Beyond good intentions

Building passport for sustainable conservation of built heritage

Joana dos Santos Gonçalves

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Beyond good intentions

Building passport for sustainable conservation of built heritage

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Summary

Sustainable Conservation are the processes of change through which the components of the inherited ecosystem from the past retain their value for present and future generations. As such, the value assessment is critical to recognise the values of heritage, not only by its aesthetical and historical values, but also by its contribution to a more sustainable future.

Recent norms, policies, and standards highlight the role of heritage for sustainability and encourage urban conservation, however, sustainable conservation is not yet the most common practice. The behavioural dimension is intrinsic to the decision-making process, however, the literature review shows that no studies were conducted to analyse designers' decision behaviours regarding sustainable conservation of built heritage.

This research aims to grow understanding on the gap in the implementation of best practices of sustainable conservation of built heritage, and to achieve solutions for behavioural change. It applies an innovative approach drawn from methods common in psychology to analyse designers' decisions behaviours, by eliciting common beliefs, challenges, and opportunities in the implementation of conservation intentions towards heritage buildings.

The results demonstrate that design decisions result from conscious and unconscious processes, some of them socially driven, while others result of individual attitudes. Contrary to practitioners, that tend to attribute the responsibility of the lack of implementation to other stakeholders in the process, design students often assume an internal locus of control, attributing the gap in implementation to autonomous decisions, derived from personal beliefs and design concepts. Moreover, sustainability is often believed as opposite or incompatible to heritage conservation. Targeting this primary belief, a building passport for sustainable conservation was developed aiming at raising awareness of the value of built heritage to sustainability. This building passport was used in several case studies of heritage buildings, to verify its contribution to support designers achieving consensual sustainability assessments and inform redesign decisions.

The results of this research can support the redesign of heritage buildings, and the development of sustainable conservation policies, and that of future research focusing on the behavioural change in sustainable conservation.

KEYWORDS heritage, sustainability, sustainable conservation, behavioural intentions, TPB

Samenvatting

Duurzame instandhouding is een proces van verandering waarbij componenten uit de geërfde ecosystemen uit het verleden hun waarde behouden voor huidige en toekomstige generaties. Hierbij is waarde-beoordeling van sterk belang om de waarde van het erfgoed te herkennen, niet alleen door de esthetische of historische waardes, maar ook door de bijdrage aan een duurzamere toekomst.

Recente normen, beleid en standaarden onderstrepen de rol van erfgoed ten behoeve van duurzaamheid en moedigen stedelijk behoud aan. Echter, duurzaam behoud is nog geen algemene gang van zaken. De gedragsdimensie is intrinsiek voor het besluitvormingsproces, maar literatuuronderzoek toont aan dat er nog geen studies zijn uitgevoerd om het besluitgedrag van ontwerpers jegens duurzaam behoud van gebouwd erfgoed te analyseren.

Dit onderzoek heeft als doel het beter begrijpen van de kloof tussen intenties en uiteindelijke implementaties van duurzaam behoud van gebouwd erfgoed, en om tot oplossingen te komen voor gedragsveranderingen. Het onderzoek gebruikt een innovatieve benadering die gebaseerd is op methoden gebruikelijk zijn in de psychologie om het besluitvormingsgedrag van ontwerpers te analyseren, namelijk door het identificeren van algemene opvattingen, uitdagingen en kansen tijdens de implementatie van conserveringsintenties voor erfgoed gebouwen.

De resultaten tonen aan dat ontwerpbesluiten voortkomen uit zowel bewuste als onbewuste processen – sommige sociaal gedreven en andere zijn het resultaat van individuele houdingen. In tegenstelling tot mensen uit de praktijk, die de verantwoordelijkheid voor onuitgevoerde implementaties doorgaans neerleggen bij andere stakeholders in het proces, kijken ontwerpstudenten juist bij zichzelf, waarbij de implementatiekloof wordt toegeschreven aan autonome besluiten die voortkomen uit persoonlijke overtuigingen en ontwerpconcepten. Bovendien wordt duurzaamheid vaak beschouwd als tegenstrijdig of onverenigbaar met het behoud van erfgoed. Afgaand op deze primaire gedachte is een gebouwpaspoort voor duurzaam behoud ontwikkeld met als doel het bewustzijn te vergroten van de waarde van gebouwd erfgoed voor duurzaamheid.

Dit gebouwpaspoort is gebruikt in diverse casestudies van erfgoed gebouwen, om te verifiëren wat de bijdrage was om ontwerpers te ondersteunen in het bereiken van afgesproken duurzaamheidsassessments en weloverwogen herontwerpbeslissingen

De resultaten van dit onderzoek kunnen het herontwerp van erfgoed gebouwen en de ontwikkeling van duurzaam conserveringsbeleid ondersteunen. Ook biedt het een basis voor toekomstig onderzoek dat zich focust op gedragsveranderingen bij duurzame conservering.

Resumo

Conservação Sustentável define-se como o conjunto dos processos de mudança através dos quais os componentes do ecossistema herdado do passado preservam o seu valor para as gerações presentes e futuras. C

om este propósito, a avaliação patrimonial é fundamental para reconhecer o significado do património construído, não apenas pelos seus valores históricos e estéticos, mas também pelo seu contributo para um futuro mais sustentável.

Embora as mais recentes normativas, legislação e recomendações internacionais salientem a importância do património para a sustentabilidade e incentivem a reabilitação urbana, a conservação sustentável ainda não é uma prática comum. Sendo a dimensão comportamental um aspeto intrínseco ao processo de tomada de decisão, a revisão de literatura demonstra, no entanto, a inexistência de estudos que analisem esse processo de decisão dos arquitetos, relativamente à conservação sustentável do património construído.

Esta investigação tem como objetivo contribuir para a compreensão sobre a lacuna na implementação de boas praticas de conservação sustentável no património construído, e propor soluções para uma mudança comportamental. Apresenta uma abordagem inovadora, tendo por base métodos da psicologia para a análise dos comportamentos dos arquitetos durante a tomada de decisão, assim como na identificação das crenças, desafios, e oportunidades mais comuns na implementação de intenções de conservação nos edifícios com valor patrimonial.

Os resultados demonstram que as decisões de projeto resultam de processos conscientes e subconscientes, alguns deles influenciados socialmente, enquanto outros resultam de atitudes individuais. Ao contrário dos arquitetos, que tendem a atribuir a responsabilidade pelas falhas na implementação dos princípios de conservação sustentável a outros intervenientes no processo, os alunos de arquitetura assumem mais frequentemente um locus de controlo interno, atribuindo essa responsabilidade a decisões autónomas, derivadas de opiniões pessoais e conceitos de projeto.

Para além disso, a sustentabilidade é também frequentemente considerada contrária ou incompatível com a conservação patrimonial. Por forma a ultrapassar esta crença primária, esta investigação desenvolve um passaporte para a conservação sustentável dos edifícios com valor patrimonial. Este passaporte do edifício foi testado em diferentes edifícios com valor patrimonial, verificando a sua contribuição como ferramenta de apoio dos arquitetos aquando das avaliações de sustentabilidade, assim como para informar as decisões de reabilitação.

Os resultados desta investigação auxiliam a reabilitação de edifícios patrimoniais e o desenvolvimento de políticas de conservação sustentável, assim como a investigação focada na mudança comportamental para a conservação sustentável.

Prologue

Problem definition and goals

The analysis of the evolution of the concepts of heritage and sustainability demonstrates their common aim towards the conservation of valuable resources for future generations. The broadening of the concept of heritage, from single historical monuments (CATHM, 1931) to entire urban ecosystems (UNESCO, 2011), introduces a significant change in the impact of heritage for the sustainable built environment. While in the past, heritage buildings were considered a minority and, as such, protected as an exception, the tendency towards a '100% heritage' approach (Pottgiesser & Pereira Roders, 2020) suggests an increasingly fundamental role for sustainable development. This approach does not imply that the entirety of the built environment must be conserved. Instead, it means that all the resources inherited from the past that form part of our human habitat deserve a careful assessment to recognise their values for the future of society (Fairclough, 2009).

According to Pereira Roders (Pereira Roders, 2019), the concepts of heritage and waste represent the two contrasting extremes of the same scale: on one side, the discarded resources with no value, and on the other side, the valuable resources that one wishes to protect. The main factor determining which side of the scale the resources fall in is their value (Pereira Roders, 2019). The integration of the contribution to sustainability as value to preserve in heritage buildings reflects the complexity of the built legacy. It expands the traditional outstanding cultural and historical values by including social, environmental, and economic values in the evaluation process (Pereira Roders, 2007; Tarrafa Pereira da Silva & Pereira Roders, 2010). The integration of sustainability on heritage value assessments has the potential to "propel conservation, sustainable design, and waste management" (Ross & Angel, 2019) of a broader set of resources while ensuring its continuity for the future through dynamic processes.

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According to the European Commission, construction and demolition waste (CDW) represents more than a third of all waste generated in the EU (Bilsen et al., 2018). This context means that the EU is responsible for generating 850 million tons of CWD per year — 336 million excluding excavated soil (Villoria Sáez & Osmani, 2019). Between 2004 and 2014, Portugal had one of the lowest CDW generation rates in Europe, with an average of 187kg per capita, while the Netherlands had one of the highest CDW generation rates, with an average of 4150kg per capita (Villoria Sáez & Osmani, 2019). While the economic crisis and differences in the activity level between the two countries may explain the statistics (Villoria Sáez & Osmani, 2019), the numbers illustrate the impact of construction and demolition waste at the European level. Despite the high recycling potential of demolition waste, according to the European Environment Agency (EEA, 2020), around 17% of it ends up in a landfill (11%) or as backfilling (5.6%); and only about 3% to 4% of materials are used in the construction sector are secondary materials (Schut, Crielaard, & Mesman, 2015). Demolition statistics are hardly available (Holck Sandberg et al., 2016) but the building stock modelling in Europe shows a tendential increase in demolition rates over time. In the Netherlands, considering only the social housing sector, almost 100 000 buildings were demolished between 2000 and 2007 (Thomsen & van der Flier, 2010). Recent data from the Dutch Central Bureau of Statistics (CBS) shows that in the year 2020 alone, 11 523 buildings were demolished in the Netherlands (CBS, 2021). This data means that around 1 000 opportunities to conserve potentially valuable resources were wasted every month. A baseline assessment of the contributions of existing buildings for sustainability could avoid the destruction of resources and promote alternative futures for built heritage as part of waste management, circular economy, and material reuse processes (Ross & Angel, 2019).

While sustainability is nowadays part of the vocabulary on interventions dealing with existing buildings, it is still far from being a reality. The topic has been introduced in national and European norms and standards. Research has focused on developing tools and guidelines for good practices, and today's information is more accessible than ever before. However, defining principles is not enough – it is necessary to implement them (Council of Europe, 1975). So, despite the good intentions in the field, why are good practices of conservation of built heritage not yet widely implemented?

Acknowledging the need to recognise the behavioural factors affecting the decision-making process, this thesis aims to better understand the gap in the implementation of sustainable conservation intentions in built heritage from a practitioner's perspective. It proposes an innovative approach to this topic by adopting a psychological behavioural perspective to the challenges faced by designers in the conservation of built heritage. As a response to the identified problem, this thesis develops a tool to contribute to increasing knowledge and awareness of the value of built heritage to sustainability. Finally, this thesis aims at verifying the contribution of such a tool for behavioural change towards a more sustainable conservation of built heritage.

Research Questions

According to the defined aim, the main research question of this thesis is:

- How to improve designers' attitudes in order to achieve behavioural change towards a more sustainable conservation of built heritage?

The main question is deconstructed into several key questions, which are answered in the different chapters of this dissertation, as shown in the research outline in Figure 1.1.

Chapter 1:

- What is sustainable conservation?
- What is built heritage?
- How did the concepts of heritage and sustainability evolve over time?

This chapter presents the background of this dissertation. It consists of reviewing the fundamental concepts of heritage and sustainability to redefine sustainable conservation (Joana Gonçalves, Mateus, Silvestre, & Pereira Roders, 2021).

This review is based on the analysis of official documents from ICOMOS, United Nations, ISO (International Standard Organization), and ECS (European Certification Standards). It aims to further understand the relationships between the sustainable built environment and heritage conservation. It concludes that the two concepts share the same goal towards preserving the ecosystems for future generations. The results of this literature review serve as a steppingstone to build the common language in the heritage field, to objectively include sustainability as a primary factor in heritage conservation decisions.

