clear knowledge of the definition. Examples of these topics are the Circular Economy and material perception (in relation to society). These topics were described in sub-questions.

What is material perception?
How has the perception of plastic changed through time?
What is the use of plastic in the building industry?
What is the current perception of recycled plastic waste as building material?
How to change the perception of plastic as a building material as an Architect?

These research- and sub-questions were meant to give me a clear overview of the current problems. Because they span a broad range of topics (perception, history, design etc.) I decided to use different methods for them.

After the literature research several actors from the professional world were interviewed (architects, governmental layer and production companies), and people which intend to buy a home as the private part of the supply chain (potential homeowners). The interview focuses on their perception of waste and their opinion on how to overcome the biggest hurdles on our way to a more circular economy.

The third part of this thesis focused on case-studies of existing projects. I researched these to get a clear overview of already existing projects, materials and ways of constructing. During the writing of this part I shifted more towards the current use of plastic in Architecture instead of case studies of recycling project because they are rather limited (at the moment). The current use of plastic gave me a clear(er) overview of plastics current position in the building world.

Design question

After analyzing the problems with the Circular Economy and the implementation of waste streams into the building world I wanted to bring this knowledge into action. By designing a 'normal' house, suited for a family of 4, I wanted to showcase the possibilities of re-using plastic waste materials.

Since my project focused more on the re-use of a certain material than on a specific location I decided to pick a building plot which could act as an example for the rest of the Netherlands. One of the 'self-building' plots in Amsterdam-Noord. This location provided me with certain boundaries (surrounding, plot size, max. building height etc.) while leaving me relatively free to focus on the re-use of plastic. The Design question I posed was follows:

> *"How to design an exemplary, sustainable, family home made from recycled plastic household waste on one of the self-building plots in Buikslotermeer, Amsterdam, the Netherlands?"*

To successfully design a house made from recycled plastic waste I also saw the need to design a (modular) building element which could be used to built this project. By looking at reference projects, material qualities and production techniques I used an iterative design process where the module I designed changed step by step according to wishes and demands I tested upon it. The original plan was to design the house entirely out of plastic without any secondary support. After looking into (fire) safety regulations I decided to add a steel structure to carry the building in case of a fire. This choice has left me with mixed feelings. In regards to feasibility of the project, it was a good decision. However, it does mean that the concept of the original project has to be let go and can be presented less concise. This equilibrium between safety and architectonic concept was hard to balance but I believe that the (partial) sacrifice of the concept was beneficial for the feasibility of the project at large.

The design of this module had to run alongside the development of the building to make sure there was interaction between the two. This two stream development worked partly. Since the module had to be applicable in a broad range of design

projects it had to have a certain level of generic qualities which would allow for this broad range application possibilities. This meant that only the qualities of the module could be implemented into the building and not vice versa.

From the previously mentioned literature research and interviews I got a set of boundaries which could be implemented into the design process. These boundaries can be found in the Roadmap I devised from interviews with actors from the professional field and possible inhabitants (see next page). This roadmap was used as a tool in the design process to check if the decisions I made in regards to the design were justifiable. In the end the design question shifted during the design process. Initially the design task was for a small family of four, but by looking at what the municipality had in mind for the proposed neighbourhood (Buiksloterham) this task shifted a bit. Since the municipality of Amsterdam wants Buiksloterham to be a completely circular neighbourhood I decided to add some functions to the program of my design.

