

Reflection

Thesis: From product to product-service system

The demarcation of producer responsibilities in the transition from linear to circular service system.

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Relationship between Research and Design

This thesis studies the role and tasks of the supply side in a PSS façade-leasing model, discussing the points of demarcation towards an indoor comfort and façade performance guarantee. The pathway towards product service systems is discussed in collaboration with Alkondor Hengelo. In setting up a graduation plan in early research stages, a design and multiple alternative designs for the CiTG pilot project façade were intended to serve as a larger (or more extensive and detailed) part of the thesis, as well as a tool for research through design. This was planned, because the aspect of circularity was understood as the main unsolved link towards providing a leased façade. However, in the process of further literature research, discussions with my mentors and taking other expert experience into account, a better understanding of the CE and the process of façade construction was obtained. This led to the conclusion, that there are multiple developments within the field of new circular business models, which are equally important and linked to each other: The technical implementation of product service systems in the construction industry and facades as part of a circular economy. To narrow down the scope of this research project, the demarcation of producer responsibilities within product service systems was chosen as the main focus, because once it is ready to be implemented, it is said to give an incentive for circular design and was therefore seen to have higher urgency of problem solving. In other words: to safeguard a sustainable lifecycle of materials in giving one party the responsibility to do so, a system of adding value to undertaking this task first needs definition and development: the PSS. Therefore, extensive literature research and discussion was done before proceeding to answering design questions. Subsequently an exemplary field study was added, to get a better understanding of how the reuse of façade panels on existing buildings might work. Lastly, a reapplication of the CiTG façade panels on a fictional new construction was conceptualized, to assess a scenario where an existing façade would form a preselected building element, defining the early design stages.

Relationship to Master Track Building Technology

The topic touches upon many relevant sub-topics of sustainable design, such as circular façades and performance optimization during the operational phase. The research questions in the field of façade design, product design and climate design are informed by multiple disciplines of the built environment, in the intersection of architectural design and engineering. Integrating these fields with product design and more business-oriented aspects of façade construction is an inherent requirement of answering questions related to façade leasing concept. The thesis explores a detailed scale of façade engineering, as well as the large scale of integration into the built environment, considering the construction industry and its effect on the environment, as well as architectural value and urban development. It is situated in the field of Building Technology, as the topic represents a complex new concept in the future of sustainable design.

Elaboration on Method and Approach

The first stage of basic literature review led to the definition of some preliminary research and design questions. One of the largest challenges in writing this thesis was the definition of a methodology and formulating the correct research questions. This stems from the highly experimental nature of the façade leasing pilot projects and limited experience of all actors: The outlines and goals are known, but details are still blurry. Therefore, some research and design questions that were once seen to be answered have been revised multiple times, because of the abstract nature of the topic. It seems like the questions could only be formulated correctly once a possible answer could be visualized. That said, some other parts of the methodology seemed clearer from the start, such as the use of a simulation to quantify and further define some of the otherwise theoretical answers. During the process of setting up said simulation, a deeper understanding of questions related to the facade construction was obtained, because causal relations became clear.

Relationship between Project and Social Context

Looking at the future of energy consumption in the built environment, newly built constructions will probably not be the biggest problem – The old building stock is our main challenge, as that is where most energy losses occur. Renovation, especially of the building envelope, is the key to cut out these Co2 emissions, but new strategies need to be found, as how to renovate the large mass of underperforming building stock. This involves solutions on the technical basis of new materials, production processes, building products and their application, but the bigger picture is equally important to keep in mind. How can we achieve all these renovations, who will invest in them, and how will we manage the facades upkeep, so that we are not faced with more problems in some years' time? Both the physical component, and the process of implementation has potential for innovation and needs advancement. The circular business model of façade-leasing could be a valuable approach to solve issues on more than a single project-basis. It could prove to be a beneficial new way of stakeholder interaction, rethinking how facades are designed, managed, operated and set into a circular loop. There is a clear need of finding large scale solutions, that reach beyond singular solutions of renovation. Although governmental legislations are known to be set to prohibit the use of office buildings below label C in a few years, that only predicts the need for renovation, but does not answer the "how?" for every owner and user of an underperforming building. Defining the process of façade leasing in more detail and working towards making it fully feasible on a managerial and technical level, could help solve issues of financing renovations, and securing the quality of the result.

A product service system in which the supplier guarantees a level of indoor comfort and energy performance related to the façade helps bridge the gap between theoretical energy labelling and physical performance indicators that can not only be measured in the building but are also experienced by users daily. In a theoretical future scenario in which non-renewable energy is highly taxed, the performance of facades becomes the most critical factor for thermal indoor comfort.

Ethical Issues and Dilemmas

A product service system with the intent of guaranteeing a certain indoor comfort and energy performance of a façade would need monitoring of comfort conditions and the use of energy data to verify the results of the applied construction. This means that, in a time of heavy discussion about the protection of personal data online, it could translate to ethical dilemmas related to monitoring of occupants' real life behaviour in a building. For example, the level of occupancy of an office can be seen as an invasion in workers privacy, collecting and possibly sharing information that is usually not discussed. An official agreement from occupants with what is being measured, could be a solution to exclude these issues.