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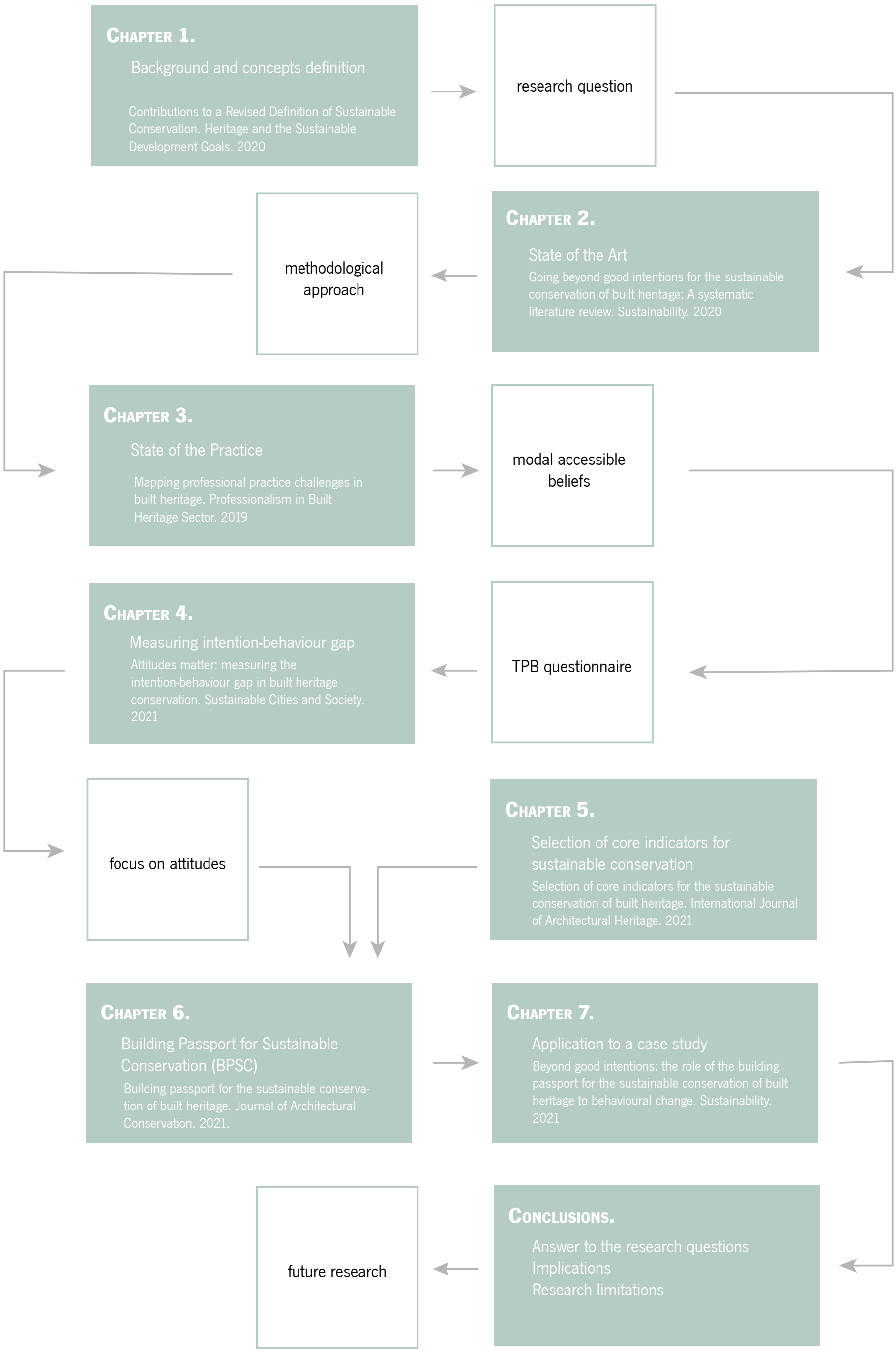

FIG. 1.1 Outline of the thesis

Chapter 2:

- How can the techniques of behavioural sciences support the identification of the main factors hindering the implementation of sustainable conservation practices in built heritage?
- How has the theory of planned behaviour (TPB) been used to promote behavioural change amongst practitioners in the field of sustainable conservation?

This chapter presents a systematic literature review on behavioural approaches for sustainable heritage conservation (Joana Gonçalves, Mateus, Silvestre, & Pereira Roders, 2020). It aims to understand how the models of analysis of human behaviour can be used to analyse the dissonance between intentions and implementation in sustainable conservation, particularly by using the TPB (Ajzen, 1991; Fishbein & Ajzen, 2011; Sheeran & Webb, 2016). The results confirm that this is an innovative line of research and that there are no previous studies analysing practitioners' behaviours. Earlier studies on residents and tourists demonstrate the potential of behavioural approaches to shed light on the latent critical factors affecting decisions. The answers to these questions contribute to further develop and support the methodological approach used in this research.

Chapter 3:

- What are the main problems that designers experience in built heritage conservation processes?
- What are the main opportunities they recognise in the processes?

The third chapter aims to understand the state of practice and identify the main challenges and opportunities practitioners face in built heritage conservation processes (Joana Gonçalves, Mateus, & Silvestre, 2019). The results show that practitioners currently have positive attitudes towards the contribution of heritage for sustainability. The results also highlight decision-making as a critical moment in the process. However, practitioners perceive low control over decisions, and they attribute the responsibility of failure in the implementation to other stakeholders (such as clients, builders, or legislators). The communication problems between different stakeholders are reinforced by the low availability of information and limited economic resources. The survey results and the focus group allowed to identify modal accessible beliefs that guide the following steps of the research.

Chapter 4:

- Which psychological constructs are hindering the implementation of sustainable conservation approaches in practice?
- Is there a gap between intention and implementation in a controlled environment with high perceived behavioural control?

Chapter 4 uses the TPB to measure the gap between designers' intentions towards heritage conservation and the actual design decisions (Joana Gonçalves, Mateus, Silvestre, Roders, & Braganca, in press). This study aims to verify the results of chapter 3 that suggest that the main reason for the lack of implementation of sustainable conservation practices is the low perceived behavioural control of practitioners. The hypothesis is that if the main factor is the perceived behavioural control (PBC), then in a controlled environment with design students, which have more creative freedom and fewer constraints imposed by norms and interaction with different stakeholders, the intention-behaviour gap should not exist. The results demonstrate that despite the influence of PBC and actual control in design decisions, attitudes have an essential role in predicting behaviour. Furthermore, despite the common goal of sustainability and heritage conservation and the positive attitude of practitioners identified in previous chapters, for design students, the incompatibility with sustainability standards is still one of the main reasons pointed out for not performing conservation as intended. These results provide the primary belief to be targeted in an intervention to improve designers' attitudes towards sustainable conservation.

Chapter 5:

- What are the common indicators in different sustainability assessment methods?
- What indicators to assess sustainability apply to existing heritage buildings?
- What are the essential indicators to cover the core aspects of sustainable development?

Chapter 5 focuses on selecting indicators for the sustainability assessment in heritage buildings during the pre-design stage (Joana Gonçalves, Mateus, Dinis Silvestre, Pereira Roders, & Vasconcelos, 2021). In this study, two building sustainability assessment (BSA) methods, VerSus (vernacular sustainable) and LBC (living building challenge (Hegazy, Seddik, & Ibrahim, 2017; Mileto, Vegas, Soriano, & Cristini, 2014), were comparatively analysed to identify common principles towards sustainable development. The results demonstrate that despite differences in the structure of the analysed tools, common categories emerge as priorities: site, energy, water, building solutions and materials, durability, indoor environment,

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community, and values. Furthermore, the cross-analysis with the international standards (ISO, 2011) for sustainability indicators allowed to systematise a concise set of 23 indicators covering the fundamental aspects of sustainable development applicable to existing single buildings. This set of indicators aims at supporting designers to identify the contribution of heritage buildings for sustainability. It is the basis of the building passport for sustainable conservation developed in this thesis.

Chapter 6:

- How can a core set of indicators for sustainability be integrated into a building passport to identify priorities and limits of acceptable change on built heritage conservation?
- How can the building passport target the challenges pointed out by practitioners in built heritage conservation processes?
- What is the effect of the building passport on designers' intentions and behaviours towards built heritage conservation?

Chapter 6 presents the integration of the core set of indicators, selected in chapter 5, in a building passport for sustainable conservation (BPSC) (Joana Gonçalves, Mateus, Silvestre, Pereira Roders, & Bragança, in press). This tool tackles the challenges pointed out by practitioners and presented in chapter 3 such as availability, complexity, and accessibility to information to support decision-making. At the same time, it targets attitudes of designers, and in specific, the belief that heritage conservation is incompatible with sustainability, as identified in chapter 4. The building passport was developed as an online and mobile devices friendly questionnaire that allows users to identify priorities and opportunities for redesign through a sequence of questions regarding the sustainability performance of the several building attributes. The application to a case study demonstrates the contribution of this tool to reach consensual results on a baseline assessment of sustainability on heritage buildings.

Chapter 7:

- What is the effect of the building passport on designers' intentions and behaviours towards built heritage conservation?

Chapter 7 analyses the application of the building passport to a case study, using the TPB. Design students working on heritage redesign projects answered the same TPB questionnaire developed and presented in chapter 4, aiming at measuring the intention-behaviour gap. Participants were divided in two groups (test and control), to ensure comparability of results. The test group answered the TPB questionnaire after applying the BPCS, while the control group did not apply the BPSC, and only answered the TPB questionnaire. This study allowed to identify the differences in the formation and intentions and behaviours of the two groups of participants. While no significant differences were found in the overall conservation behaviours, the analysis shows that the BPSC contributes to strengthen attitudes towards certain building attributes and to support more informed and targeted conservation decisions.

Finally, the conclusions answer the main research questions and provide recommendations for future research on the field of behavioural change for sustainable conservation of built heritage.

Theoretical framework and methodology

This research uses the Theory of Planned Behaviour (TPB) (Ajzen, 1991; Ajzen & Fisbbein, 1974; Fishbein & Ajzen, 2011) to analyse the intention-behaviour relationship (Sheeran & Webb, 2016) on designers' decisions towards a sustainable conservation of built heritage. This socio-psychological model has been applied in the last decades to predict and understand behaviours related to health (Budden & Sagarin, 2007; Chatzisarantis & Hagger, 2007; de Bruin et al., 2012; Ghany, Strader, Thomas, & Seeff, 2009), consumer decisions (Giampietri, Verneau, Del Giudice, Carfora, & Finco, 2018; Hansen, 2008; Vermeir & Verbeke, 2008), and pro-environmental behaviours (Nigbur, Lyons, & Uzzell, 2010; Paul, Modi, & Patel, 2016; Thoradeniya, Lee, Tan, & Ferreira, 2015).

At the core of this theoretical model is the notion that "the most important predictor of a person's behaviour is the intention to perform it" (Sheeran, 2002). The consistency between intentions and behaviours depends on the existence of "facilitating conditions" (Triandis, 1979). Understanding the factors affecting these facilitating conditions is essential to design effective interventions for participants to act on their positive intentions.

According to the TPB model, the diagram in figure X shows the elements that affect behaviours (Ajzen, 1991; Fishbein & Ajzen, 2011). Attitudes can be cognitive (conscious) or affective (unconscious). They represent feelings and internal beliefs in response to an object or situation and determine personal favourable and unfavourable evaluations. Subjective norms express beliefs about normative expectation resulting from external social pressures. This psychological construct includes factors as the potential to obtain approval, rewards, or punishment over the performance of a particular behaviour. Perceived behavioural control (PBC) refers to beliefs about factors that may impede the performance of the behaviour, expressing to which degree a person believes to have control over the situation and implement the behaviour. Factors affecting PBC include knowledge (to be aware of relevant information to perform the behaviour), ability (to have the necessary skills to perform the behaviour), resources (existence of the necessary means), availability (to have access to the necessary resources), opportunity (to have the opportunity to act), cooperation (to be able to negotiate with the different actors involved in the process), and unexpected situations (Sheeran, 2002).

While these three psychological constructs have an impact in the formation and implementation of intentions, attitudes and subjective norms tend to be moderated by PBC since, as stated by Sheeran (Sheeran, 2002), people “do not generally intend to perform behaviours that they perceive to be outside of their control”. According to this author, despite the role of subjective norms in determining intentions, self-chosen intentions resulting from personal beliefs are more likely to be successfully implemented. Intervention should thus be directed at the internal motivations of participants and at increasing the perceived behavioural control to empower the target group to perform the intended behaviours.

To identify the factors affecting the implementation of sustainable conservation intentions in built heritage, this research uses a mixed-methods approach, grounded on human-centred design, by focusing on a deeper understanding of the professional’s challenges, needs, and motivations community (IDEO.org, 2015). It consists of a four-phase pre-/post-experimental methodology, as proposed by Ajzen (Ajzen, 2006) and presented in the diagram in figure 1.2: the identification of modal accessible beliefs, the measurement of the intention-behaviour gap, the development of an intervention to tackle the identified gap, and the application of the intervention.

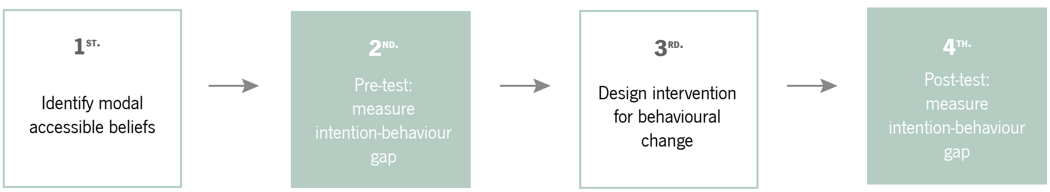

FIG. 1.2 Methodological steps to test an intervention to reduce the intention-behaviour gap

To recognise modal accessible beliefs, a pilot study was conducted, using an online survey to identify the main challenges faced by practitioners in the built heritage field (J Gonçalves, Mateus, Silvestre, & Vasconcelos, 2017). Following the survey, an international focus group discussion was organised to promote collective reflection (Joana Gonçalves et al., 2019). The discussion was structured around a user journey map, diagrammatically representing the processes of built heritage conservation and the interactions between multiple stakeholders to elicit challenges and priorities in the process (Risler & Ares, 2014).

In the second phase, the research population was narrowed down to architecture students of the Heritage & Architecture studios offered at the Faculty of Architecture and the Built Environment, at TU Delft, to isolate the factors affecting the gap between intention and behaviour (Joana Gonçalves, Mateus, Silvestre, Roders, et al., in press). Designers assumingly have more creative freedom in the educational context since they are not limited by interactions between multiple stakeholders and compatibility with normative regulations. These particular circumstances allow to verify the role of internal beliefs and, in particular, personal attitudes on the performance of sustainable conservation behaviours.

A TPB questionnaire was developed to measure the consistency between intentions and behaviours (Ajzen, 2002). The questionnaire included four main groups of questions. The first group focused on participants attitudes towards the attributes of the building; it focused on individual value assessments “I consider the attribute to be valuable/not valuable”. The second group of questions aimed at identifying subjective norms and the presence of social pressure over the performance of the conservation action, through the question “it is expected of me that”. The third group targets perceived behavioural control, focusing on self-efficacy (Sheeran, 2002): “it is easy for me to”. The fourth group of questions measures participants’ intentions towards the conservation of building attributes (“I intend to”). A month later, after the design process, students received a follow-up questionnaire on which they were asked to self-assess their design decisions (“in my design, I decided to”), reporting the level of conservation of the same list of building attributes.

In the third phase, a building passport for sustainable conservation was developed, targeting the challenges identified by practitioners and the factors affecting the intention-behaviour consistency identified in the second phase. This tool was developed through a comparative analysis of literature and sustainability indicators in BSA methodologies, using content and thematic analysis (Joana Gonçalves, Mateus, Dinis Silvestre, et al., 2021). According to their scope, the content analysis focused on describing and quantifying keywords and clustering indicators in common categories. The thematic analysis took an interpretative and qualifying approach, classifying indicators according to three variables from the ISO 21929, namely: the scale of analysis, life cycle stage, and core aspects for sustainability (ISO, 2011).

