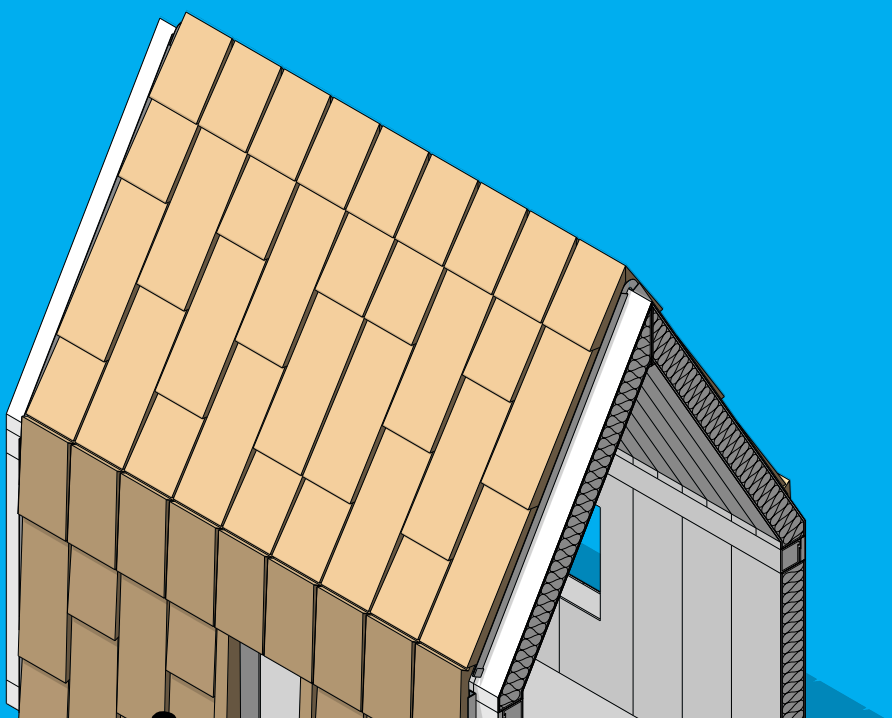
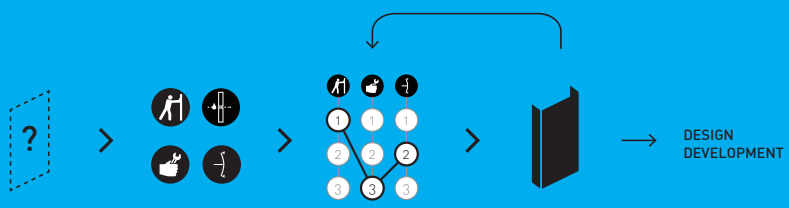
PD LAB
THE DEVELOPMENT OF A BIOBASED CLADDING SYSTEM

Reflection



REFLECTION

Reflecting on a research process and in particular on the used methodology is very interesting, since it provides valuable lessons for future research on related topics. The methodology (see fig. 71) will be reflected by discussing the decisions that were made during the actual design process (see fig. 73). This way, the questions of 'how' and 'why' did the methodology (not) work can be answered. Finally, the future use of the methodology, together with the relevance of the research beyond the PD lab will be discussed.



based on: Van Veen (2016)

fig. 1. Design methodology

Decision making during the design process

PD lab

In this research, the PD lab functioned as a case for which a new, biobased cladding system was developed. Previous research on the development of a cladding system provided a design methodology, including design criteria, aspects to take into account and a method to assess aspect concepts. However, this design methodology did not include a material selection method yet.

Material selection

The challenge of the material selection was to find out how the philosophy of the PD lab could be translated into material criteria and a material assessment method. This turned out to be quite hard, as comparing materials get very elaborate very quickly. This made the development of a material assessment method come to a halt and that way the whole research process. After discussing this problem with mentors and a holiday trip far away from the research, the realization came that the material assessment simply had to result in a suitable material choice, instead of the best material choice. To continue with the research process, a provisional material choice was made for the thermoplastic bio-composite material Resysta. Later on, based on extra criteria that followed from the concept development, a definitive choice could be made.

Concept development

The design methodology that was used in previous research on the development of a cladding system, used five aspects of a cladding system as a starting point for the concept development. After generating aspect concepts, the most suitable were combined into concept: the rectangular panel concept. This concept was

