Design through standardization

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Abstract

This paper aims to explore the applicability of the standardization of heritage and sustainability values in the context of church transformations in the Netherlands. Through comparative research on available assessment tools, specifically focusing on church transformations, the study investigates whether these tools extend beyond their original purpose of standardization, and therefore, if this standardization of values can be used in the design process. The central question is articulated as follows: *How can standardization of sustainability and heritage values be used in the design process of church transformations in the Netherlands?*

The comparative literature research identifies two pertinent tools, DuMo and BPSC, both addressing standardization of sustainability and heritage values with distinct methodologies. The analysis of these tools' applicability in practice leads to the second phase of the research, aiming to determine if the core indicators of these tools can facilitate in the decision-making process of church transformation design.

While assessment tools primarily seek to standardize values, this paper explores their potential applications standardization of values can have in the design approach. Although not initially created for the purpose of design, the standardization achieved through these tools can enhance comprehension of various considerations in different stages of the design process. In conclusion, this research contributes to the existing framework on the standardization of heritage and sustainability values, specifically within the context of church transformations in the Netherlands.

Key words
Heritage - Sustainability - Standarization - Assessment tools - Church transformations.

Introduction

The Netherlands, like many other European countries, boasts a rich history of Christianity deeply ingrained in society. This historical narrative finds expression in various tangible and intangible elements [1]. Churches, as embodiments of religious history, represent both tangible structures in Dutch society and intangible aspects such as the stories and sentiments woven into their histories [2]. Distinguishing between these tangible and intangible values is crucial, forming the foundation for the standardization of a church's values. This standardization of both tangible and intangible elements constitutes a key component of the theoretical framework underpinning this research, which seeks to assess the utility of standardization tools in the design process of church transformations.

The focus on church transformations within the specific context of the Netherlands stems from the repercussions of secularization in the Dutch society. Over the past decade, an increasing number of churches have fallen into disuse as a result of dwindling church attendance. This has resulted in a disconcerting trend where a new church in the Netherlands becomes vacant every week [3]. In the midst of this cultural and religious shift, challenges and opportunities have emerged. The vacancy of these historic buildings poses a threat to their preservation, and without intervention, they face deterioration and a loss of inherent value. However, an opportunity lies in repurposing these vacant churches to accommodate the evolving functions of the future while preserving their tangible and intangible values [2].

Moreover, contemporary building transformations emphasize not only heritage preservation but also the incorporation of sustainability and circularity. The adaptive reuse of old structures is inherently sustainable, capitalizing on the recycling of existing materials and structures [4]. Nevertheless, in line with current climate goals for 2030 [5], there is a growing emphasis on enhancing the sustainability of churches wherever feasible [6][7]. Given the escalating significance of sustainability and circularity in the building sector, these aspects emerge as pivotal values in the comparison of assessment tools concerning their applicability to the design process.

While the existing literature extensively addresses the standardization of heritage and sustainability values [8], this paper seeks to contribute to this body of knowledge by investigating the potential implications of standardization. Specifically focusing on the standardization of sustainability and heritage values, the research aims to explore the utility of standardization in the design process of church transformations. Consequently, the central question guiding this graduation paper is: *How can the standardization of sustainability and heritage values be used in the design process of church transformations in the Netherlands?*

Methodology

This thesis seeks to address the primary research question: *How can assessment tools for the standardization of sustainability and heritage values be used in the design process of church transformations in the Netherlands?* The process involves several steps leading to a conclusion, starting with the establishment of a theoretical framework required to answer the question.