In the fourth phase of the research, the building passport was applied by Heritage & Architecture students in a redesign studio at TU Delft (Joana Gonçalves, Mateus, Silvestre, Pereira Roders, et al., in press). The same TPB questionnaire developed in the second phase (Joana Gonçalves, Mateus, Silvestre, Roders, et al., in press) was applied, to verify the effects of the building passport on participants' attitudes, subjective norms, perception of control, intentions, and behaviours. Due to the unexpected circumstances of the COVID 19 pandemic (Alderweireld et al., 2020; Meier et al., 2020), which forced switching from regular to online education, the results of the second and the fourth phase are not directly comparable. For this reason, the fourth phase of research divided the participants into two groups: the test group applied the building passport, followed by the TPB questionnaire. In contrast, the control group only answered the TPB questionnaire without using the building passport.

The four phases of research are preceded in this thesis by the state-of-the-art chapter, which uses a systematic literature review methodology to understand further how the TPB has been used to promote good practices on sustainable conservation of built heritage (Joana Gonçalves et al., 2020). The systematic literature review follows the PRISMA recommendations (Moher, Liberati, Tetzlaff, & Altman, 2010) to collect, organise, classify, and analyse the 1058 records identified in the Web of Science bibliographic database, using the keywords "heritage", "sustainability", and "behaviour".

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1 Sustainable Conservation

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ABSTRACT

The inclusion of Heritage in the global agenda for sustainable development has contributed to a broader discussion around the interconnection between heritage and sustainability. However, the definitions of both concepts lack consensus. In the last decade, hundreds of definitions of sustainability can be identified in the scientific literature. Often these definitions focus on different dimensions of sustainable development and do not cover the overlapping of social, economic, and environmental aspects. The indicators vary according to the main goal and/or specific building under assessment. Moreover, the concept/notion of heritage is understood as a social process based upon definitions and values, which are dynamic and evolve. During the last decades, there is growing attention for the integration of such comprehensive concepts and several frameworks have been developed. However, a systematic definition of the relation between the two concepts is lacking. Some authors even pointed out that the multiple approaches, too specific for each context, lack objectivity and reduce credibility. The main goal of this paper is to contribute to a revised definition of sustainable conservation at the intersection of these two concepts, based on a narrative review of the recent literature and international reference documents, developed by different organisations, such as ICOMOS, the United Nations, and the International Organization for Standardization and the European Committee for Standardization.

1.1 Introduction

Heritage and sustainability have traditionally been studied as separate concepts, by different disciplines. Codes, recommendations, and standards are being established with specific focuses and goals. Depending on the approach, heritage can be understood as either a vector for development (Janssen, Luiten, Renes, & Stegmeijer, 2017) or a victim of development (Unesco, 2015). Therefore, the role of heritage for sustainable development is not being embraced in its full potential (Bullen & Love, 2011).

Despite the increasing number of studies on Heritage and Sustainability, both concepts lack consensus on their definition, as well as on their relation. The integration of such comprehensive concepts in a common framework has been a recurrent challenge for several decades (Appendino, 2018; Berthold, Rajaonson, & Tanguay, 2015; Cinieri & Zamperini, 2017; Gharib, 2014; Guzmán, Roders, & Colenbrander, 2017; Landorf, 2011; Liusman, Ho, & Ge, 2013; Magrini & Franco, 2016; Norrström, 2013; Sehili, Chennaoui, & Madani, 2016; Tweed & Sutherland, 2007; Vehbi & Hoskara, 2009; Zamperini & Cinieri, 2013). However, there is still the perception that such a framework is still lacking (Appendino, 2018; Gharib, 2014; Guzmán et al., 2017; Landorf, 2011) and that the multiple approaches, too specific for each context, lack objectivity and reduce credibility (Berthold et al., 2015).

This paper presents the results of a review of the literature and international reference documents on the definitions of heritage conservation and sustainable built environment, to contribute to a revised definition of sustainable conservation.

1.2 Methods

The review on recommendations, standards, and codes was performed on the topics of heritage and sustainability, with a focus on the definitions of these main concepts. This review is divided into three parts: 1) the evolution of the concept of Heritage in the international charters, since the beginning of the 20th century; 2) the evolution of the concept of sustainability in international regulations and standards; and, 3) the integration of the two concepts in the documentation where both concepts were referenced.

This review aims to provide a better understanding of the several factors that the concepts of heritage conservation and sustainable built environment have in common. By understanding these concepts, further research can be developed for the definition of a framework on the contributions of heritage to a more sustainable built environment.

This review was performed by analysing official documents from ICOMOS, United Nations, International Organization for Standardization and European Committee for Standardization. Figure 1.1 lists the reviewed documents in chronological order. These illustrate the current international reference documents in the domains of heritage (top line), sustainability (bottom line) and both (middle line), in the scope of the built environment.

A sample of 32 documents on international recommendations for best practices, both in heritage and sustainability of the built environment, were analysed. The documents were examined by searching for the keywords “heritage”, “conservation”, “sustainable” and “environment”, in the glossary and terminology sections. If those sections were not available, the definitions of the concepts were deducted by content analysis of the integral documents. If the documents did not directly contribute to the theoretical evolution of the concepts, they were excluded from the analysis (Council of Europe, 1985; Icomos, 1987, 1994, 2003; ISO, 2013, 2014).

1.3 Results

1.3.1 Heritage conservation

The word “heritage” refers to an inheritance: something transmitted or acquired from a predecessor or passed down from previous generations (“Heritage,” 2019; Oxford University, 2019a). Since the 19th century, the concept has been used in the cultural sector, overcoming the limits of an individual inheritance to represent a collective legacy (Otero-Pailos, 2016).

Follows a comprehensive evolution of what is recognised as heritage, clustering the definitions of the most important international documents accordingly.

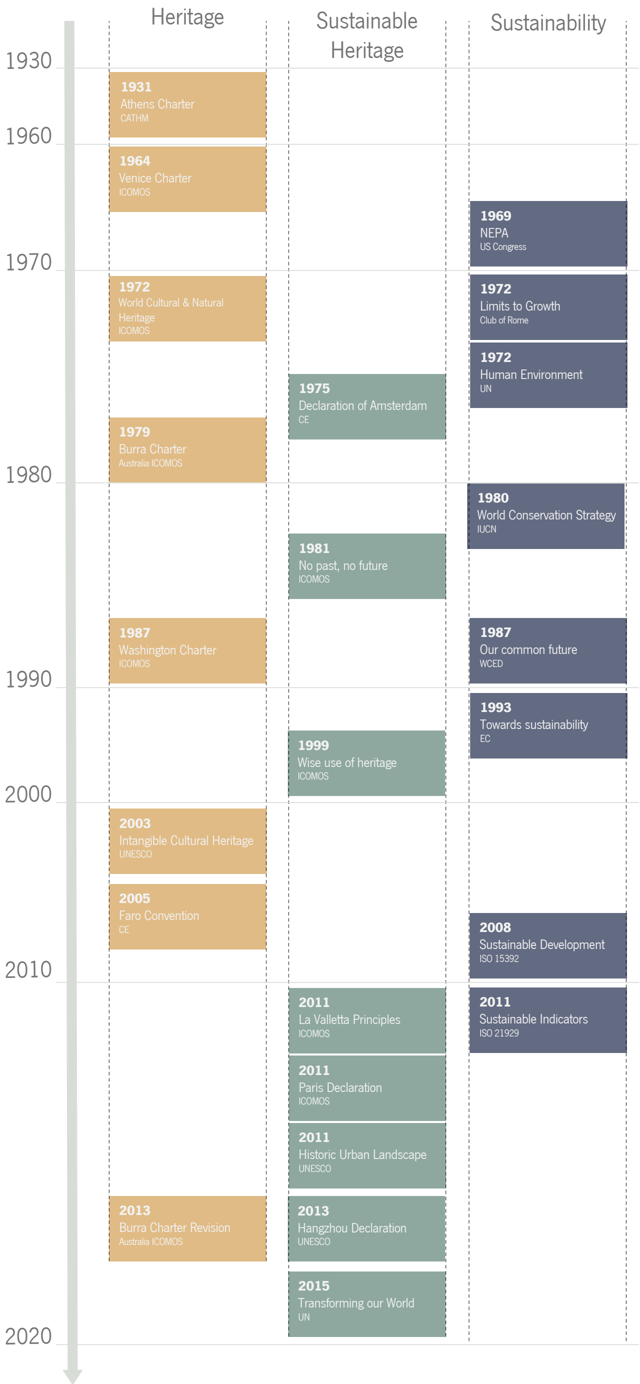

FIG. 1.1 Timeline of international documents on heritage and sustainability

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Heritage as monument

The Athens Charter for the Restoration of Historic Monuments (Athens Charter) (CATHM, 1931) was the first doctrinal document internationally ratified on the principles for heritage interventions. The concept of heritage was limited to historical monuments: particular buildings or human-made objects valuable for their historic or artistic interest. About 30 years later, the International Charter for the conservation and restoration of monuments and sites (Icomos, 1964) enlarged the concept of monuments to include the urban and rural settings, claiming the importance of smaller buildings as historic documents with their own value. Conservation is defined as “a common responsibility to safeguard [monuments] for future generations” (Icomos, 1964).

Heritage as place

In 1972, UNESCO integrated the conservation of natural and cultural heritage in the Convention concerning the protection of the World Cultural and Natural Heritage (Unesco, 1972). The definition of heritage was redefined to include buildings, groups of buildings and sites, natural or “combined works of nature and Man” (Unesco, 1972). In this shifting environment, the Guidelines for the Conservation of Places of Cultural Significance (Burra Charter) (Australia, 1979) aimed to clarify the terms used by experts to define cultural heritage. It uses the concept of “place” instead of the expression “monument”, to refer to all the “sites”, “areas”, “buildings” and “other works” with cultural significance (Australia, 1979). Conservation is the most integrative term, used to refer to all the actions taken to look after a place and retain its value.

Heritage as ecosystem

In 2003 a new concept to define “heritage” was introduced by UNESCO, to recognize the need to complement existing recommendations on cultural heritage with the concept of “intangible heritage” (Unesco, 2003). It includes practices, knowledge and skills, developed for communities through generations as a response to environment and nature. The Convention for the Safeguarding of the Intangible Cultural Heritage (Unesco, 2003) is the pivotal document that would influence the subsequent policies of heritage management (Australia, 2013; Council of Europe, 2005; Icomos, 2011b; Unesco, 2011). In the latest revision of the Burra Charter – The Australia ICOMOS Charter for Places of Cultural Significance (Australia, 2013), “place” is still the broader expression used to define “heritage”.

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However, while the original version was focused on the fabric – the physical attributes of the "place" - the revision states the importance of considering that value is also embodied in the associations – the connections between people and place. The Framework Convention on the Value of Cultural Heritage for Society (Council of Europe, 2005) systematises an inclusive concept of heritage as "a group of resources inherited from the past", that shape a unique urban ecosystem (Unesco, 2011). With this broadening of the concept, the Recommendation on the Historic Urban Landscape (HUL Recommendation) introduces a new approach no longer defined by categories of "Heritage", but recognising "a historic layering of cultural and natural values and attributes" in the hole human environment, formed by the broader urban context and its geographical setting (Unesco, 2011).

1.3.2 Sustainable environment

The word "sustainable" refers to a state in which something is maintained and continued for a long period (Oxford University, 2019b; "Sustainable," 2019). The origin of the concept, as it is commonly used nowadays, associated with responsible use of resources for balanced development, dates to the 1950s. This section presents the origins of the concept "Sustainability", along with the relationship established with the evolving concept "environment".

Sustainability of the human environment

In the United States, the National Environmental Policy Act (NEPA) (U.S.Congress, 1969) was one of the first national environmental policies worldwide. It aimed at promoting "general welfare" by maintaining the harmony between man and nature for present and future generations. This harmony between nature and the human-made environment was later designated as "Human Environment" by the United Nations (UN, 1972). It includes the natural environment – comprising water, air, land, fauna and flora – and the built environment that constitutes the setting where people work and live.

Sustainability of the living resources

In 1972, the Club of Rome envisioned a world system capable of ensuring ecologic and economic stability in the future, without "sudden and uncontrollable collapse" (Meadows, Meadows, Randers, & Behrens Iii, 1972), in the Report on The limits to growth. “Sustainability” is used to define a state of equilibrium between economic growth and natural resources. Also, the World Conservation Strategy (IUCN, 1980) uses the word “sustainable” in the sense of a balance between humanity and the planet - the living resources and the non-living resources on which they depend. It states that sustainability is not possible without conservation. While ‘development’ aims at achieving human goals using resources, ’conservation’ aims at achieving them “by ensuring that such use can continue” (IUCN, 1980). A few years later, the Brundtland Report - Our Common Future (WCED, 1987) established the most accepted definition of sustainable development: “development that meets the needs of the present without compromising the ability of future generations to meet their own”. Development is understood as a process of change that has as a major objective the satisfaction of human needs and aspirations, in three dimensions: economic, social and environmental. “Environment” is defined as the result of the interrelationship between people and natural resources, that “doesn’t exist as a sphere separated from human actions, ambitions and needs” (WCED, 1987).

Sustainability of the built environment

Stating that standardisation is needed to “establish a common basis for communication” (ISO, 2008) between the different stakeholders, the ISO 15392:2008 - Sustainability in building construction — General principles establishes general principles for the adaptation of sustainable development to the building construction sector. “Built environment” is defined as the “collection of man-made or induced physical objects located in a particular area or region; including buildings, landscape, infrastructure and other construction works”, but refers the importance of embracing the human dimension, considering communities, traditions, health and comfort and social equity (ISO, 2008). The standardised definition of sustainable development goes back to the definition of the Brundtland report (WCED, 1987) , detailing, however, that it concerns “all resources providing a better quality of life”. Sustainability is defined as “a state in which components of the ecosystem and their functions are maintained for the present and future generations” (ISO, 2008). Till today, this definition is the basis of several international regulations and standards (CEN, 2010; ISO, 2011, 2017).

1.3.3 Sustainable conservation

This section presents how the concepts of “heritage conservation” and “sustainable built environment” have been linked over time.

