

Reflection

My master's thesis focused on the application of the PSS in the Built Environment, aiming to contribute to the circular economy. I initially adopted a qualitative research method that encompassed a literature review, case studies, and expert interviews to understand the crucial factors, properties and characteristics necessary for a successful PSS, and to discover potential opportunities for PSS in the Built Environment.

However, my approach evolved throughout this research journey. Initially, I intended to conduct case studies, but recognizing the existing wealth of such studies, I decided to harness current literature to examine existing PSS instead. Furthermore, my initial plan was to interview a variety of stakeholders to understand their perspectives on PSS. However, as the research progressed, it became evident that focusing on suppliers might yield more insightful results. Although the interviews provided valuable information, the consensus was clear: companies were primarily profit-driven and not yet prepared to incorporate PSS.

Despite the challenges encountered, my research approach was effective. It unearthed numerous factors, characteristics, and properties influencing PSS and gathered considerable information that could contribute to the development of an ideal PSS. However, this was a challenging endeavour. A significant amount of theoretical research exists on the topic, but practical insights were often lacking. A more hands-on approach, such as participating in a live PSS project, could have augmented my research.

The legal aspect was particularly challenging due to my lack of previous knowledge in the field, coupled with the need to translate Dutch regulations into English. Consequently, I suggest future research in this area would greatly benefit from collaboration with a legal expert.

Throughout my research, I discovered that I struggled with extended periods of desk research. This was evidenced as I approached my second progress meeting (P2), where I found it difficult to maintain motivation. Thankfully, my mentors and peers supported me, and with their help, I managed to refine and expand my literature review based on the feedback received. By the third progress meeting (P3), I had to recalibrate my expectations of the project's significance and adjust my research design accordingly.

Reflecting on this process, I realize I have learned invaluable lessons. I've grown to appreciate a more structured research approach and the need to continue when results do not align with expectations. Moreover, I have understood the importance of persistence in the face of seemingly exhaustive research.

Interestingly, my research also gave me profound insights into the real estate industry, which is primarily profit-driven. I've come to appreciate the role of young professionals who aspire to make a difference, despite their limited influence in companies. On a personal note, I discovered a growing passion for sustainability and circular measures, which were topics I had not previously considered.

Content-wise, I gained substantial knowledge about the legal system and its influence on decision-making processes. I now understand the need for creativity to navigate regulations and the importance of making informed choices regarding contracts. In retrospect, I realize my research has barely scratched the surface of these complex topics.

Lastly, my study made me confront the reality that the Netherlands, contrary to my initial belief, has a long way to go in achieving a circular economy as envisioned by the Ellen MacArthur Foundation (EMF).

The concept of circularity is interpreted in various ways, and achieving a truly circular economy will necessitate extensive collaboration among diverse stakeholders.

In the final stretch of my graduation period, post my P4 presentation, I plan to concentrate on refining my research and incorporating the feedback I receive, granted I successfully pass this stage. There is potential to delve deeper into certain aspects of my study to obtain more precise findings. A promising avenue might involve taking a single product and exhaustively detailing the requirements for its transformation into a PSS. This would allow me to delve into the unique intricacies and specifications of that product. However, the execution of this plan hinges on the feedback received during the P4 presentation and the remaining timeframe of my graduation period.

1. What is the relation between your graduation project topic, your master track (Ar, Ur, BT, LA, MBE), and your master programme (MSc AUBS)?

The relation between my graduation project topic, my master track, and my master programme is that the topic fits within the Master track Management in the Built Environment (MBE) and the Master programme Architecture, Urbanism, and Building Sciences (AUBS) as it focuses on the built environment and contributes to sustainability and circularity in the construction industry. These topics have been leading subject during the master. Making it possible to treat products in the built environment as a service, many different factors are involved such as stakeholder mapping, building law and financial motives and calculations. This relates well to the MBE master track, all different components and factors needs to be managed and multidisciplinary design-based solutions needs to be created. All learned lessons and courses are connected when it comes to PSS.

2. How did your research influence your design/recommendations and how did the design/recommendations influence your research?