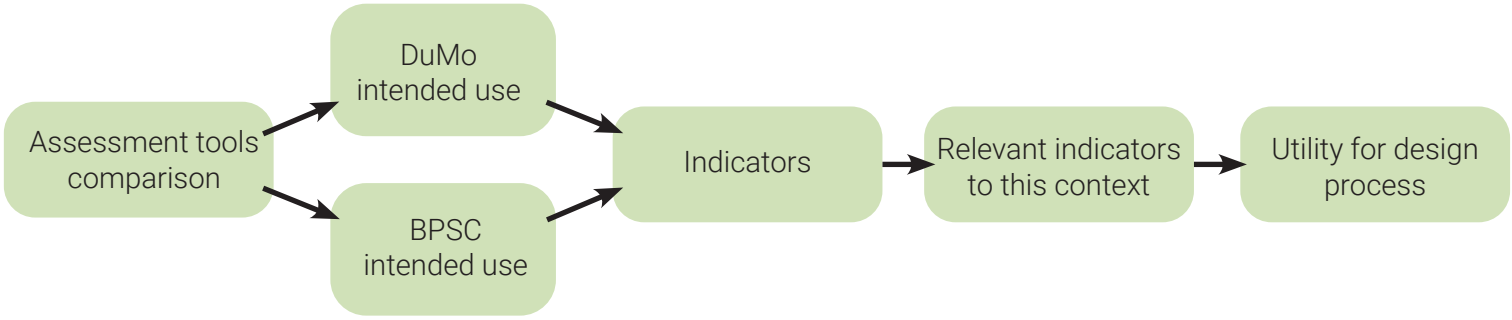
The initial phase involves setting up the theoretical framework concerning possibilities to standardize heritage and sustainability values. The existing framework of assessment tools plays a big role in the possibilities of standardization. Numerous existing standardization tools have different focuses and applications. Through comparative research, the most relevant tools for the context of church transformations in the Netherlands are identified.

The subsequent step entails an in-depth exploration of the two most useful tools, highlighting why they are particularly interesting for comparison and research. This aspect of the theoretical framework primarily examines the functionality and purpose behind these standardization tools, emphasizing the importance of indicators and strategies used to measure values. Understanding these indicators facilitates a comprehensive analysis of the original purpose of the tools and their effectiveness in achieving their goals.

Following the establishment of the general framework for standardization tools and a detailed description of the researched tools, the focus shifts to translating this knowledge to address the main objective of the thesis: Can these tools extend beyond their original purpose and assist in the design process of church transformations? Analysing the indicators and methods of DuMo and BPSC, the research investigates if and how the most relevant indicators can be applied in a broader context than their initial purpose.

Ultimately, the research leads to a conclusion and discussion on whether existing the standardization of values have the potential to be directly translated into decision-making in the design process.

1. Methodology (own schemtic)



Theoretical Framework

In accordance with the methodology, the initial step in addressing the research question is to examine standardization within the broader building sector. Possible tools serve various purposes, but their overarching theme is to enhance the comprehension of data. For this discipline particularly tangible and intangible values of buildings. Establishing key indicators and factors underlying how buildings are valued is crucial in this context.

This thesis exclusively focuses on church transformations in the Netherlands, as outlined in the introduction. Understanding the implications of transformations on existing heritage is vital in the context of transforming heritage buildings. Despite the usual separation of heritage and sustainability sectors, this context of heritage transformation intertwines the two disciplines, creating an intriguing analysis of overlapping and assembling values.