Integrated Conservation

Despite focusing on the natural environment, the NEPA from 1969 (U.S.Congress, 1969) states the need to preserve important historical, cultural and natural heritage, to safeguard the harmony between man and nature. Only that can ensure an environment that supports diversity and variety of individual choice for all citizens. Heritage, built and natural, is understood as part of the environment. Also, the European Charter of the Architectural Heritage (Council of Europe, 1975) defines “heritage” as an irreplaceable expression of wealth and diversity. It introduces the concept of integrated conservation, defined as the responsibility of passing this resource to future generations. The No past, no future Assembly (Icomos, 1981) highlighted the need for a higher awareness of the world to adapt to new conditions for a more balanced life. By introducing priorities as the conservation of energy, use of endogenous materials and methods and appropriate technology, it states that the study of man’s history and the contribution of heritage for a better quality of life is part of an environmental policy to improve the relationship between man and nature.

Management of change

The Wise Use of Heritage Assembly (Icomos, 1999) outlined that the key objective of both sustainable development and urban conservation is to manage change for the survival of humanity. Urban sustainable development must include economic, social, environmental and cultural dimensions to “offer economic opportunities, provide the context for social cohesion, ensure a safe and healthy habitat, as well as reinforce the sense of place and the sense of identity of its residents” (Icomos, 1999). Heritage is defined as second nature – the physical environment resulting from the tangible and intangible relationships between man and nature. It states the urgency to include urban conservation in the principles of sustainable development, considering heritage as an irreplaceable resource for present and future generations. Heritage is understood as an essential resource of the urban ecosystem, composed of tangible and intangible elements. To ensure the harmonious development of historic towns and their settings – the natural and human-made contexts, the goal of conservation is the management of change on the natural, built and social environment, to provide for a better quality of life and enhance valuable resources.

Conservation as sustainability

The Paris Declaration on heritage as a driver of development (Icomos, 2011a) stated that development is not to achieve economic growth but to achieve “a more satisfactory intellectual, emotional, moral and spiritual experience”. Heritage is defined as a crucial, non-renewable resource for present and future generations. Culture contributes to social cohesion and well-being and “must be integrated as the fourth pillar of sustainable development, alongside the economic, social and environmental pillars” (Icomos, 2011a). Despite the title “heritage as a driver of development”, heritage is not understood in its contributions for the three dimensions of sustainability, but as a separate factor. Instead of a separate pillar of sustainability, the Hangzhou Declaration: Placing Culture at the Heart of Sustainable Development Policies (Unesco, 2013) positions culture at the heart of sustainable development. Heritage is defined as an enabler of sustainability, a resource for innovative solutions, knowledge capital and an economic asset. It outlines the contributions of heritage for a more inclusive social development, for the reduction and poverty and economic development, and to promote environmental sustainability and reduce the environmental footprint of societies. Instead of the isolated protection of architectural buildings/elements, the HUL Recommendation fosters the conservation of the overall urban setting (Unesco, 2011). The definition of sustainability is integrated and inseparable of the concept of conservation, attained by a “balanced relationship between the urban and the natural environment, between the needs of present and future generations and the legacy from the past” (Unesco, 2011). Assuming that the principle of sustainable development provides for the preservation of existing resources, it states that the protection of urban heritage is a condition sine qua non for sustainable development.

The Sustainable Development Goals (SDG)

In 2013, the Hangzhou Declaration targeted directly the post-2015 UN Development agenda to consider culture “in equal measure with human rights, equality and sustainability” (Unesco, 2013). Despite all the recommendations that since the 1970s reflected on the links between heritage and sustainability, only in 2015 the world leaders in the United Nations adopted the Sustainable Development Goals (SDG), that mention cultural heritage as part of a goal concerning the sustainability of cities (UN, 2015). Accordingly, the importance of “protect and safeguard the world’s cultural and natural heritage” contributes to making “cities and human settlements inclusive, safe, resilient and sustainable” (UN, 2015).

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1.4 Contributions for a sustainable conservation terminology

From the review of the links between heritage conservation and sustainable built environment, it is concluded that the latter has been more integrated by the domain of the former than the other way around, mostly in international expert recommendations and guidelines. From the analysis of the literature, some integrative definitions can be derived.

1.4.1 To a revised concept of heritage conservation

It is possible to recognize a shift in the meanings of the semantic evolution of the concept of "Heritage" (Figure 1.2), by analysing its definitions since the Athens Charter (CATHM, 1931). This starts with the inclusion of single architectural monuments, passing through the gradual inclusion of surroundings, to a more comprehensive concept based on a holistic and integrative urban ecosystem, composed of material and intangible elements, valuable for future generations. As stated by Howard (Howard, 2003), heritage is "anything that someone wishes to conserve and to pass on to future generations". Two elements are certain and recurring in the definitions across time: heritage is about resources inherited from the past; conservation is about transmission for future generations.

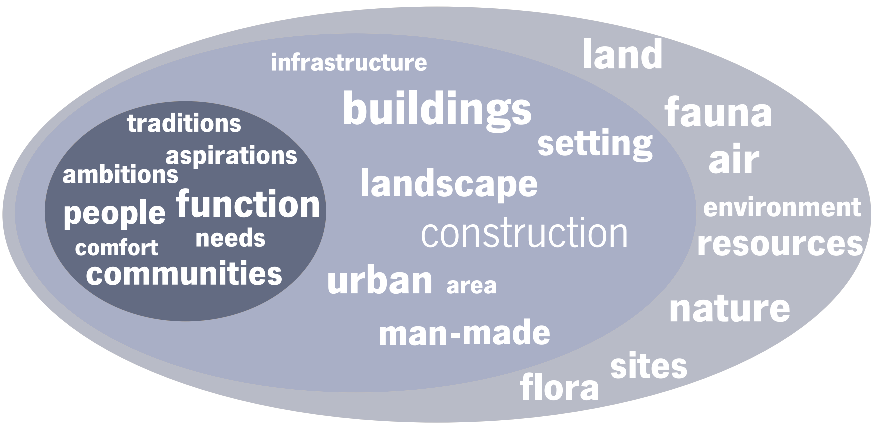

FIG. 1.2 Concept of "Heritage", including intangible (dark), tangible, and natural (light) elements

Based on this analysis, the following definitions are presented:

- Heritage: a group of resources inherited from the past that communities wish to pass on to future generations. It is an ecosystem, that includes tangible and intangible dimensions, as a result of the interaction between nature, fabric and people through time;
- Conservation: includes all the processes of looking after heritage, as the ecosystem inherited from the past, to retain its value for future generations. It may include different actions, such as maintenance, preservation, restoration, reconstruction or adaptation.

1.4.2 To a revised concept of sustainable environment

The semantic evolution of the concept “sustainability” (Figure 1.3) confirms the broadening of the concept of “environment” with gradual inclusion of tangible and intangible attributes that contribute to a better quality of life. As stated by Kristinsson, “sustainable is everything that future generations want to inherit, use and maintain (Yanovshtchinsky & van den Dobbelsteen, 2013). Two elements were kept constant in the definitions across time: the environment is made by living and non-living resources; sustainability is about preserving those resources for future generations.

FIG. 1.3 Concept of “Environnment”, including intangible (dark), tangible, and natural (light) elements

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Based on this analysis, the following definitions can be extracted:

- Environment: concerns the interrelationship between people and natural resources, the built environment and the human sphere. It includes all the resources providing a better quality of life;
- Sustainability: state of equilibrium in which the components of the ecosystem - comprised by nature, humans and built environment, and its functions are maintained for present and future generations.

1.4.3 To a revised concept of sustainable conservation

Originally, heritage was understood as part of the environment, with a growing relationship with the social dimension of sustainability. Gradually, it was recognised that heritage is cross-cutting to the three dimensions of sustainability: it is an economic asset, it is knowledge capital on how to cope with the natural environment, and it provides for social cohesion and a better quality of life.

In the analysed documents, it is possible to identify the evolution in heritage planning as defined by Janssen et al. (Janssen et al., 2017). Heritage and sustainability evolved from a sectorial approach – being tackled as two separate domains, to a factor approach – with heritage being considered as one of many factors that contribute to sustainability. Lately, the vector approach, where heritage is considered as a driver for development, can be identified in the international recommendations such as the HUL Recommendation (Unesco, 2011) and the Hangzhou Declaration (Unesco, 2013).

The reference to cultural and natural “heritage” in the Sustainable Development Goals (UN, 2015) is expected to promote reform in the field of heritage planning in practice, by introducing the topic into supra-national governance, and expect local implementation. However, it is still partial compared to other international documents on heritage (Icomos, 2011a, 2011b; Unesco, 2011, 2013) and sustainable built environment (ISO, 2008) – going back to a factor approach. It does not recognise the contributions of heritage in its full potential, from the perspective of the three dimensions of sustainability, but only on its protection by the state parties. The UN’s Sustainable Development Goals (2015) added very little to what was already stated in the American NEPA in 1969 (U.S.Congress, 1969).

Based on this analysis, the concept of “sustainable conservation” was defined. Considering the evolution of the concepts of heritage and sustainability, but also the way they have been interrelated in the last decades, it is possible to derive the following definitions:

- Heritage environment: concerns the irreplaceable and non-renewable resources that form the overall urban ecosystem, with natural, tangible and intangible elements (Figure 1.4). It is an economic asset, knowledge capital and it ensures a better quality of life for present and future generations;
- Sustainable conservation: concerns the processes of management of change of the ecosystem inherited from the past, so its resources can benefit present generations while retaining its value for future generations.

FIG. 1.4 Merging the concepts of Heritage and Environment

1.5 Conclusions

The revision of the concepts of “heritage” and “sustainability” evidence that there are several commonalities between the two concepts: both involve the ecosystem inherited from the past, resulting from the interaction between people and nature through time, comprising tangible and intangible attributes that enable a better quality of life.

Also, the relationship between conservation and sustainability becomes clearer, since the two concepts share the same goal: to preserve the ecosystems for future generations. While conservation focuses on the past – safeguarding resources from the past for future generations – sustainability focuses on the present: ensuring that those resources (that are inherited from the past) are of benefit for present generations while retaining its value for the future. Using the two concepts together – sustainable conservation - results in an extension of their boundaries, defining balanced management of change that recognises the inheritance of the past, its benefits for the present, and the legacy for the future.

Finally, the results of this study are an invitation to produce further investigations with an expanded focus on the indicators and values for sustainable conservation. Hence, this study can be used as a stepping-stone to build a common language to objectively consider sustainability in well-founded decisions in heritage conservation.

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2 Going beyond good intentions

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ABSTRACT

This research addresses the performance gap between intentions towards a sustainable conservation of built heritage and its actual implementation. Socio-psychological models of human behaviour, such as the theory of planned behaviour (TPB), have been studying this dissonance between intention and behaviour, and allow to recognise latent critical factors. This paper provides a systematic literature review of research publications on the intersection of the topics of human behaviour, heritage, and sustainability. It aims to analyse how the TPB has been used in the field of sustainable conservation of built heritage. The studies are categorised according to the type of heritage, main actors targeted, aims, and methodology. A total of 140 publications were analysed. The results show a recent field of research. In the domain of built heritage conservation, behaviour is commonly addressed as a synonym of performance, targeting the building itself. Most publications relating socio-psychological constructs of behaviour and heritage sustainability can be found in the tourism and hospitality field, focusing on tourists' and residents' behaviours. The review shows that practitioners are still absent from the literature. However, research addressing other stakeholders shows that the theoretical framework can play an important role in the implementation of sustainable conservation practices in the built heritage.

2.1 Introduction

The inclusion of heritage on the global agenda for sustainable development (UN, 2015) has raised awareness for the importance of bridging the concepts of heritage and sustainability. Today, the concept of sustainable conservation can be defined as an extension of sustainable development, recognizing the value of the inheritance from the past for present and future generations (Gonçalves, Mateus, Silvestre, & Roders, 2019). As stated by the Recommendation on the Historic Urban Landscape, heritage conservation is a condition sine qua non for sustainable development (Unesco, 2011).

As a driver of sustainable development (Zamperini & Cinieri, 2013), the benefits of heritage range from improving social cohesion and wellbeing (Icomos, 1999) to contributing to local economies as a focus of attractiveness and economic growth (Icomos, 2011a). But significant contributions can also be found on the environmental dimension, as heritage is a knowledge capital on how to cope with the environment (Unesco, 2013), on circular economy and/or on reduced carbon footprint (Icomos, 2011b).

In the last decades, many studies have focused on the different connections between heritage and environmental sustainability. These studies highlighted the benefits of traditional passive solutions for energy efficiency (e.g., (Fernandes, Mateus, Gervásio, Silva, & Bragança, 2019; Gonçalves, Mateus, & Ferreira, 2014; Posani, Veiga, & de Freitas, 2019)), the advantages of natural materials for healthy indoor environments (e.g., (Pacheco-Torgal & Jalali, 2012)), or the effectiveness of resilience strategies to face natural hazards (e.g., (Mendes & Lourenço, 2009; Ortega, Vasconcelos, Rodrigues, Correia, & Lourenço, 2017)). Tools to support decision-making have been developed to encourage design decisions to integrate economic aspects, cultural significance, and environmental performance (Havinga, Colenbrander, & Schellen, 2019; Ornelas, Miranda Guedes, Sousa, & Breda-Vázquez, 2020; Pereira-Roders, Post, & Erkelens, 2008). However, despite the information, standards and tools already developed, a common question still emerges in the literature: why are sustainable conservation approaches not more widely implemented in the built heritage field (Appleton, 2003; Vandesande, 2017; Veldpaus et al., 2016)?

This research aims at contributing to going beyond good intentions towards the sustainable conservation of the built heritage (Albert, Bandarin, & Roders, 2017). It uses a systematic literature review to understand how behavioural sciences, which for long proved the correlation between intention and behaviours

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(Ajzen, 1985, 1991, 2002; Ajzen, Czasch, & Flood, 2009; Ajzen & Fisbbein, 1974; Sheeran & Webb, 2016), can support the identification of the main factors that are today undermining the implementation of sustainable conservation practices in the built heritage.

2.1.1 Theoretical Framework

The intention–behaviour gap is addressed in psychology as cognitive dissonance. Sociopsychological models, such as the theory of reasoned action (TRA (Ajzen & Fishbein, 1970)) and the theory of planned behaviour (TPB (Ajzen, 1991)), are based on the premise that "the immediate antecedent of behaviour is the person's intention to perform the behaviour" (Ajzen, 1991). However, these theories also recognise that intentions and behaviour do not always match, due to low facilitating conditions and to intervening events (Ajzen & Fisbbein, 1974; Triandis, 1980). Understanding these facilitating conditions is essential to design effective interventions, where participants implement their positive intentions, since the gap between intention and behaviour can mainly be attributed to inclined abstainers, meaning persons who intend to act, but fail to implement their intentions (Sheeran, 2002; Shirokova, Osiyevskyy, & Bogatyreva, 2016).