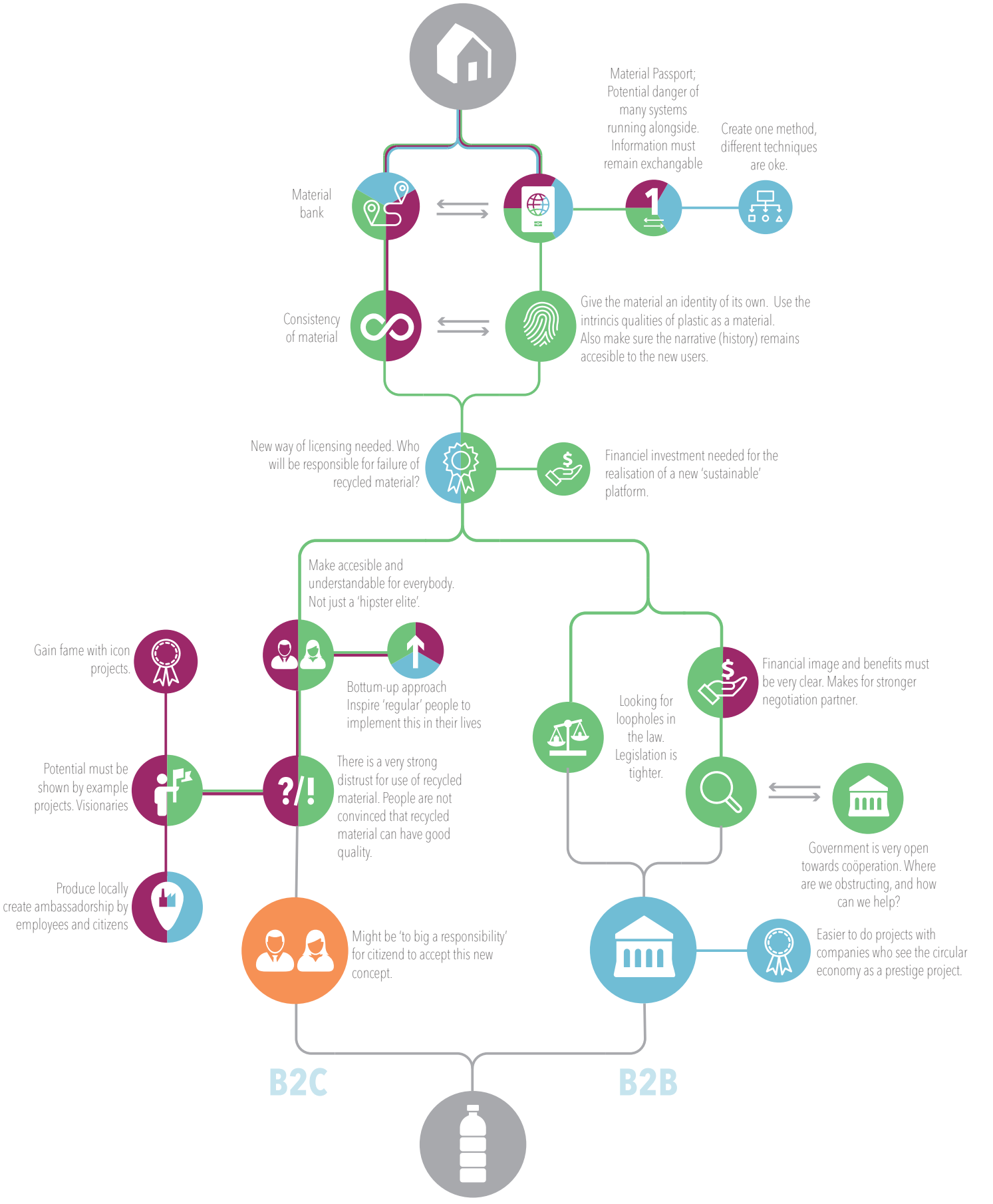
One of the points of the roadmap is that the new material must be made accessible and understandable for everybody. This can be achieved several ways, but since the apprehension towards plastic is so severe I decided to add a place where people can work with the material themselves should be added. This 'workshop' would allow people from all ages and backgrounds to get a 'hands on' experience with the recycling process. This experience must show them the possibilities and the qualities of the material. To host and embed this workshop space in the neighbourhood I also added a visitor's centre. Here information can be found on the topic for everybody who is interested.

The second addition to the program came purely from the circular ambitions from the municipality of Amsterdam. Since the municipality wants the new neighbourhood to be completely circular there should be on recycling facilities on location. By adding the new plastic recycling plant to the program I fulfilled in the wishes of the municipality and added an extra example to the range of possibilities which could be realised with plastic as a building material.