Criteria for Relevant Tools

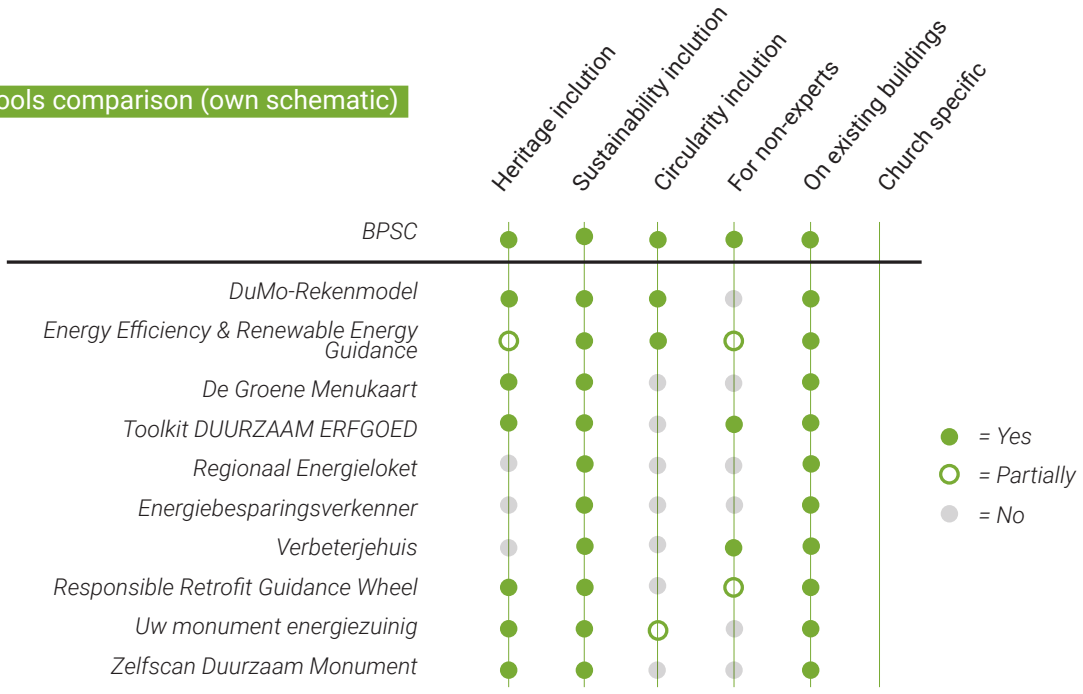
Due to the inherent contradictions and similarities between heritage and sustainability, thorough research on the standardization of these values has already been conducted [9][10]. These assessment tools, designed with different viewpoints and purposes, necessitate criteria specific to the context of church transformations in the Netherlands. The main criteria, as illustrated in Figure 2, align with the research question:

"How can the standardization of sustainability and heritage values be used in the design process of church transformations in the Netherlands?"

The primary factors for analysis are sustainability and heritage, crucial in evaluating existing tools. While there are numerous tools for either sustainability or heritage, only a few consider both aspects. Furthermore, tools specific to churches, transformations or the Dutch system are prioritized. These three criteria, derived from the research question, aid in narrowing down the selection of tools for comparative research.

Through direct contact and interviews with the creator of one main tool, BPSC[9], and other tools researched by KaDer [11] in a comparative study of assessment tools useful in the Netherlands, a selection of tools is identified in Figure 3. Upon examination, BPSC and DuMo[10] emerge as the most interesting tools for in-depth research and comparison in the context of this thesis. Both tools integrate heritage and sustainability, utilize distinct methods, and serve different purposes. The shared main aspects, while having differences in the other factors, make them suitable for a detailed comparison.

2. Assessment tools comparison (own schematic)



BPSC assessment

"The aim of this tool (Building Passport for Sustainable Conservation) is to identify priorities for future interventions, by recognizing the contributions of heritage buildings to sustainability that should be preserved and the fragilities that need to be improved."

As mentioned in the citation, the purpose of this tool is to assist in prioritizing interventions, utilizing a Likert scale [13] questionnaire-based methodology. It's crucial to note that this questionnaire is designed for non-experts, requiring users to have some knowledge about the building. However, the primary objective is to provide individuals with concrete and comprehensible knowledge about the building.

While the questions eventually yield the outcome of the standardization tool for user utilization, the focus of this thesis is on understanding the origins of these questions. The questionnaire, comprising approximately 50 questions, is structured based on Brand's layers [14], with the addition of the seventh layer, spirituality by de Jonge [15]. These layers serve as indicators, representing the factors deemed most important by the tool for a comprehensive assessment of heritage and sustainability values. The indicators, organized by the layers of Brand, are presented in Figure 3.