According to the Theory of Planned Behavior (Ajzen, 1985, 1991), intentions are influenced by three considerations: 1) beliefs about consequences of an action, determining favourable or unfavourable personal evaluations (attitude); 2) beliefs about normative expectations, resulting from external social pressures (subjective norm); and 3) beliefs about factors that may impede performance, or the perceived behavioural control (PBC). Although these aspects may impact the actual performance of intentions, attitudes and subjective norms tend to be moderated by perceived behavioural control, since "participants do not generally intend to perform behaviours they perceive to be outside their control" (Sheeran, 2002). Knowledge, ability, resources, availability, opportunity, and cooperation are the main factors affecting the perception of control (Sheeran, 2002).

To secure intention implementation, "people need to initiate, maintain and close goal pursuit" (Sheeran & Webb, 2016), and challenges may be found in the three steps. According to Pieters and Zeelenberg (Pieters & Zeelenberg, 2005), intention–behaviour inconsistency induces regret in abstainers, as an indicator of a failed decision process. While good intentions alone may not be sufficient to change behaviours, high levels of perceived behavioural control are more likely to be converted to performance (van Hooft, Born, Taris, van der Flier, & Blonk, 2005).

According to Sheeran (Sheeran, 2002), even if external pressures (i.e., obtaining approval, rewards or punishment from others) have a role in determining intention, self-chosen intentions resulting from personal beliefs are more likely to be successfully implemented. Thus, interventions should be directed to the internal motivations of participants and to increasing the perceived behavioural control, empowering the target group acting on the specific factors that are affecting performance.

The TRA and the later extended TPB define a framework with a limited set of psychological constructs (attitudes, subjective norms, perceptions of control, intentions) that can be used to predict and understand behaviours in multiple domains. While the behaviour itself is domain-specific, and defined in the scope of each specific research, Fishbein and Ajzen (Ajzen & Fishbein, 2010) suggest that the basic four psychological constructs can be applied, as long as they are defined in a consistent way (focusing the same action and target, in the same context, at the same time). These models to analyse and predict behaviours have been frequently used in the scope of health-related behaviours, such as medication, self-examination or nutrition (Budden & Sagarin, 2007; Chatzisarantis & Hagger, 2007; de Bruin et al., 2012; Ghany, Strader, Thomas, & Seeff, 2009), and to understand consumers' decisions in market studies (Fennis, Adriaanse, Stroebe, & Pol, 2011). More recently, the scope was broadened to studies on entrepreneurship (Shirokova et al., 2016), job search decisions (van Hooft et al., 2005), or sustainable consumption patterns (Paul, Modi, & Patel, 2016; P. Wang, Liu, & Qi, 2014).

In the context of a sustainable built environment, the TPB has been used to profile users according to predictable behaviours, to establish recommendations and policies for planning and design. Sang, Yao, Zhang et al. (Sang et al., 2019) identified the factors affecting consumers' willingness to buy green-labelled houses. It showed that internal psychological factors play a role side by side with design and government measures for implementation (Sang et al., 2019). Du Toit, Wagner and Fletcher (Du Toit, Wagner, & Fletcher, 2017) profiled householders based on their recycling behaviours and housing type, identifying critical factors behind the practices. Ortiz and Bluyssen (Ortiz & Bluyssen, 2018) profiled home occupants based on their energy consumption patterns, creating a tool that allows interventions to be better tailored to specific user needs.

This paper presents a literature review of studies that use the methodological insights of behavioural sciences to address challenges related to heritage conservation, and more specifically to its sustainability. The main goal is to grow understanding of how the TPB can be applied to promote the implementation of good practices on sustainable conservation of built heritage, going beyond good intentions.

2.2 Materials and Methods

This research follows a systematic literature review methodology (Boland, Cherry, & Dickson, 2017; Moher, Liberati, Tetzlaff, Altman, & Group, 2009), aiming at answering the question of how the TPB has been used to instigate practitioners' behavioural change in the field of sustainable conservation of built heritage.

Data were searched for on Web of Science bibliographic database, on June 16th 2020, considering the presence of key terms in "all fields." A scoping search on the Web of Science bibliographical database focused on the specific topic of the application of the TPB in the field of heritage and sustainability (heritage AND theory of planned behav* AND sustain*) results in only 14 publications. To attain a more complete picture of the field, the main search uses broader search syntaxes: "heritage AND sustain* AND behav*", "heritage AND sustain* AND intention", and "heritage AND theory of planned behav*". Given the low quantity of results obtained during the process, no limitations were applied regarding date or type of publication, allowing to understand tendencies on how this issue has been explored in the last decades.

The data extraction was organised in a sequential selection of publications (Figure 2.1), with different inclusion and exclusion criteria. In the first step, the 1058 results obtained using the search syntaxes were filtered according to scope. Duplicates were eliminated, as well as publications considered out of the scope of this research. Papers were included when they mention "heritage" or semantically related expressions, such as "historical buildings", "monuments", or "cultural value". When the use of the keywords "heritage" and "intention" was found circumstantial and not fundamental (for instance "the intention of the paper is"), papers were also excluded. No requirements were applied to the meaning of "behaviour" at this stage. It resulted in a total of 506 publications, after eliminating duplicates.

In the second step, data were organised and classified in data extraction tables and excluded from further analysis if they were not related to human behaviour, and if they were not published in English.

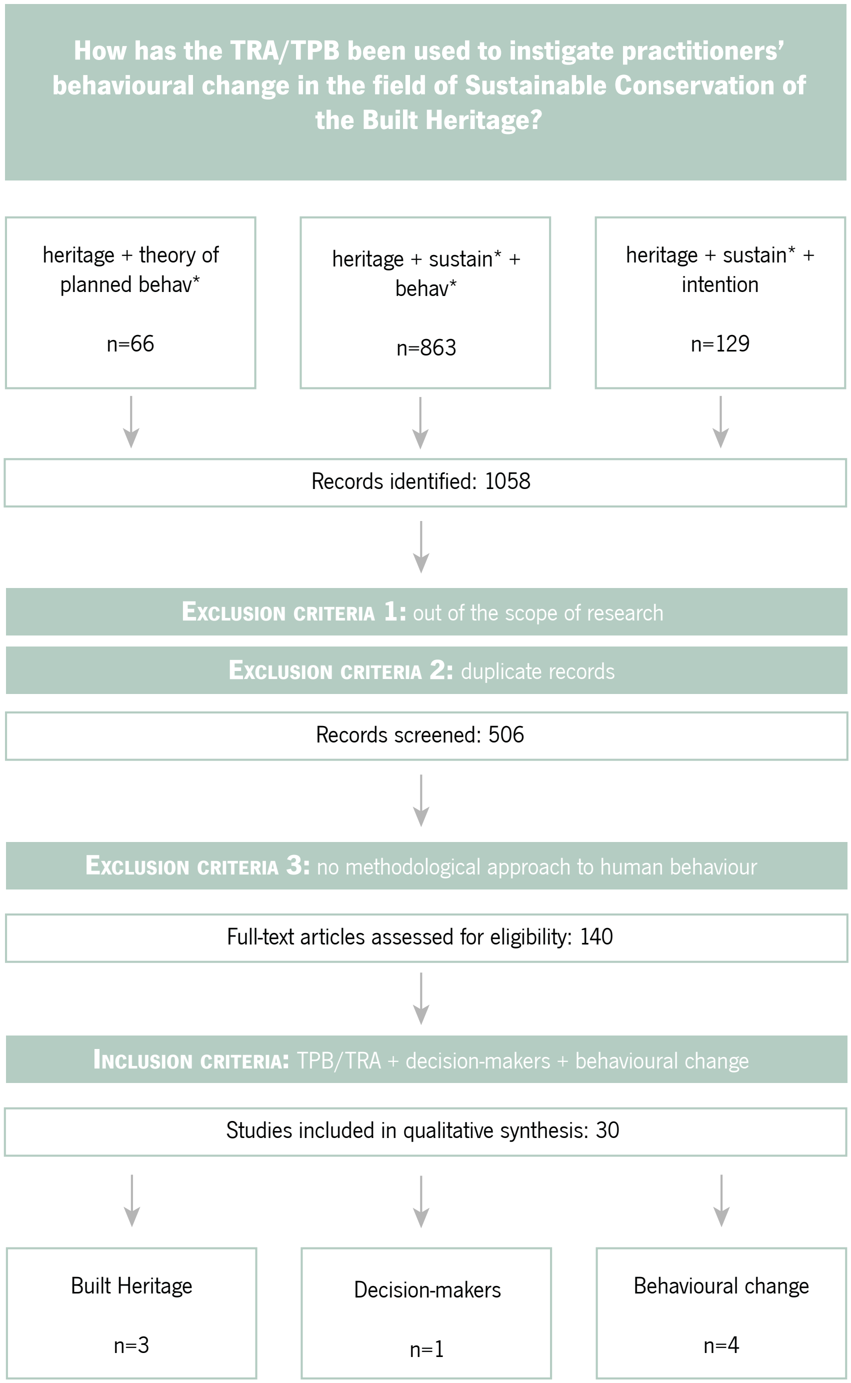

FIG. 2.1 PRISMA flow diagram with inclusion and exclusion criteria for the selection of literature

In the third step, the 140 remaining publications were analysed considering, as key variables, type of heritage; type of stakeholder; aims and methodology. Lastly, 30 studies with clear methodological frameworks related to the TPB or the TRA, behavioural intentions, behavioural change, and decision-makers were analysed in-depth, considering study scale and sample, and conclusions. From these studies, 4 were related to behavioural change, 3 to built heritage, and only 1 focused on decision-makers.

2.3 Results

2.3.1 General Overview

From the selected 506 papers, almost a third (154 papers) were related to built heritage. However, only 33 of those refer to human behaviour. In the 121 remaining publications about built heritage, the term behaviour was used to refer to the building's performance: either structural behaviour or hygrothermal and energy behaviour.

Therefore, building performance in the built heritage context is tackled as: 1) Structural behaviour (representing 44% of the publications about built heritage) which includes seismic vulnerability assessment of existing buildings (e.g., (Ferreira, Mendes, & Silva, 2019; Fumo, Formisano, Sibilio, & Violano, 2018; Mongelli, Bellagamba, Iannone, & Bracco, 2018; Valluzzi, Calò, & Giacometti, 2020)), structural health monitoring (e.g., (Barsocchi et al., 2020; Marzouk, 2020; Papa & Taliercio, 2003; Roselli et al., 2018)), or mechanical properties of construction materials (e.g., (Costa, Arduin, Rocha, & Velosa, 2019; Freire, Veiga, Santos Silva, & Brito, 2019; Matias, Faria, & Torres, 2014; Sáez-Pérez, Durán-Suárez, & Brummer, 2018; Yokoyama et al., 2009)). 2) Hygrothermal and energy performance of buildings (representing a quarter of the publications on built heritage); integrates publications about bioclimatic strategies (e.g., (Balaguer, Mileto, Vegas López-Manzanares, & García-Soriano, 2019; Hanie, Nina, & Mohammad, 2011)), strategies for energy renovation (e.g., (Carranza, Lanzarote, Madrigal, & Francés, 2014; D'Aprile, Bicco, Gambardella, & Gambardella, 2012; Musso & Franco, 2014; Roberti, Exner, & Troi, 2018)), or hygrothermal performance of traditional building systems (e.g., (Biseniece et al., 2017; Hamard, Cazacliu, Razakamanantsoa, & Morel, 2016; Litti, Khoshdel, Audenaert, & Braet, 2015; Sahin, Coşkun, Arsan, & Gökçen Akkurt, 2017)).

In parallel with the use of the concept of behaviour as performance, the findings also show the use of the concept as background or factor. In 10% of the cases, human behaviour is mentioned as the publication background, referring, for instance, to past behaviours of a community in the scope of archaeological research (Clark et al., 2020). In 19% of the cases, behaviour is recognised as a factor that can influence the findings. As examples, Mutani et al. mention that “energy models should take into account also the urban morphology, people’s behaviour, social and economic conditions, local and national regulation, and the use of outdoor public spaces” (Mutani, Todeschi, Kampf, Coors, & Fitzky, 2019); while Galvin et al. state the need to consider “consumer behaviour issues such as the rebound effect” for sustainable thermal retrofit of existing buildings (Galvin & Sunikka-Blank, 2017). However, the topic is not explicitly addressed in those studies, highlighting the importance of further research from a behavioural perspective.

The findings show that this is a recent field of research. Around 40% of the results were published since 2018; 75% after 2015. Publications before 2008 are only residual (less than 4%). There is a great geographic diversity in the origins of the publications, with Italy (15%) and China (10%) leading the results. However, most publications (63%) from southern Europe (Portugal, Spain, and Italy) use behaviour to refer to the building’s performance, leaving China and Australia as the major contributors in the topics of human behaviour, heritage, and sustainability. In the same way, the exclusion of papers that consider behaviour as performance results in a significant reduction of the papers in the research field of engineering, and building technology and construction, falling from 32% to only 9% of the overall selection. The selected publications are concentrated on the research fields of social sciences (39%), science and technology (30%), and environmental sciences and ecology (27%). A resulting set of 140 publications with a methodological approach to human behaviour in the scope of sustainable heritage was further analysed in the following section.

2.3.2 Methodological Approaches to Human Behaviour

Aims

By analysing the aims of the studies, a total of 23 common themes emerged, showing the predominant focus of studies in certain actors and objectives, as shown in Table 2.1.