Because of these added functions to the program the location of the project within the Buiksloterham area changed a few times. The originally chosen building plots were no longer suited for the renewed and enlarged program. The new plot did have the possibility to house the new program due to that it is on the boundary between two different function blocks in the urban plan. The original plot only allowed for housing and work related functions. The new plot also allowed for more industrial functions which are needed for the recycling plant.

Relation between research and design

In general the relation between research and design is strong. The roadmap created during the research phase was a good guidance in decision making. The shift in design project was partly due to this tool and partly due to the fact that the original design project did not take the wishes of the municipality into account and gave a one dimensional view of accessibility of the material. The original project would just show that it was possible to re-use plastic as a building material, the new project shows this possibility (in a wider range than originally planned) but also allows (hands-on) interaction with the cycle which the municipality of Amsterdam is trying to establish.


Material Passport; Potential danger of many systems running alongside. Information must remain exchangable
Create one method, different techniques are oke.
Material bank
Consistency of material
Give the material an identity of its own. Use the intrincis qualities of plastic as a material. Also make sure the narrative (history) remains accesible to the new users.
New way of licensing needed. Who will be responsible for failure of recycled material?
Financiel investment needed for the realisation of a new 'sustainable' platform.
Make accesible and understandable for everybody. Not just a 'hipster elite'.
Gain fame with icon projects.
Bottum-up approach Inspire 'regular' people to implement this in their lives
Financial image and benefits must be very clear. Makes for stronger negotiation partner.
Looking for loopholes in the law. Legislation is tighter.
Potential must be shown by example projects. Visionaries
There is a very strong distrust for use of recycled material. People are not convinced that recycled material can have good quality.
Government is very open towards coöperation. Where are we obstructing, and how can we help?
Produce locally create ambassadorship by employees and citizens
Might be 'to big a responsibility' for citizend to accept this new concept.
Easier to do projects with companies who see the circular economy as a prestige project.
B2C
B2B

The problem of this roadmap is that it consists of topics which still are relatively free for interpretation and don't have a hard 'checklist'. The broadness of this roadmap was necessary because it should be applicable to 'all' building projects. The downside of this 'broadness' is that the free interpretation of this roadmap leads to an empty use of the word 'plastic architecture' or Circular economy.

Next to that I think it would also be advisable to interview a broader range of people. Currently only firms related to the building industry and (potential) homeowners were interviewed. To get a more accurate roadmap more firms from outside the building industry should be taken into account. But more importantly, people from a broader range of backgrounds. Right now only the upper-middle class was interviewed, but to really land this project in our society people from all layers should be incorporated.

Another issue that became clear to me during the research and design of this project is that the majority of the problems which we face in regards to the circular economy can not be solved with architecture or design. We need strong and thorough legislation, coöperative companies, municipalities and governments, a new system of dealing with material identity and material passports, but most of all a change in mindset. All these things can be supported and stimulated by (architectural) projects, but must first and foremost be carried by society at large.

The need for a more sustainable approach towards building has been a very popular topic in recent years. Since the building industry is responsible for such a large part of the raw materials used a certain responsibility lies within our sector. With this project I not only propose a possible solution for the waste which has been created for more than over a century, I also propose a new way of building which enables the user/ owner to quickly and easily disassemble the building after it no longer has any use. The program which is realised in this project not only showcases the accessibility of the material as a building component, but also allows people to see the value of plastic waste regardless of its use in the building world. We live in a world where material reserves are slowly but surely being depleted. The acceptance of the circular economy and waste material as a source for new products is now more relevant than ever and this project helps in this process of acceptance on several scales. It gives a kickstart to the recycling cycles envisioned by the municipality of Amsterdam, it gives people from all ages and backgrounds the possibility to have a hands on interaction with the recycling process and showcases the ease and benefits of a building designed and built with waste material.

To further the topic of plastic waste, research on the topic of recycling should be done. How do we get people to recycle (more)? How do we optimize the collecting, cleaning and repurposing of certain material flows? A new material passport should be developed which not only focusses on the technical and mechanical properties of a material, but also on the 'story'. Where the material has come from and what has been its purpose. This material passport could be the key player in the acceptance process of people in regards to waste material. These problems must be addressed by society at large. Only then we can find a solution to the problem of plastic waste.

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Sources

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