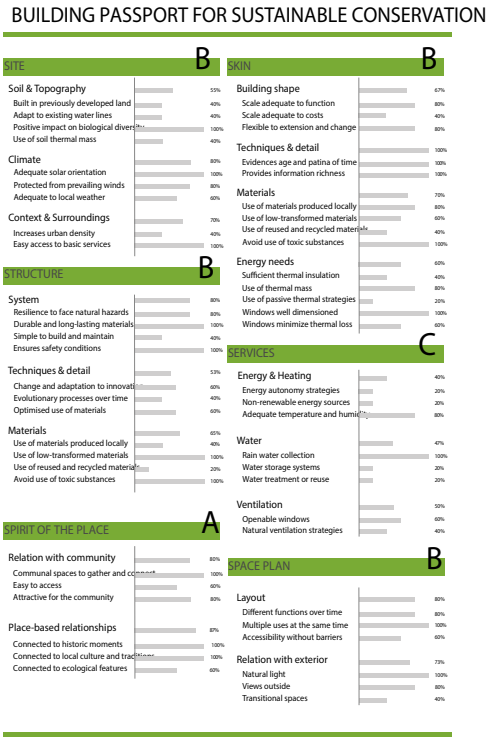
BPSC	
Site	1. Relation with soil 2. Relation with climate 3. Relation with surroundings
Skin	4. Building shape 5. Buildings techniques 6. Building materials 7. Reduction energy needs
Structure	8. Structural system 9. Structural techniques 10.Structural materials
Service	11. Energy and Heating 12. Water 13. Ventilation
Space plan	14. Layout 15. Relation Exterior
Spirit	16. Community 17. Place-based

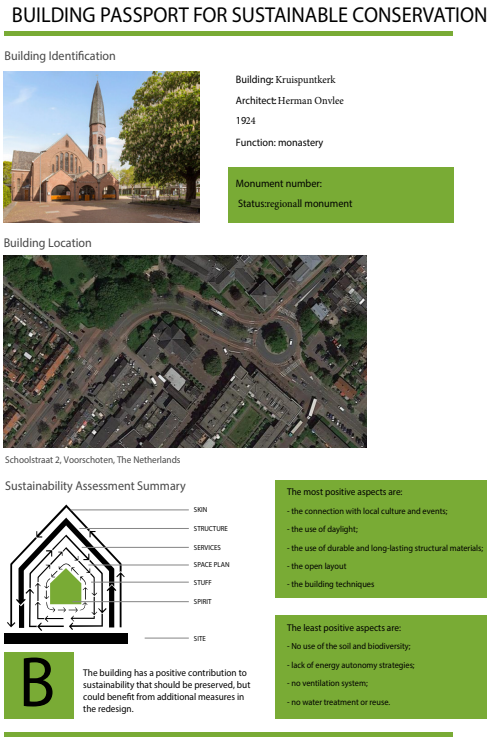
BPSC in Practice

To grasp the methodology of the tool, an example is provided using the Kruispuntkerk in Voorschoten, although it is applicable to all churches in need of transformation in the Netherlands.

The questionnaire, diverse in its content, ranges from sustainability-oriented questions, like the presence of rainwater collection systems (services layer), to heritage-focused ones, such as the building's connection to historic moments or events (spiritual layer). The filled questionnaire results in the "building passport," detailed in the appendix and illustrated in Figure 4. The completed questions unveil which layers and indicators score highest or lowest on heritage and sustainability values. Focusing on the most polarized results, the passport offers a list of the most and least positive effects, as shown in Figure 5.

4. Building passport





BPSC Findings:

Firstly, the positive aspects of this tool and its methodology should be acknowledged. While a prior value assessment was conducted, completing this questionnaire aids in understanding the factors and indicators of value. Grouping indicators in the same layers highlights similarities and relationships between them. Additionally, it facilitates the integration of tangible and intangible aspects, creating a more comprehensible assessment of intangible values by connecting them to tangible building layers.

The passport reveals the most noteworthy aspects, forming the basis for a more in-depth analysis of these relevant indicators in future research. Although the standardization provides instruments for future research, there are some challenges.

BPSC results present a percentage and grade based on an individual-filled questionnaire, introducing a form of bias influenced by the individual's prior knowledge. However, the tool also requires prior knowledge of the building to answer questions, creating a contradiction.

Despite biases and difficulties in complete objectivity, BPSC's aim was never to entirely objectify every indicator. Instead, the goal is to enhance understanding and prioritize heritage and sustainability values, assisting in defining boundaries for preserving important heritage layers and identifying potential improvements.