TABLE 2.1 Thematic analysis of the main constructs and main aims identified in the literature

Actors	Main Construct	Aim	%
Residents (n = 38)	Attitudes towards tourism	Measure residents' attitudes towards heritage tourism	6%
	Intentions towards tourism	Measure residents' intentions to support tourism	6%
	Value recognition	Measure residents' awareness of heritage values	5%
	Pro-environmental attitudes	Measure residents' pro-environmental attitudes	3%
	Conservation behaviours	Identify factors affecting the conservation of natural and cultural heritage	3%
	Willingness to pay	Residents' willingness to pay for the preservation of values	2%
	Segmentation	Profile residents based on behavioural characteristics	1%
	Integration behaviour	Measure residents' urban integration and willingness to relocate	1%
Tourists (n = 79)	Satisfaction	Measure tourists' satisfaction in heritage destinations	11%
	Spatial behaviour	Identify travel and movement patterns	7%
	Behavioural intentions	Identify factors affecting tourists' behavioural intentions	6%
	Willingness to pay	Measure tourists' willingness to pay for the preservation of values	5%
	Segmentation	Profile tourists based on behavioural characteristics	5%
	Perceptions	Assess tourists' perceptions of heritage experiences	5%
	Intention to revisit	Measure tourists' intention to revisit	5%
	Attitudes	Assess tourists' attitudes towards heritage destinations	4%
	Behavioural change	Persuasive communication and information to change tourist behaviour	4%
	Consumption behaviour	Measure factors affecting consumer decisions	3%
	Well-being	Measure the effect of visit in tourists' psychological wellbeing	2%
Business (n = 9)	Business intentions	Factors affecting entrepreneurial behaviour	5%
	Behavioural change	Increase pro-environmental behaviours	2%
	Perceptions	Measure perceptions of investors	1%
Decision-Makers	Decision-making behaviour	Factors affecting decision-making behaviour	2%
Others			3%

Almost a quarter of the publications (22%) are related with behavioural intentions: either measuring factors affecting tourists' cultural intentions (e.g., (Goldberg et al., 2016; Nian et al., 2019; Ramkissoon, 2015; Ramkissoon & Uysal, 2011)) and intention to revisit a destination (e.g., (Bergel & Brock, 2019; Kim, Thapa, & Kim, 2018; Piramanayagam, Rathore, & Seal, 2020; Yuangang Zhang & Wang, 2019)), the residents' intention to participate in heritage tourism (e.g., (Megeirhi, Woosnam, Ribeiro, Ramkissoon, & Denley, 2020; Q. Yuan, Song, Chen, & Shang, 2019)), or the business intentions of tourist operators and investors (e.g., (C. Wang, Li, & Xu, 2019)). However, no studies were found directly targeting the cognitive dissonance between intentions and behaviours, and the factors affecting this gap, even if 6% of the publications refer to behavioural change (Gregory-Smith, Wells, Manika, & McElroy, 2017; Salvatierra & Walters, 2015; Weiler, Moyle, Wolf, de Bie, & Torland, 2017; Wells, Manika, Gregory-Smith, Taheri, & McCowlen, 2015).

Satisfaction is a common construct in the literature, used to assess visitors' experiences in the scope of marketing management on touristic destinations (e.g., (Lee & Phau, 2018; Martin, Marrero-Rodríguez, Moreira, Roman, & Santana, 2016; Muñoz-Fernández, López-Guzmán, López Molina, & Pérez Gálvez, 2018; Valentina, Marius-Răzvan, Login, & Anca, 2015)). Willingness-to-pay is used to analyse residents' and visitors' disposition to support the costs of the preservation of cultural and natural heritage, allowing to identify and prioritise values (e.g., (Cong, Zhang, Su, Chen, & Wang, 2019; Dragouni & Fouseki, 2018; Farr, Stoeckl, Esparon, Larson, & Jarvis, 2016; Jin, Juan, Choi, & Lee, 2019; Jurado-Rivas & Sánchez-Rivero, 2019)). The publications referring to segmentation studies aim at typifying profiles of tourists (e.g., (Brida, Meleddu, & Pulina, 2016; Di Pietro, Mugion, Mattia, & Renzi, 2015; Gálvez, Granda, López-Guzmán, & Coronel, 2017; Kastenholz, Eusébio, & Carneiro, 2018)) or local communities (Menor-Campos, Pérez-Gálvez, Hidalgo-Fernández, & López-Guzmán, 2020) according to behavioural characteristics, such as motivation to visit heritage sites [101] or awareness of the World Heritage brand (Adie, Hall, & Prayag, 2018), for instance.

Actors and Type of Heritage

Considering the actors targeted in the studies, four main groups emerge: 1) tourists and visitors; 2) residents and local communities; 3) business owners, tourist operators, and staff; 4) decision-makers, public authorities, and government.

The majority (56%) of the publications focus on tourist perspectives, as presented in Table 2.2. In this group, one-third of the results are related to natural heritage, reflecting the predominance of studies in the field of pro-environmental behaviours, measuring, for instance, tourists' perspectives on environment and their perceived responsibility (e.g., (Gao, Huang, & Zhang, 2017; Gao, Zhang, & Huang, 2018; Wolf, Stricker, & Hagenloh, 2015)). Additionally, in the scope of natural heritage, several studies analyse the effects of visitation in mental and physical well-being (e.g., (Barton, Hine, & Pretty, 2009; K. Huang, Pearce, Wu, & Wang, 2019; Weiler et al., 2017)). A significant number of publications (15%) refer to heritage as a destination. In these cases, research is mostly related to factors affecting travel behaviours and intention to revisit, such as authenticity (e.g., (Lin & Liu, 2018; Rani, Othman, & Ahmad, 2014)), visiting experience and satisfaction (e.g., (Kunasegaran, Rasoolimanesh, & Khan, 2019; Romão, Neuts, Nijkamp, & Shikida, 2014)), or place attachment (e.g., (Ramkissoon, 2015)). For instance, Ramkinsson (Ramkissoon & Uysal, 2010) analysed how perceived authenticity—a place's cultural and natural characteristics that are interpreted as genuine—affects tourists' intentions to consume cultural attractions. The author also relates the concepts of place attachment (emotional bonds emerging from interactions between people and settings of a place) and satisfaction (judgement of the perceived quality of a setting considering physical characteristics and settings) with tourists' intentions towards heritage destinations.

TABLE 2.2 Literature referring to tourists and visitors

#	Author, Year	Country	Heritage	Actors	Theoretical Framework
1	Bae, Jung, Moorhouse, Suh, and Kwon, 2020	South Korea	(destinations)	visitors	brand equity theory
2	Cappa, Rosso, and Capaldo, 2020	Italy	(museums)	visitors	visitor-sensing; spatial analysis
3	Piramanayagam et al., 2020	India	archaeological (WHS)	visitors	behavioural intention
4	Menor-Campos et al., 2020	Spain	urban (WHS)	tourists	behaviour segmentation
5	Chow, Ma, Wong, Lam, and Cheung, 2019	China	natural	tourists	behavioural intention
6	(Cong et al., 2019)	China	natural	tourists	WTP; choice experiment method
7	Curnock et al., 2019	Australia	natural (WHS)	tourists	theory of emotions
8	Jin et al., 2019	South Korea	sites (WHS)	tourists	contingent valuation method; stakeholder theory; WTP
9	Jurado-Rivas and Sánchez-Rivero, 2019	Spain	urban (WHS)	tourists	WTP; behaviour segmentation
10	Huang et al., 2019	China	intangible; natural	tourists	PERMA model
11	Kunasegaran et al., 2019	Malaysia	intangible	tourists	Urry's tourist gaze theory
12	Khairi, Ismail, and Syed Jaafar, 2019	Malaysia	urban (WHS)	tourists	theory of tourism consumption

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TABLE 2.2 Literature referring to tourists and visitors

#	Author, Year	Country	Heritage	Actors	Theoretical Framework
13	Medina-Viruel, López-Guzmán, Gálvez, and Jara-Alba, 2019	Spain	urban (WHS)	tourists	Crompton's motivational theory
14	Nian et al., 2019	China	natural (WHS)	tourists	value–belief–norm; TPB
15	Weber, Groulx, Lemieux, Scott, and Dawson, 2019	Canada	natural (WHS)	tourists	(unclear)
16	Woyo and Woyo, 2019	Namibia	(destination)	tourists	(unclear)
17	Wu, Shen, Wang, Hou, and Yang, 2019	China	(museum)	tourists	subjective well-being
18	Zhang and Wang, 2019	China	urban (WHS)	tourists	planning behaviour theory/TPB
19	Scuttari, Orsi, and Bassani, 2019	Italy	natural (WHS)	visitors	(unclear)
20	Alazaizeh, Jamaliah, Mgonja, and Ababneh, 2019	Jordan	archaeological (WHS)	visitors	attribution theory
21	Bergel and Brock, 2019	Germany	natural (WHS)	visitors	customer engagement; TPB
22	Song and Kim, 2019	South Korea	built (WHS)	visitors	value–attitude–behaviour hierarchy
23	Adie et al., 2018	United Kingdom	built (WHS)	tourists	Branding; behaviour segmentation
24	Borges, Vieira, and Gomes, 2018	Portugal	urban (WHS)	tourists	(unclear)
25	Cheng, Wang, Cao, Zhang, and Bai, 2018	China	sites	tourists	service quality
26	Gao et al., 2018	China	natural (WHS)	tourists	generational cohort theory
27	Kim et al., 2018	USA	natural (WHS)	tourists	behavioural intention
28	Lee and Phau, 2018	Australia	urban	tourists	cognitive appraisal theory
29	Mehmood, Liang, and Gu, 2018	China	natural (WHS)	tourists	word-of-mouth; behavioral intention
30	Prayag, Suntikul, and Agyeiwaah, 2018	China	intangible	tourists	cognitive-affective-behaviour system
31	Kastenholz et al., 2018	Portugal	(destination)	visitors	behavior segmentation
32	Lin and Liu, 2018	China	(destination)	visitors	existential authenticity
33	Martinez-Garcia, Raya-Vilchez, and Galí, 2018	Spain	(destination)	visitors	attraction theory
34	Weaver et al., 2018	China	(museum)	visitors	Social representations theory
35	Muñoz-Fernández et al., 2018	Spain	urban (WHS)	tourists	(unclear)
36	Wang, Yang, Han, and Shi, 2017	China	natural (WHS)	tourists	(unclear)
37	Gálvez et al., 2017	Spain	intangible	tourists	behaviour segmentation
38	Gao et al., 2017	China	natural (WHS)	tourists	Norm-activation theory
39	Su, Hsu, and Swanson, 2017	China	natural (WHS)	tourists	(unclear)
40	Soliman and Abou-Shouk, 2017	Egypt	built, natural	tourists	theory of reasoned action
41	Trivedi, 2017	Thailand	(destinations)	tourists	(unclear)

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TABLE 2.2 Literature referring to tourists and visitors

#	Author, Year	Country	Heritage	Actors	Theoretical Framework
42	Buonincontri, Marasco, and Ramkissoon, 2017	Italy	sites	visitors	theory of reasoned action
43	Brida, Dalle Nogare, and Scuderi, 2016	Italy	(museums)	Tourists	rational addiction theory
44	Farr et al., 2016	Australia	natural (WHS)	tourists	WTP; equity theory
45	Getzner, Färber, and Yamu, 2016	Austria	natural	tourists	Economic valuation method
46	Lee, Phau, Hughes, Li, and Quintal, 2016	Australia	urban	tourists	consumer-based theory of authenticity
47	Martin et al., 2016	Spain	urban (WHS)	tourists	Visitor experienced quality
48	Brida, Meleddu, et al., 2016	Italy	(museums)	visitors	behaviour segmentation
49	Sabou, Nistoreanu, and Maiorescu, 2016	Romania	urban	Tourists	Spatial analysis
50	Khairi and Ismail, 2015	Malaysia	urban (WHS)	tourists	Spatial analysis
51	Mustafa, 2015	Jordan	archaeological	tourists	socialization theory; behavioural intentions
52	Ramkissoon, 2015	Australia	(destination)	tourists	attitude-behavior framework; behavioral intention
53	Huang, Weiler, and Assaker, 2015	Australia	urban	tourists	consumer satisfaction theory; TPB
54	Toha & Ismail, 2015	Malaysia	urban (WHS)	tourists	Tourist tracking; spatial analysis
55	Di Pietro et al., 2015	Italy	urban	visitors	behaviour segmentation
56	Salvatierra and Walters, 2015	Australia	natural	visitors	behavioural change
57	Wolf et al., 2015	Australia	natural	visitors	Outcomes-Focused Management
58	Rani et al., 2014	Malaysia	(destination)	tourists	Behavioral intention
59	Romão et al., 2014	Netherlands	natural (WHS)	tourists	behaviour segmentation
60	Ballantyne, Hughes, Ding, and Liu, 2014	Australia	built	visitors	(unclear)
61	Jones and Yamamoto, 2014	Japan	natural (WHS)	visitors	WTP
62	King and Halpenny, 2014	Australia	(brand)	visitors	Branding theory
63	Bernadó, Bigorra, Pérez, Russo, and Clave, 2013	Spain	urban (WHS)	tourists	Spatial analysis
64	Li, Sia, and Zhu, 2013	China	(destination)	tourists	Social exchange theory
65	Wallace, 2013	United Kingdom	archaeological (WHS)	visitors	Spatial analysis
66	Ramkissoon, Smith, and Weiler, 2013	Australia	natural	visitors	Behavioural intentions
67	Boukas, 2012	Cyprus	archaeological	visitors	importance–satisfaction analysis
68	Ramkissoon and Uysal, 2011	Mauritius	sites	tourists	Behavioral intentions; TPB

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TABLE 2.2 Literature referring to tourists and visitors

#	Author, Year	Country	Heritage	Actors	Theoretical Framework
69	Yang, Hens, De Wulf, and Ou, 2011	China	natural (WHS)	tourists	(unclear)
70	Boley, Nickerson, and Bosak, 2011	USA	(destination)	visitors	(unclear)
71	Ramkissoon and Uysal, 2010	Mauritius	sites	tourists	Behavioural intentions
72	McNamara and Prideaux, 2010	Australia	natural (WHS)	visitors	(unclear)
73	Weiler and Ham, 2010	Australia	sites	visitors	(unclear)
74	Barton et al., 2009	United Kingdom	natural	visitors	Rosenberg self-esteem scale
75	McKercher et al., 2008	China	natural	visitors	Neutralization theory
76	Cooper, 2000	Australia	natural (WHS)	visitors	(unclear)
77	Fellenius, Williams, and Hood, 1999	Canada	(destination)	tourists	behavior segmentation
78	Suryawardani, Wiranatha, and Petr, 2016)	Indonesia	(destination)	tourists	Expectancy theory
79	Hidalgo-Fernández, Hernández-Rojas, Jimber del Río, and Casas-Rosal, 2019	Spain	archaeological (WHS)	tourists	American customer satisfaction index

Literature focused on residents' behaviours, shown in Table 2.3, correspondents to almost one third (27%) of the analysed publications. It often refers to urban heritage, for instance, measuring factors affecting residents' support for sustainable heritage tourism development (e.g., (Chong, 2020; Gannon, Rasoolimanesh, & Taheri, 2020; Megeirhi et al., 2020; Zheng, Liang, & Ritchie, 2020)). Centred on built heritage, Cai and Lu (Cai & Lu, 2018) determined aspects affecting residents' social integration in historic blocks, while Judson et al. (Judson, Iyer-Raniga, & Horne, 2014) analyse how residents balance energy needs and heritage significance in renovation processes. A significant number of publications about residents (13%) target intangible cultural heritage (ICH), such as the research of Su, Li, Wu and Yao (Su, Li, Wu, & Yao, 2020) which develops a scale to measure inheritors' perception of ICH value, or the research of Yuan, Lun, He et al. (Z. Yuan et al., 2014) which explores community perspectives on traditional ecological knowledge.