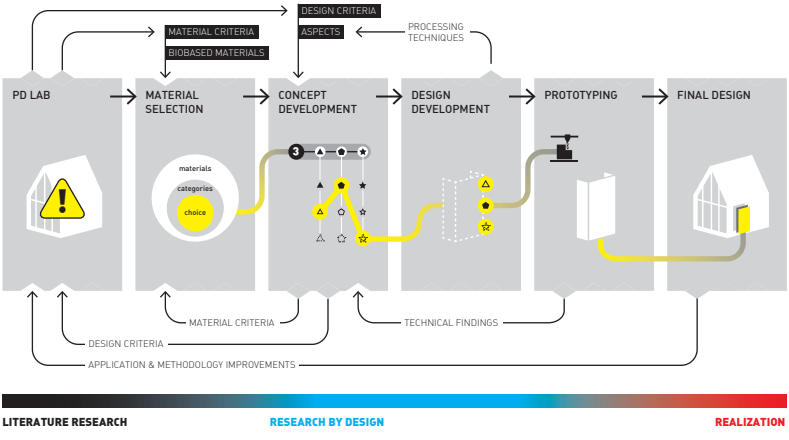


fig. 2. Research methodology

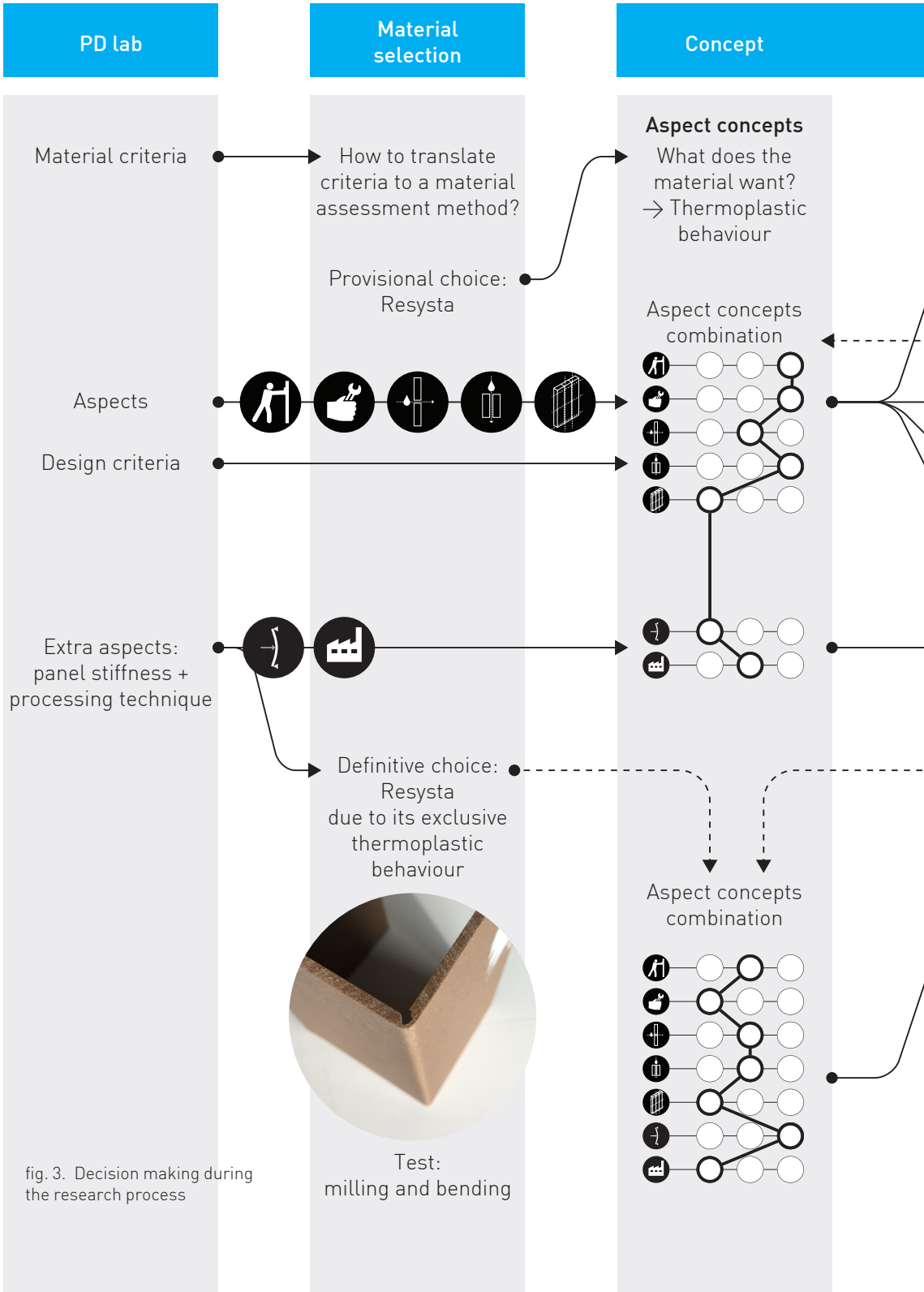


fig. 3. Decision making during the research process

development

Design development

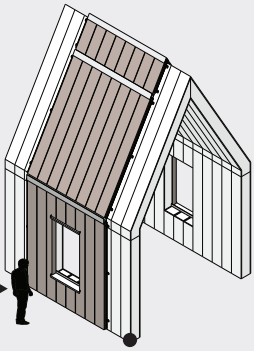
Final design

Total concepts

1. Rectangular

Prototyping

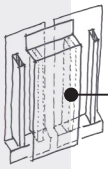
Reflection: what other combinations are possible?