6. Significant aspects

The most positive aspects are:

- the connection with local culture and events;
- the use of daylight;
- the use of durable and long-lasting structural materials;
- the open layout
- the building techniques

The least positive aspects are:

- No use of the soil and biodiversity;
- lack of energy autonomy strategies;
- no ventilation system;
- no water treatment or reuse.

DuMo assessment

"The aim of a DuMo-Profile, originated from the two Dutch words "Duurzaam" (sustainability) and Monumentaal (heritage), is to assess heritage listed buildings based on their sustainable and heritage qualities"

While DuMo's standardization tool appears simple at first glance, its underlying valuation system is a complex calculation model intended for experts well-versed in the building's details. For the purpose of this thesis, only an understanding of the reasoning behind this valuation is essential. The model relies on a set list of indicators that forms the backbone for the standardization tool, further categorized into different strategies (see Figure 6).

DuMo in Practice:

Though presenting the entire calculation of these indicators is impractical, a quick explanation is shown to understand where the indicators are coming from [16]. Heritage experts score the building's heritage component using a questionnaire, resulting in the Mo-coefficient (Figure 7). Simultaneously, the Du-coefficient calculates the sustainability impacts of all materials used in the project, yielding a score (Figure 8). Finally, these two coefficients are multiplied to generate the DuMo-score (Figure 9). It's crucial to note that two comprehensive expert calculations are necessary to achieve the goal.

DuMo

Basic
1. Traditional strategies
2. Minimal interventions
3. Reversibility
4. Fitting use
5. Adapted comfort requirements

Materials
6. Reuse materials
7. Environmentally materials

Energy
8. Adjoining unheated space
9. New installations
10.New isolation

Water
11. Infiltrated rainwater
12. Water saving measures

Climate
13. Exploit high spaces
14. Limiting harmful emissions

Maintenance
15. Protection plants and animals
16. User's information
17. Regular maintenance

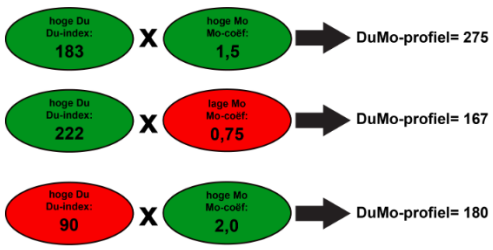
Design
18. Interaction Du & Mo
19 Balancing interests
20. Alignment of restoration strategy DuMO

7. Mo-coefficient

Aanraakbaarheidscategorie	Mo-Coëfficiënt	betekend een minimale Du-index om op eind score van 180+ te komen
A	2 – 3	60-90
B	1,5 - 2	90-120
C	1 – 1,5	120-180

8. Du-coefficient

9.DuMo-coefficient



This, however, is just one part of the calculation, as the model produces a DuMo score for the existing building. In practical terms, new interventions must align with both coefficients to be beneficial. The model offers insights into the potential consequences of interventions concern-ing heritage or sustainability valuation. How DuMo is intended is that one or more of the strate-gies seen in figure 6 are used to improve the overall DuMo coefficient. Through calculating the impacts of different strategies, the most beneficial one can be applied.

DuMo Findings

The most valuable information for the church transformation process lies in the indicators and strategies used for data valuation. These strategies offer meaningful insights into possible de-sign solutions and their implications for sustainability and heritage.

While the tool's extensive calculation capabilities could be perceived as a strength, its complexi-ty also limits its utility. Even for experts, doubts may arise about the tool's efficiency due to its complexity and time-consuming nature. Despite this, the tool's usefulness lies in the diverse strategies and indicators it provides.

DuMo, with its intricate calculation approach, was hypothesized to compare different design decisions based on sustainable conservation impact. In practice, the tool's complexity poses challenges in achieving the desired results efficiently. Nevertheless, the strategies and indica-tors contribute significantly to the standardization of values.

Comparison of BPSC and DuMo

With the theoretical framework established and an elaborate analysis of DuMo and BPSC conducted, it is evident that both tools, despite having distinct purposes, rely on indicators of heritage and sustainability in their methodologies. These indicators play a crucial role in addressing the central question of the thesis: How can assessment tools for the standardization of sustainability and heritage values be used in the design process of church transformations in the Netherlands?