TABLE 2.3 Literature referring to residents and local communities

#	Author, Year	Country	Heritage	Actors	Theoretical Framework
1	Chong, 2020	Malaysia	(resources)	community	(unclear)
2	Su et al., 2020	China	intangible	inheritors	value cognition
3	Gannon et al., 2020	Malaysia	urban	residents	social exchange theory; theory of substantive and formal rationality
4	Megeirhi et al., 2020	South Africa	urban (WHS)	residents	value–belief–norm
5	Qiu, Zheng, Xiang, and Zhang, 2020	China	intangible	residents	value–attitude–behaviour hierarchy
6	Zheng et al., 2020	China	urban (WHS)	residents	social dilemma theory
7	Olya, Shahmirzdi, and Alipour, 2019	Turkey	natural (WHS)	community	social exchange theory; complexity theory
8	Prados-Peña, Gutiérrez-Carrillo, and Barrio-García, 2019	Spain	built	community	branding
9	Davoodi and Dağlı, 2019	Turkey	urban	residents	(unclear)
10	Gursoy, Zhang, and Chi, 2019	China	urban (WHS)	residents	value orientation; identity theory
11	Jin et al., 2019	China	natural (WHS)	residents	WTP; contingent valuation method
12	Yuan et al., 2019	China	urban	residents	social exchange theory; TPB
13	Zhang, Lee, and Xiong, 2019	China	built	residents	TPB
14	Zhang et al., 2019	China	natural	residents	social exchange theory; TPB
15	Dragouni and Fouseki, 2018	United Kingdom	(destinations)	community	WTP
16	Cai and Lu, 2018	China	built	residents	(unclear)
17	Chen and Yang, 2018	China	urban	residents	Bourne's relocation decision model
18	López, Virto, Manzano, and Miranda, 2018	Spain	urban	residents	triple bottom line
19	Yasin, Abdullah, Ibrahim, Khalid, and Wahab, 2018	Malaysia	urban (WHS)	residents	(unclear)
20	Goldberg et al., 2018	Australia	natural (WHS)	residents, tourists	TPB
21	Domic and Boukas, 2017	Cyprus	intangible	communities	critical ethnography; behaviour segmentation
22	Wang, Zhang, Han, and Liang, 2017	China	Built, natural (WHS)	community	ground theory; role theory
23	Esariti, Yuliastuti, and Ratih, 2017	Indonesia	urban	residents	theory of Rappoport
24	Weiler et al., 2017	Australia	natural	residents	persuasive communication theory; behavioural change
25	Rodzi, Zaki, and Subli, 2016	Malaysia	Intangible (WHS)	community	(unclear)

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TABLE 2.3 Literature referring to residents and local communities

#	Author, Year	Country	Heritage	Actors	Theoretical Framework
26	Basarić, Vujičić, Simić, Bogdanović, and Saulić, 2016	Serbia	urban	residents	(unclear)
27	Goldberg et al., 2016	Australia	Natural (WHS)	residents	(unclear)
28	Lwoga, 2016	Tanzania	built	residents	TPB
29	May-Chiun and Songanc, 2014	Malaysia	(destination)	communities	(unclear)
30	Bosman and Whitfield, 2014	South Africa	built	community	vernacular theory; theory of ecological perception
31	Judson et al., 2014	United Kingdom	built	homeowners	Social practice theory
32	Yuan et al., 2014	China	intangible	residents	(unclear)
33	Omar, Muhibudin, Yussof, Sukiman, and Mohamed, 2013	Malaysia	Urban (WHS)	community	Stakeholders theory
34	Yunus, Karim, and Samadi, 2013	Malaysia	natural	community	(unclear)
35	Ma, Zhao, and Gong, 2013	China	natural	residents	(unclear)
36	Ryan, Chaozhi, and Zeng, 2011	China	Built (WHS)	residents	(unclear)
37	Nicholas, Thapa, and Ko, 2009	USA	Natural (WHS)	residents	Stakeholders theory
38	Senaratne, Abeygunawardena, and Jayatilake, 2003	Sri Lanka	Natural (WHS)	residents	Household production theory

The publications referring to other stakeholders (from business owners to decision-makers) are presented in Table 2.4. Only 2% of the studies approach behaviour in the perspective of the decision-makers. No studies were found about practitioners and designers involved in the conservation of built heritage. In this group, natural heritage is the most frequent type. For example, the research of Chi, Zhang and Liu (Chi, Zhang, & Liu, 2019) analysed managers of tourism companies in a natural heritage site, to study their corporate social responsibility behaviours (the integration of environmental and social concerns in business operations), while Esparon, Gyuris and Stoeckl (Esparon, Gyuris, & Stoeckl, 2014) analysed the impact of eco-certification on consumers' choice of tourism operators. Several studies use students as the research population. While in some cases this choice reflects a convenience sampling, aimed at representing other actors, like potential visitors or the general community (e.g., (Choi, Lee, Tanaka, & Xu, 2018)), in other cases this designation reflects the actual population, such as in the case of Rose, Rose and Merchant (Rose, Rose, & Merchant, 2017), that analyses the effect of heritage brands in students intentions to apply to a university, or the research of Forleo, Romagnoli and Palmieri (Forleo, Romagnoli, & Palmieri, 2019) that recognises in students the potential to shape a system of values and beliefs for the future of sustainable development.

TABLE 2.4 Literature referring to other stakeholders

#	Author, Year	Country	Heritage	Actors	Theoretical Framework
1	Ferretti and Grosso, 2019	Italy	built; urban	decision-makers	Multi-attribute Value Theory
2	Wang et al., 2019	China	(tourism)	enterprises	Behavioural intentions; motivation theory of self-determination
3	Chi et al., 2019	China	natural (WHS)	managers	Stakeholder theory; agency theory
4	Forleo et al., 2019	Italy	natural	students	WTP; TPB; behavior segmentation
5	Mustafa, 2019	Jordan	archaeological	tour guides	norm activation theory; TPB
6	Zhang and Zhang, 2018	Japan	(destinations)	enterprises	network centrality; stakeholder theory
7	Väisänen and Törn-Laapio, 2018	Sweden	(resources)	entrepreneurs	(unclear)
8	Choi et al., 2018	South Korea	natural	students	random utility maximization theory
9	Gregory-Smith, Wells, Manika, and McElroy, 2017	United Kingdom	(destination)	employees	Social marketing; realist evaluation; behavioural change
10	McCamley and Gilmore, 2017	United Kingdom	(destination)	enterprises	supply chain theory
11	Rose et al., 2017	USA	(brand)	students	Behavioral intentions
12	Abdulla, Abdelmonem, and Selim, 2017	United Kingdom	urban	users	hierarchy of walking needs
13	Gribaudo, Iacono, and Levis, 2017	Italy	urban	users	internet of things; spatial analysis
14	Valentina et al., 2015	Romania	(resources)	consumers	(unclear)
15	Miralles i Garcia, 2015	Spain	natural	decision-makers	(unclear)
16	Wells et al., 2015	United Kingdom	(organization)	employees	Behavioural change; social marketing intervention
17	Çetinkaya and Zafer, 2015	Turkey	archaeological	Tour guides	(unclear)
18	Esparon et al., 2014	Australia	Natural (WHS)	consumers	importance-performance analysis
19	Gheorghe, Nistoreanu, and Filip, 2013	Romania	intangible	consumers	Direct market research
20	Hall, 2013	New Zealand	intangible	foragers	(unclear)
21	Santos, Mendes, Rodrigues, and Freire, 2012	Portugal	natural	geocachers	Spatial analysis
22	Wiedmann, Hennigs, Schmidt, and Wuestefeld, 2011	Germany	(brand)	consumers	Branding theory
23	Thomas, Miller, Thomas, Tunstall, and Siggins, 2007	United Kingdom	(tourism)	enterprises	Phenomenological methodology

Theoretical Frameworks and Research Methods

Regarding the methodology, three types of information emerged: theoretical frameworks, data collection instruments, and data processing techniques. However, not always publications include a clear methodological framework, with the three types of information, with the theoretical framework missing in around 20% of the publications.

The diagram in Figure 2.2 presents the distribution of techniques according to the identified goals. Interviews are currently used in qualitative studies, aimed at eliciting respondents' values and attitudes (e.g., (Judson et al., 2014; Väisänen & Törn-Laapio, 2018; W. Wang, Zhang, Han, & Liang, 2017; Yunus, Karim, & Samadi, 2013)). Visitor sensing or tracking is the predominant technique in studies about spatial behaviour, focused on understanding crowd movements in museums or urban spaces (e.g., (Bernadó, Bigorra, Pérez, Russo, & Clave, 2013; Cappa, Rosso, & Capaldo, 2020; Khairi & Ismail, 2015; Sabou, Nistoreanu, & Maiorescu, 2016; Wallace, 2013)). Experimental interventions are a common method when addressing behavioural change (e.g., (Salvatierra & Walters, 2015; Weiler et al., 2017; Wells et al., 2015)), but were also found in the context of willingness-to-pay studies (Getzner, Färber, & Yamu, 2016) and business intentions (Marchegiani, 2018). The most common method for data collection in the survey, allowing to cover most of the identified aims, was a quantitative approach. The results are then commonly analysed with factor analysis (CFA/EFA), to reduce the number of variables to a few constructs, followed by structural equation modelling (SEM), to establish relationships between latent constructs, according to a pre-established hypothesis (e.g., (Alazaizeh, Jamaliah, Mgonja, & Ababneh, 2019; Gannon et al., 2020; Kim et al., 2018; Megeirhi et al., 2020; Piramanayagam et al., 2020; Prados-Peña, Gutiérrez-Carrillo, & Barrio-García, 2019; Ramkissoon & Uysal, 2010; Rani et al., 2014)).

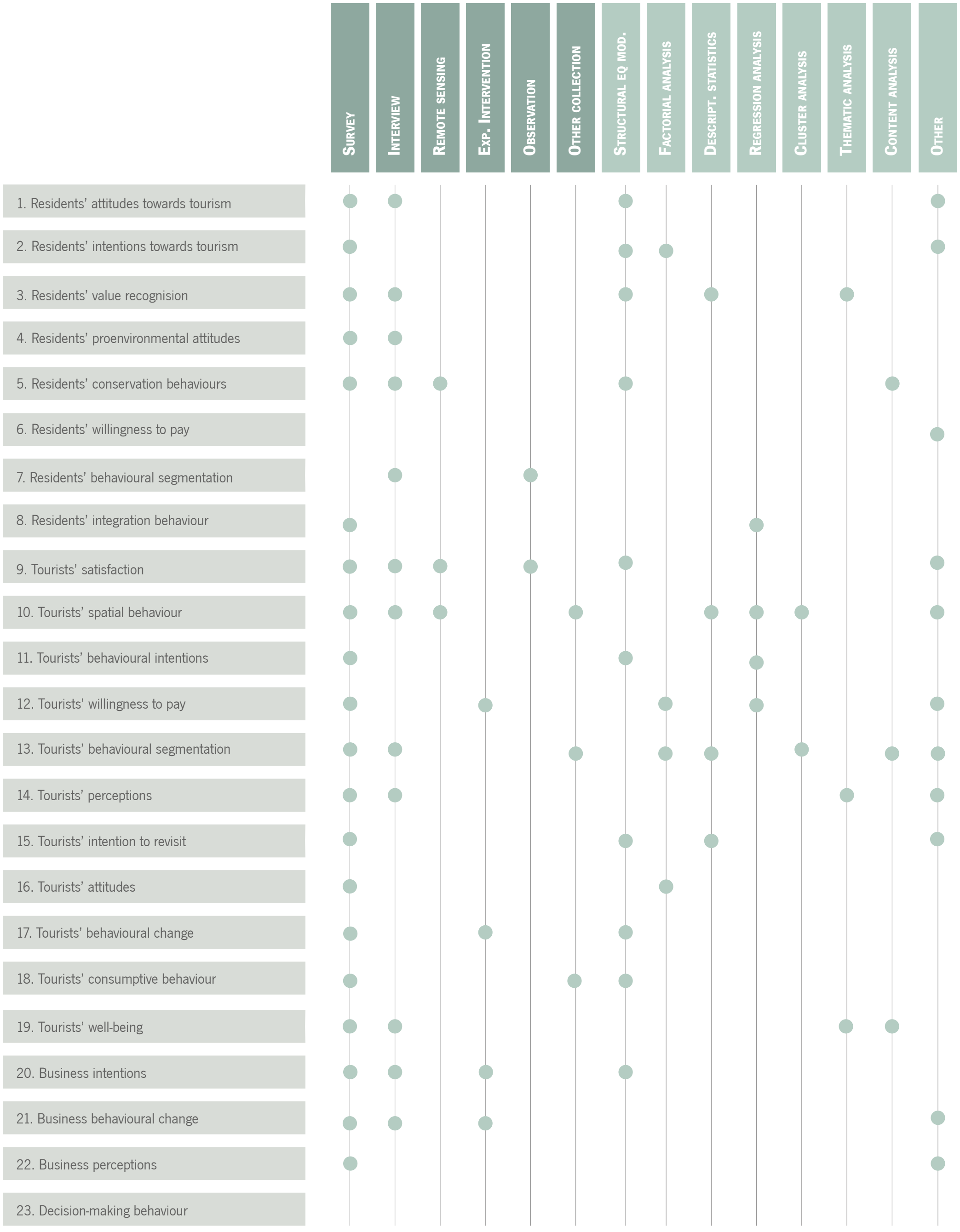

FIG. 2.2 Distribution of data collection and data analysis techniques according to research aims

The analysis allows for identifying a great diversity of theoretical approaches. Despite that, three trends emerge that confirm the identified aims: 1) theory of planned behaviour and theory of reasoned action, aimed at measuring intentions and predict behaviours; 2) behavioural segmentation theory, used in studies aiming at clustering individuals according to behavioural profiles; 3) willingness to pay, aiming at measure customer priorities and value judgements towards a given service or product. Together, these theoretical frameworks represent a quarter of the analysed publications. Even if only 11% of the analysed publications refer directly to Ajzen's theories of behaviour (Bergel & Brock, 2019; Buonincontri, Marasco, & Ramkissoon, 2017; Forleo et al., 2019; Goldberg et al., 2018; S. Huang, Weiler, & Assaker, 2015; Lwoga, 2016; Mustafa, 2019; Nian et al., 2019; Ramkissoon & Uysal, 2011; Soliman & Abou-Shouk, 2017; Q. Yuan et al., 2019; Yang Zhang, Lee, & Xiong, 2019; Yuangang Zhang & Wang, 2019; Yuling Zhang et al., 2019), another 8% of the publications directly target behavioural intentions within a similar conceptual framework (Chow, Ma, Wong, Lam, & Cheung, 2019; Kim et al., 2018; Mehmood, Liang, & Gu, 2018; Mustafa, 2015; Piramanayagam et al., 2020; Ramkissoon, 2015; Ramkissoon, Smith, & Weiler, 2013; Ramkissoon & Uysal, 2010; Rani et al., 2014; Rose et al., 2017; C. Wang et al., 2019). Together with the studies on behavioural change (Gregory-Smith et al., 2017; Salvatierra & Walters, 2015; Weiler et al., 2017; Wells et al., 2015), and targeting decision-makers with a clear methodology (Ferretti & Grosso, 2019), these records are further analysed in the next section.