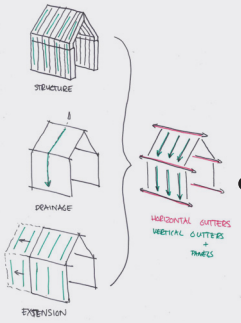


2. Diamond

3. Accolade

4. Extruded



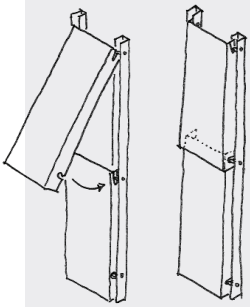


Minimizing production steps

Vertical or horizontal orientation?

Limitations of extrusions:
open ends, inflexible production and a max width of 300mm

5. Tapered



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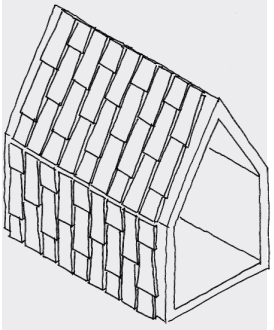

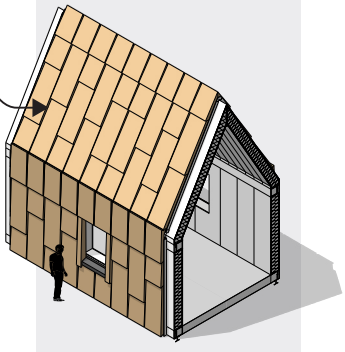

elaborated towards a complete system and prototypes were made, but the advice was given to look for other aspect concept combinations as well, before completely elaborating this concept. This way, it was found that the methodology lacked an extra concept level, since a cladding system is more than the sum of the aspect concepts. Therefore, total concepts were introduced into the methodology. By making different aspect concept combinations, three extra total concepts were generated besides the rectangular total concept: diamond panels, accolade panels and extruded panels.

Design development, prototyping and final design

The fourth one, the extruded panel total concept, was chosen for further elaboration because of the processing technique of extrusion and the seemingly large design freedom and fast and continuous production it allows. This total concept was elaborated towards a final design that was presented at the P4. However, the final design and a 1:1 prototype made very clear that extrusion is a processing technique with critical limitations for the design of a rainscreen cladding system. These limitations were: open ends, inflexible production an a maximum width of 300 mm. Furthermore, the proposed final design did not perform optimal in terms of tolerances and assembly.

As a result of the found limitations and the comments after the P4, a search for a new design with less complex details started. However, the design problems were strongly related to the processing technique on which the fourth total concept was based. Therefore, the decision was made to return to the concept development stage.

However, instead of choosing one of the other total concepts, a fifth total concept was generated. Interestingly, the aspect combination that led to this total concept had already passed a lot earlier in the design process. Due to doubts regarding the aesthetic performance of this concept, it was not elaborated at that moment. Apparently, the aesthetics criterion unconsciously weighed much heavier than the other criteria in the assessment of the various aspect and total concepts. When this realization came, together with the many potentials it had, this fifth total concept eventually was chosen and further elaborated towards a second final design.

Functionality of the methodology

Although there were quite some moments during the research process at which a significant amount of time could have been saved, this was never caused by a wrong approach of the methodology itself, but rather a result of the fact that the methodology is not complete and needs further development.

Just like the material assessment and total concept assessment were added to the methodology during this research, it would be of great use if the methodology would focus more on the implementation of the building system in a circular economy. This could be done by adopting criteria regarding the economic, environmental, behavioural, societal, technical and governmental challenges that come with the transition to a circular economy.

Additionally, it would be good to find a way to make the methodology more objective. At the moment, the assessment of the concepts and the weighing for the criteria is quite subjective. This was part of the cause that the total concept choice had to be revised, since the assumptions appeared to be incorrect or incomplete later on in the process.

Furthermore, it was found that a change in material has far reaching consequences for the design, production of a product and its implementation in a circular economy. Because of this and the fact that the PD lab is based on industrial production, the methodology should focus more on processing techniques. More knowledge of the opportunities and limitations of different processing techniques would be of great use for future use of the methodology, as more optimal design results could be achieved in a shorter time.

Finally, it remains important to not lose the complete system out of sight, since de development of a complete building system is ultimately the goal of the methodology. Besides the standard components, the critical components should be taken into account at a very early stage of the design process. This could be achieved by adding an system concept level, above the aspect and total concept levels.

Relevance of the results beyond the PD lab

Although the resulting cladding system design was developed for a specific case project, the relevance of this research goes beyond the PD lab. In terms of biobased materials, it shows the potentials of the industrial application of bio-composites in building composites. Furthermore, by explaining the importance of the circular economy and the technical consequences it has for the design of a building component, the transition of the building industry towards such an economy is brought a step closer.