10. Indicators

DuMo

Basic
1. Traditional strategies
2. Minimal interventions
3. Reversibility
4. Fitting use
5. Adapted comfort requirements

Materials
6. Reuse materials
7. Environmentally materials

Energy
8. Adjoining unheated space
9. New installations
10.New isolation

Water
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12. Water saving measures

Climate
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BPSC

Site
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Structure
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10.Structural materials

Service
11. Energy and Heating
12. Water
13. Ventilation

Space plan
14. Layout
15. Relation Exterior

Spirit
16. Community
17. Place-based

The assessment of these tools reveals that the indicators could influence design choices. Figure 10 summarizes both indicators and their subdivisions, translating them into potential design decisions. In BPSC's model, the standardization offers immediate starting points for redesigning specific layers, with indicators specifying the focus within each layer. Therefore, in its current state, BPSC can already be utilized to establish boundaries and starting points at the beginning of the design process.

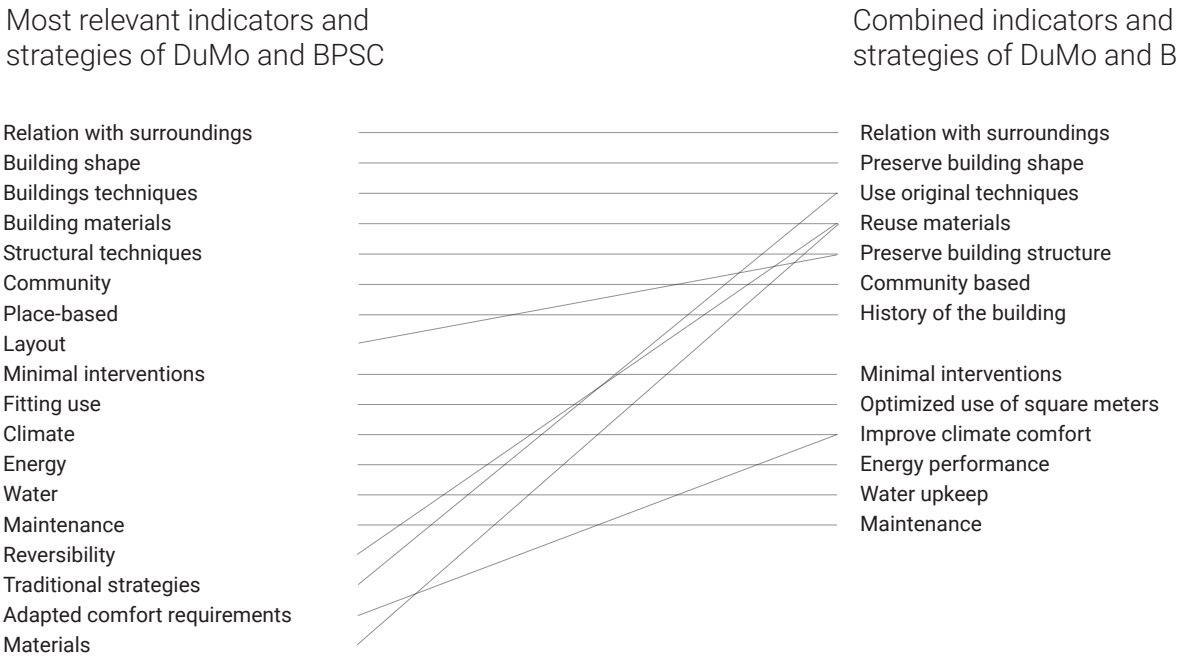
On the other hand, DuMo's model presents indicators in the form of strategies, serving as options for design. However, DuMo goes further by scoring interventions afterward. This scoring process can be directly translated into the design phase by evaluating design decisions.

Both tools can support making design decisions by understanding indicators and their implications for design. While BPSC focuses more on the start of the design phase, and DuMo on evaluating design choices, comparing these tools enhances understanding of designing possibilities.