My research and design recommendations held a mutually influential relationship throughout my graduation project. The research steered the design recommendations, while the design process further informed the research, created a dynamic that was instrumental in the project's progression. The research centred around exploring the concept of PSS in the Built Environment, investigating its potential contributions to circular economies, and uncovering the complex factors and dynamics involved. Through in-depth literature review and expert interviews, I gathered substantial knowledge about the essential characteristics for a successful PSS and identified new opportunities for potential PSS applications in the Built Environment. This research fundamentally informed my design recommendations by highlighting the key considerations and criteria for establishing successful PSS.

For instance, the research findings on sustainability, contracts, design and materials, financing, market mismatch, company readiness, risks and regulations, and stakeholder roles helped shape the design recommendations. Understanding these factors played a crucial role in framing the design strategies. It became clear that careful planning, a focus on sustainability and circularity, contract management, and stakeholder collaboration were integral to the successful implementation of a PSS model.

On the other hand, the process of drafting design recommendations and considering practical implementations of PSS influenced my research by shedding light on gaps in existing knowledge and potential challenges. For example, the realization of the mismatch between theoretical propositions and practical realities of the construction industry prompted further research into this gap. The design process also emphasized the importance of stakeholder collaboration and practical feasibility, highlighting areas that needed further research, such as the legal aspects of PSS and the readiness of companies to adopt such models.

In conclusion, the research and design recommendations within this project were deeply interconnected and influenced each other. The research informed the design strategies, and the act of designing, revealed areas that required further research, thereby creating a symbiotic relationship that enriched both elements of the project.

3. *How do you assess the value of your way of working (your approach, your used methods, used methodology)?*

Reflecting on the methodology and the approaches I adopted during my research, I believe they hold significant value in navigating the complexity of the topic and in achieving the project's objectives. However, the process also revealed areas for improvement and adaptation, which became evident as the project evolved. The qualitative research methodology, which involved literature review, study of existing PSS, and in-depth expert interviews, was instrumental in acquiring a comprehensive understanding of PSS. The literature review provided a solid theoretical foundation, helped identify key factors properties and characteristics necessary for successful PSS, and exposed potential possibilities for PSS applications. Meanwhile the expert interviews offered valuable real-world insights, augmenting the theoretical knowledge with practical perspectives.

However, my approach required a certain level of flexibility and adaptation. Initially, I planned to perform extensive case studies and diverse stakeholder interviews, but I found that existing literature provided more relevant information than expert interviews of all stakeholders. I adjusted my approach to focus more on suppliers and less on other stakeholders, as their insights were more directly related to the implementation of PSS. Similarly, I discovered that a more detailed, product-specific investigation would grant more valuable insights, leading to a shift in my research focus.

The process also highlighted the challenges and limitations of my methodology. For instance, the heavy reliance on desk research was sometimes monotonous and challenging to stay motivated. Legal aspects, particularly Dutch regulations, were difficult to navigate due to my lack of background in that area, and the translation work was also time-consuming. However, these challenges provided learning opportunities and highlighted areas where collaboration with experts, such as legal professionals, would be beneficial in future research.

4. *How do you assess the academic and societal value, scope and implication of your graduation project, including ethical aspects?*

Evaluating the academic and societal value, scope, and implications of my graduation project, it's clear that it contributes significantly in both spheres while also considering ethical aspects. From an academic standpoint, my project deepens the understanding of the application of PSS in the Built Environment, a topic that is increasingly gaining attention in the realm of sustainability and circular economy research. The project synthesizes and builds upon existing literature, providing new insights and perspectives on the practical implementation of PSS. It highlights the challenges, barriers, and potential solutions in real-world scenarios, going beyond theoretical discussions and providing a more holistic view of the subject. The project also identifies areas for future research, such as the need for more in-depth, product-specific studies, and the exploration of legal and regulatory challenges. These contributions are valuable for academics and researchers in the field, paving the way for further study and refinement of PSS concepts and applications.

On a societal level, my research carries significant implications as it aligns with the global urgency to transition towards more sustainable, circular economies. By investigating the practical application of PSS in the Built Environment, the project offers potential pathways for industries and businesses to reduce waste, maximize resource efficiency, and contribute to environmental sustainability. It

underscores the importance of stakeholder collaboration, regulatory support, and market acceptance in achieving these goals. Moreover, it brings to light the ethical responsibility of industries to consider sustainability in their operations and business models.

