

Reflection - Master thesis
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INNOVATION OF CONSERVATION

Towards Energy Efficient Monuments

| REFLECTION

7.1 Research methods and validity of findings

The applied research methods are literature research, empirical research and operational research. The empirical research consists of two parts: the expert interviews and the case studies. The operational research consists of the design of the strategy. In this paragraph, a reflection will be provided on each research method and the validity of the findings.

7.1.1 Literature research

The concept of inserting cultural values of a monument in a BIM model for the support of decisions on renovation designs is new. However, it is based upon existing theory. Cultural value assessment of monuments is a practice that is already applied for years and integrating information in a BIM model is the main intention of building information modeling. Therefore, the analysis of the six defined themes in the literature, formed the starting point of this research and resulted in the opportunity to combine the theory and create new ideas. In order to validate the practical applicability of the theory, it is tested within the empirical research. Theories are confirmed such as the theory on the possibility to define the tolerance for change (touch abilities) of monumental building components. However, theories are also rejected, such as the quantification of cultural values.

There was no recent literature available about the Dutch methods to assess cultural values. The most recent source that described new theory for this dated from 2008. The interviewees agreed upon the fact that the theory on this subject is outdated and should be revised and updated. Therefore, the literature about the cultural value assessment only was not sufficient.

There is an abundance of literature about BIM technologies and energy renovations of existing buildings. This resulted in the opportunity to base and validate the theoretical findings of these themes on different sources.

7.1.2 Empirical research

Expert interviews

The interviews are performed with a semi-structured interview approach. This appeared to be the right approach, because it provided the flexibility to zoom in on the field of expertise of the interviewees by asking fol-

low-up questions that one cannot prepare in advance. The aim of the semi-structured interviews was to test the practical applicability of the theory, which was crucial for the design of a practical applicable strategy.

Case studies

In this research, two case studies are performed with the comparative research design. Both cases are analyzed on the cultural values and thermal performance aspects, which functioned as the starting point for the creation of a renovation design. For both cases, the possible energy conservation measures, the process and the decision-making are analyzed and compared. The conclusions are based upon these analyses, however the outcome cannot be generalized. In order to validate the outcomes of comparative case studies, many more case studies are required. Therefore, these case studies can also be seen as explorative case studies. The aim of this research is to design a strategy and therefore the focus was not on the analysis part of the research but more on the operational part. However, the empirical case studies were needed in order to confirm the theory, have a starting point for the operational research part and have data to implement in the test case.

10.1.3 Operational research: Design of the strategy

The operational research part consists of the design of the strategy. An operational research design consists of several steps: define the problem, design a concept, test and evaluate the conceptual design and optimize the design towards a final design (Dym & Little, 2004). All these steps have been taken in this research in order to reach the final design of the strategy. The conceptual design of the strategy as explained in chapter 1.7, is optimized based on the outcomes of the theoretical and empirical research towards the final design (chapter 4.8). The actions that have to be taken in order to implement the strategy, such as the implementation of the cultural values in BIM, the creation of multiple design options in BIM and the calculation of the energy performance of these options, are tested in the test-case Lidwina Monastery and validated. However, testing the strategy on one case is not enough to generalize the result. Next to this, the validation of the strategy would be more reliable when it is implemented in real renovation projects of monuments.

10.2 Reflection on societal relevance

The aim of creating the strategy was to support the creation of an energy renovation plan for a monument that does not harm the cultural values and increases the energy performance. Also, according to the literature, citizens, organizations and entrepreneurs who have plans for a monument must be nurtured and supported (Jansen, 2014). The strategy can support the management of the design phase of a renovation plan, the creation of a suitable design and the decision upon the design option. This emphasizes the societal relevance of this research. Furthermore, due to this support, monuments can be conserved and improved on their thermal performance and through this, better function in society. The buildings can reflect the history of society, without having a negative impact on the environment. Less negative impact on the environment is more beneficial for the society of today and the society of the future.

10.3 Reflection on scientific relevance

The need for decision support tools that stimulate adaptive reuse is also acknowledged in the field of research (Franco, Magrini, Cartesegna, & Guerrini, 2015; Yung & Chan, 2012). This research answers this need. Next to this, research is conducted about implementing cultural values in a BIM model of a monument for educational purposes or for museums to show the history of buildings in virtual reality (Bonsma et al., 2016). However, implementing cultural values in the way this research suggests with the aim of including them in analyses and in the design of a renovation plan, is never done before. This new perspective opens multiple further research possibilities as described in the scientific recommendations.

10.4 Reflection on the process

The research design, as presented in the research proposal in figure 10, represents the executed process and planning quite well. I started with the literature research, although from P2 until P4, the literature research, empirical research and operational research were performed simultaneously in an iterative process.

On beforehand, I did not plan to perform the expert interviews. During the literature research I noticed that a research institute (NIBE) also performed research on sustainable monument conservation and therefore, I decided to contact this institute to discuss the literature. The interview/discussion gave me many new practical insights and via Birgit I got in contact with the other interviewees. Since I had the time to dive into the subject, I was able to perform these additional interviews. In retrospect, the outcomes of these interviews had a large impact on the outcome of the research. Having contact with experts in the field of interest resulted also in the possibility to retrieve very specific case study data. Finding a case study that met all the case study criteria was difficult. Through NIBE, I received all the data and contacts that I needed for the case studies. Therefore, a lesson learned is that contacting people in the field of interest will help more than searching for information available on the internet. Next to this, I also enjoyed to speak with these people. They inspired me in a way that I would have never experienced if I stayed behind my desk.

The design of the strategy started with the idea to implement cultural values in a BIM model, however it took a while before I found out what the final design of the strategy should look like. I needed the time to process the information and ideas in my mind. During this 'processing time', I produced nothing on paper which felt really frustrating. However, when it suddenly all came together in my mind, I was able to document it properly. I think it is important to realize that I need the time to process information in my mind and cannot produce the same amount of output every day. I appreciate that the graduation project provides time to properly process information and the opportunity to dive into a subject of personal interest.