Comparison of DuMo and BPSC Indicators

The first part of the comparison involves assessing the indicators used by both tools. Are there similarities in what each tool considers crucial for valuing heritage and sustainability? When comparing these indicators, their relevance to the context of transforming churches in the Netherlands is checked first. Subsequently, the comparison identifies similar indicators that can be combined, leading to the most relevant indicators shown in Figure 11.

11. Indicators comparison

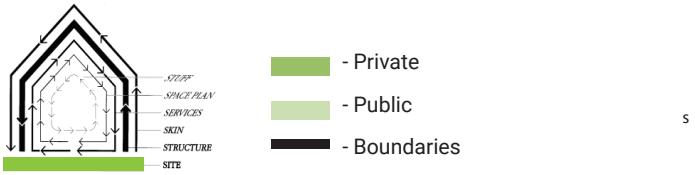


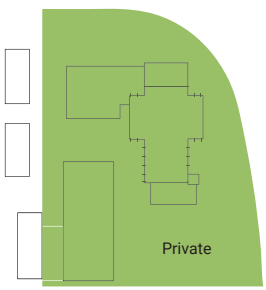
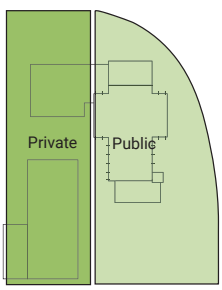
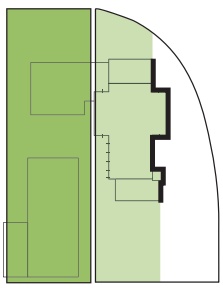
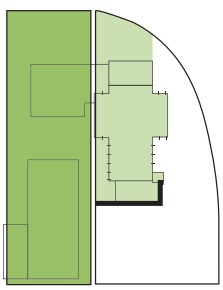
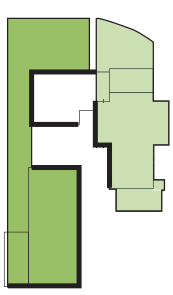
Design possibilities

It is evident that DuMo and BPSC can be used for making design decisions, but can the narrowed-down list of indicators provide a more in-depth vision of design possibilities through standardization? Two draft models are proposed to address this question and support the transformation process of churches in the Netherlands.

The first draft model is based on BPSC's methodology, utilizing the "site" layer of Brand in the Kruispuntkerk case study (Figure 12). It illustrates how indicators could establish boundaries directly translated into design choices. While choices are influenced by more than just indicators, they aid in understanding the importance of certain building forms and elements.