In terms of scope, the project is focused primarily on the Dutch Built Environment. However, the findings and insights could be relevant and applicable to other geographical contexts and sectors, broadening its impact. As for ethical considerations, my project is rooted in the principle of promoting environmental sustainability and social responsibility. It encourages industries to shift away from traditional, linear models of consumption and towards more sustainable, circular models. In doing so, it acknowledges the ethical imperative of current generations to preserve the environment for future generations. However, it also recognizes the economic realities and challenges that businesses face, and does not advocate for sustainability at the expense of economic viability.

5. *How do you assess the value of the transferability of your project results?*

The value of the transferability of my project results is quite significant. While the research primarily focused on the Dutch Built Environment, the principles, challenges, and proposed strategies for implementing a PSS model are universally applicable. The insights gained from this project can be useful in similar contexts globally, making the results highly transferable.

Moreover, the methodological approach used in this study: combining literature review, expert interviews, and comparative analysis, provides a robust research framework that can be replicated in other studies on PSS or similar topics. Thus, the transferability of the project results extends beyond the content to include the research approach itself. However, given the specific legal and cultural context within which this research was conducted, it's essential to acknowledge that certain aspects may require adjustments or further exploration to be fully applicable in different contexts. This understanding further underlines the value of transferability, as it emphasizes the need for locally specific solutions while also providing a broader framework for PSS implementation.

A. *How has your understanding of the Product-Service System (PSS) model evolved over the course of this research, and in what ways do you feel this model can be leveraged further for sustainability in the built environment?*

Over the course of this research, my understanding of the PSS model has significantly evolved. When I first began this journey, I viewed the PSS model as a simple transition from selling products to offering services. However, as I delved deeper, I realized the complexity of this model and its multidimensional nature. PSS is not merely about offering services; it's about adopting a different mindset, a shift from a linear to a circular economy, and a comprehensive overhaul of traditional business models.

The PSS model is not a one-size-fits-all solution. Each product has unique characteristics that influence its suitability for PSS. Moreover, the successful implementation of PSS involves various stakeholders, and understanding their roles and responsibilities is crucial. I also came to appreciate the importance of the legal and financial aspects of implementing PSS, areas that I initially overlooked.

Despite these complexities, I have grown to see the PSS model as a powerful tool for promoting sustainability in the built environment. This model encourages the reuse and recycling of products, contributing to waste reduction and resource efficiency. It also incentivizes manufacturers to design durable, high-quality products that can withstand multiple life-cycles, leading to less environmental impact.

However, the current application of the PSS model in the built environment is far from its potential. Moving forward, I believe there are several ways to leverage this model further for sustainability. For

instance, more research is needed to understand the suitability of different products for PSS. Practical, real-world pilot projects can provide valuable insights into the challenges and solutions of implementing PSS. Additionally, the legal and financial frameworks need to adapt to support the PSS model. Governments and policy makers can play a significant role in promoting PSS by raising awareness, providing incentives, and creating a conducive regulatory environment.

B. In what ways did your research contribute to the field of sustainable built environment?

My research contributes to the field of sustainable built environment by providing a detailed exploration into the application of PSS in this area. By investigating the factors that influence the success of PSS, it offers a framework for understanding the potential of this model in driving towards a more circular economy.

The research delved into various aspects including the product suitability for PSS, the need for a legal framework that supports this model, and the role of various stakeholders in its implementation. It highlighted the need for more in-depth, product-specific research to understand the unique characteristics and requirements of each product. This emphasizes the complexity and context-dependent nature of implementing PSS, shedding light on the need for tailored solutions.

Furthermore, the research brought attention to the legal and regulatory challenges associated with PSS, calling for a closer collaboration with legal experts and an evolution in the legal system to accommodate these new business models. This underscores the interconnectedness of sustainability initiatives with broader societal systems and the need for a supportive legal environment.

The research also emphasized the importance of stakeholder collaboration and capacity building. It elucidated the gap between theory and practice and the need for more practical insights and real-world testing. These findings highlight the importance of multi-stakeholder engagement and real-world applicability in advancing sustainability in the built environment.

By identifying these various challenges and opportunities, my research contributes to a better understanding of the potential and practicalities of PSS in the built environment. It offers valuable insights for industry professionals, policymakers, and researchers who are looking to explore and implement more sustainable and circular practices in the field.