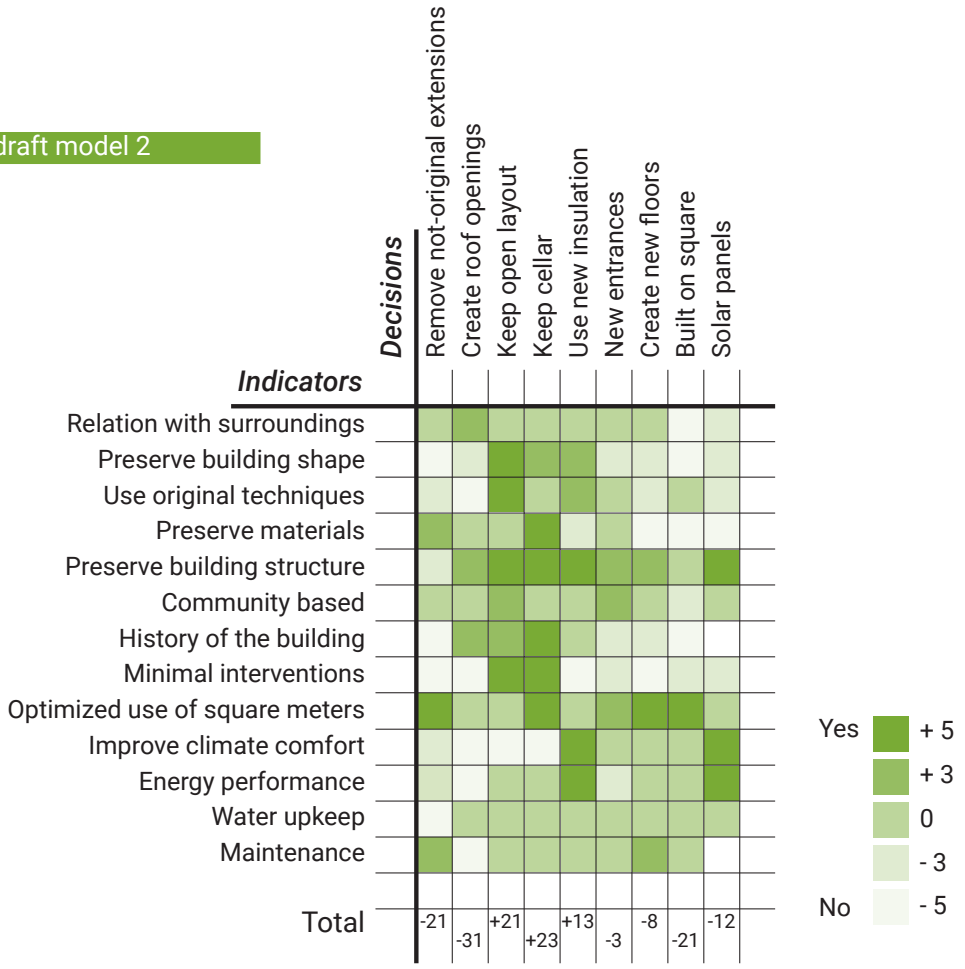
12. Draft model 1



Optimized use of square meters	Community based	History of the building	Relation with surroundings	Minimal interventions
				
Use the whole plot and not only the existing building	Add a community based function in the plot	Preserve the most iconic view of the church	Keep the existing square at the start of the town-center	Try to keep the existing walls to preserve the history and minimize material lose

The second draft model is influenced by DuMo's methodology, focusing on scoring interventions and design decisions retrospectively (Figure 13). It demonstrates how different design decisions can be evaluated based on their impact on the indicators, acknowledging potential biases in the valuation of indicators.

13. draft model 2



Conclusion

The entire research endeavor was directed towards addressing the fundamental question posed at the beginning: How can the standardization of sustainability and heritage values be used in the design process of church transformations in the Netherlands? Through research of the existing possibilities to standardize values, it quickly was narrowed down to existing assessment tools, specifically DuMo and BPSC. Every method and choice made in the comparative analysis of the two assessment tools was grounded in this specific context.

In conclusion, even though the intended use of standardization may not include design phases, they undeniably offer valuable insights for such projects. At the core of standardization lies the indicators used to evaluate heritage and sustainability. These indicators are the core to existing assessment tools. By homing in on the relevance and impacts of these indicators, a meaningful translation to decision-making in the design phase can be achieved. While this thesis only presents two examples of how these indicators can directly influence design decisions, it underscores the capability of standardization tools to provide crucial information. Therefore, in addition to the existing framework of standardization, this paper delves more in-depth into the broader utilization of standardization tools beyond their original purpose. This focus remains specific to the context of church transformation in the Netherlands but holds the potential for adaptation to assessment tools in other disciplines.

Discussion

As previously discussed, this thesis sought to elaborate on standardization of values and explore possibilities beyond their original purpose. This is achieved by doing comparative research of assessment tools. Although the paper concentrates on two tools within the context of church transformation in the Netherlands, its insights can be applied to the broader standardization framework. Reflecting on the methodology employed, it sheds light on the extended applications of the standardization of values and the tools to achieve this.

However, it's crucial to acknowledge a significant bias in this research, particularly in the selection of indicators. The choice of significant indicators was influenced by personal experiences with using the tools in practice. To enhance objectivity, a more quantitative research approach could be beneficial in obtaining a more widely supported list of indicators.

Additionally, it's essential to consider the research's association with a graduation design project. This prompts the question: Did the research outcomes influence the design, or did the design influence the research? This introduces another layer of bias that needs to be acknowledged. While a thesis should ideally be grounded in the objective translation of data, human error remains a potential factor.

Concluding the discussion, biases were present in the choices made throughout the research. Nevertheless, the comparative analysis of assessment tools and their implications for designing provided a valuable expansion of the existing framework of standardization of values.

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