2.3.3 Behavioral Intentions and Behavioural Change for Sustainable Heritage

To answer the research question, the next section presents an in-depth analysis of the publications based on the TRA and on the TPB, those focused on practitioners and decision-makers' behaviour, and the publications that present the results of interventions designed for behavioural change. Considering the overlapping between the three topics, a total of 30 publications were analysed. Most of the literature found (68%) was published after 2017, and no results were found before 2010. Most of the results are from China and Australia, and together they represent half of the publications in the field (47%). The summary of the findings is presented in Table 2.5.

TABLE 2.5 Summary of main goals and methodologies found in the literature

#	Author, Year	Country	Heritage	Constructs	Method	Population
1	Piramanayagam et al., 2020	India	archaeological	destination image; visitor experience; intention to revisit	Questionnaire; CFA; SEM	384 tourists
2	Yuan et al., 2019	China	urban	involvement, perceived impacts, place attachment, intention to support tourism	Questionnaire; SEM	336 residents
3	Wang et al., 2019	China,	(tourism)	lifestyle-oriented motivation, corporate social responsibility, operational intention	Questionnaire; SEM	154 guesthouse owners
4	Nian et al., 2019	China	natural	perception of OUV, service quality, place attachment, conservation intention	Questionnaire; SEM	563 tourists
5	Zhang et al., 2019	China	built	attitudes, subjective norms, perceived control, self-regulation, social capital, intention and behaviour towards conflict	Interview; questionnaire; SEM	250 residents
6	Zhang and Wang, 2019	China	urban	attitudes, motivation, space emotion, subjective norms, perceived control, travel intention	Questionnaire; SEM	650 tourists
7	Bergel and Brock, 2019	Germany	natural	affective attitude, influence behaviour, destination loyalty intention, perception of entrance fees	Questionnaire; SEM	802 visitors
8	Mustafa, 2019	Jordan	archaeological	value orientation, social norms, commitment to conservation	Questionnaire; SEM	96 tour guides
9	Zhang et al., 2019	China	natural	livelihood strategies, perception of changes, pro-environmental behaviours	Interviews: questionnaire; multiple regression	314 residents
10	Ferretti and Grosso, 2019	Italy	built	power–interest matrix; preferences; values; trade-offs	Stakeholders' analysis	Decision-makers
11	Forleo et al., 2019	Italy	natural	use and non-use values; willingness-to-pay; pro-environmental behaviours	Questionnaire; hierarchical cluster analysis	542 students
12	Chow et al., 2019	China	natural	place attachment; satisfaction; pro-environmental intentions	Questionnaire; regression	402 tourists
13	Mehmood et al., 2018	China	natural	word-of-mouth; user generated content; heritage image; attitudes; travel intention	Questionnaire; SEM	280 tourists
14	Goldberg et al., 2018	Australia	natural	attitudes; perceived barriers; pro-environmental behaviours	Questionnaire; Variance inflation factors	3181 residents; 2621 tourists

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TABLE 2.5 Summary of main goals and methodologies found in the literature

#	Author, Year	Country	Heritage	Constructs	Method	Population
15	Kim et al., 2018	USA	natural	perceived sustainability, pro-environmental behaviour; revisit intention; word-of-mouth	Questionnaire; CFA; SEM	300 tourists
16	Soliman and Abou-Shouk, 2017	Egypt	sites	attitudes, motivation, cultural/heritage dimension, subjective norms, travel intention, behaviour	Questionnaire; SEM	200 tourists
17	Rose et al., 2017	USA	(brand)	attitudes, present-time orientation, perceived linkage past–present, intention to consume	Questionnaire; multiple regression	90–240 students
18	Buonincontri et al., 2017	Italy	sites	tourism experience, place attachment, pro-environmental behaviour	Development of a questionnaire	visitors
19	Weiler et al., 2017	Australia	natural	perceived benefits, credibility, mental imagery	pre-/post-experimental design; questionnaire; t-test	1053 residents
20	Gregory-Smith et al., 2017	United Kingdom	(tourism)	realist evaluation: context, mechanism, outcome	Interviews; intervention; focus group	57 employees
21	Lwoga, 2016	Tanzania	built	attitudes, subjective norm, perceived control, conservation intention, tourism employment status	Questionnaire; SEM	208 households
22	Huang et al., 2015	Australia	sites	elaboration, relevancy, empathy, attitude, satisfaction, behavioural loyalty, WOM intention	Questionnaire; SEM	282 tourists
23	Salvatierra and Walters, 2015	Australia	natural	past experience, knowledge, image perception, travel intention	pre-/post-experimental design; questionnaire; ANOVA	168 potential visitors
24	Wells et al., 2015	United Kingdom	(tourism)	potential to change pro-environmental behaviour; personal responsibility; information adequacy; satisfaction; self-efficacy; motivation	Interviews; pre-/post-experimental design; questionnaire; linear regression; ANOVA	96–237 employees
25	Ramkissoon, 2015	Australia	(destination)	perceived authenticity; place attachment; place satisfaction; cultural intentions	Theoretical model	tourists

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TABLE 2.5 Summary of main goals and methodologies found in the literature

#	Author, Year	Country	Heritage	Constructs	Method	Population
26	Mustafa, 2015	Jordan	archaeological	value orientation; awareness of consequences; ascription of responsibility; pro-heritage intentions	Questionnaire; t-test	271 tourists
27	Rani et al., 2014	Malaysia	(destination)	perceived authenticity; satisfaction; revisit intention	Questionnaire; CFA; SEM	255 tourists
28	Ramkissoon et al., 2013	Australia	natural	place attachment; place satisfaction; pro-environmental intentions	Questionnaire; EFA; multiple regression	452 tourists
29	Ramkissoon and Uysal, 2011	Mauritius	sites	perceived authenticity, motivation, information search behaviour, destination imagery, cultural intention	Questionnaire; SEM; multiple regression	600 tourists
30	Ramkissoon and Uysal, 2010	Mauritius	sites	authenticity; cultural intention	Questionnaire; CFA; SEM	600 tourists

Sustainable Heritage Conservation

Sustainability is the journal with more publications on the topic (19%), followed by the Journal of Travel Research (14%). Despite mostly being published under the topic of “social sciences” (57%), the majority of studies were published in journals of the tourism and hospitality field (62%), confirming the predominance of studies focusing on tourist behaviour and in the notion of heritage as a destination. In more than half of the publications (65%), the term “sustainability” is used in the context of sustainable tourism development and heritage destinations (Bergel & Brock, 2019; Buonincontri et al., 2017; Mustafa, 2019; Nian et al., 2019; Soliman & Abou-Shouk, 2017; C. Wang et al., 2019; Yang Zhang et al., 2019; Yuangang Zhang & Wang, 2019; Yuling Zhang et al., 2019).

Sustainable heritage is not a clear concept, and, even if often mentioned, is rarely defined. Despite that, two main approaches emerge in the literature: one targeting environmental protection, and another one more focused on the social dimension, targeting community participation. Lwoga (Lwoga, 2016) and Yuan et al. (Q. Yuan et al., 2019) state that the engagement of local communities is essential to achieve a sustainable heritage management. While Lwoga (Lwoga, 2016) studies residents’ intention to conserve built heritage, Yuan et al. (Q. Yuan et al., 2019) focus on residents’ intentions to support tourist development. Additionally, Zhang et al. (Yang Zhang et al., 2019) contribute to improve inclusive decision practices, by analysing residents’ behaviours towards conflict resolution.

The environmental dimension of sustainability is addressed in 40% of the publications (e.g., (Bergel & Brock, 2019; Nian et al., 2019; Salvatierra & Walters, 2015; Soliman & Abou-Shouk, 2017; Wells et al., 2015)). Chow et al. (Chow et al., 2019) analyse tourists' environmentally responsible behaviours in the context of natural heritage, aiming at contributing to reduce tourism negative environmental impacts. Moreover, Forleo et al. (Forleo et al., 2019) and Goldberg et al. (Goldberg et al., 2018) focus on the protection of areas with environmental value and on their long-term preservation for future generations. The research of Buonicontri et al. (Buonincontri et al., 2017) develops a scale to measure factors affecting the sustainable behaviour of heritage visitors, developing a set of indicators to assess pro-heritage behaviours (limiting visits to heritage sites, donations and willingness to pay for preservation, engaging in voluntary work, etc.) Additionally, the study of Wang et al. (C. Wang et al., 2019) considers environmental and heritage protection as two essential vectors of corporative socially responsible practices, in the context of sustainable tourism.

In both approaches to sustainability (social and environmental), the analysed literature focused on anthropogenic pressure, touristic pressure, and on the overexploitation of resources. Nian et al. (Nian et al., 2019) and Kim et al. refer to the need to avoid the overexploitation of tourism facilities and the uncontrolled touristic capacity, in order to protect the ecological environment from intensive land use and deterioration of biodiversity. For Zhang and Wang (Yuangang Zhang & Wang, 2019), sustainable tourism must avoid the negative impacts of mass tourism, while maximizing tourism's benefits, by creating employment and increasing income of local communities. Furthermore, Buonicontri et al. (Buonincontri et al., 2017) refer to sustainable tourism as a balance operation, between visitation, authenticity, and conservation.

Built Heritage

More than one third (38%) of the publications analysed refer to natural heritage, and 15% refer to heritage sites—including, but not specifying, museums, monuments, archaeological, historical, and natural sites. Only in 15% of the cases, studies focus on built heritage.

In the context of built heritage, some authors, i.e., Lwoga (Lwoga, 2016) and Zhang et al. (Yang Zhang et al., 2019), use the TPB to analyse the residents' behavioural intentions in heritage buildings. Lwoga [183] elicits the tourism employment status as a moderator of conservation intentions, by imposing more perceived social pressure over respondents. It shows that raising awareness for

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heritage conservation has the potential to elevate positive attitudes and, at the same time, trigger social pressure to conserve, acting on two socio-psychological factors affecting residents' engagement. Zhang et al. (Yang Zhang et al., 2019) identified common themes of conflict for residents, related to the protection of the traditional building (comfort and quality of life, allocation of maintenance duties, or protection regulations, for instance) and the sharing of tourism benefits (profit distribution or property rights, etc.) Like the study of Lwoga (Lwoga, 2016), it shows that favourable attitudes are the most important variable to determine residents' intention to engage in conflict resolution within cultural heritage management.

Decision-Makers

The analysed studies focusing on tourists' behaviour represent 60% of the sample, followed by residents' behaviour (22%). No studies were found analysing the behaviours of practitioners involved in heritage conservation processes. Only the study of Ferretti and Grosso (Ferretti & Grosso, 2019) targets directly the behaviour of decision-makers in the conservation of built heritage. It uses a stakeholder analysis methodology to develop a tool for decision-making that considers the weight of each stakeholder, developing a power–interest matrix and eliciting values and possible trade-offs. This research is not focused on analysing behavioural intentions or the dissonance between intentions and implementation and does not use the theoretical framework under analysis in the present research.

Research Methods

On average, the studies have a sample of 584 respondents, which allows for statistically significant analysis using structural equation modelling, with a recommended minimum of 200 respondents (Ramkissoon & Uysal, 2010; Q. Yuan et al., 2019). The studies of Wang et al. (C. Wang et al., 2019) and Mustafa (Mustafa, 2019), however, use the structural equation modelling despite not meeting this criterion, considering the provided samples as representative of the studied population. Multiple regression (Ramkissoon et al., 2013; Ramkissoon & Uysal, 2011; Rose et al., 2017; Yuling Zhang et al., 2019), t-tests (Mustafa, 2015; Weiler et al., 2017), and one-way variance analysis—ANOVA (Salvatierra & Walters, 2015; Wells et al., 2015) are also used to establish relations between the questionnaire variables and to confirm the hypothesis.

All the questionnaires use Likert scales to assess the level of agreement/ disagreement of respondents with given statements. Some studies include a preparatory step with interviews (Gregory-Smith et al., 2017; Wells et al., 2015; Yang Zhang et al., 2019; Yuling Zhang et al., 2019) or preliminary surveys (Ramkissoon & Uysal, 2011; Rose et al., 2017) to elicit modal accessible beliefs (conscious beliefs common to the majority of the population). All the studies that target behavioural change suggest two-step methodologies, with pre-/post-experimental design, surveying or interviewing the population before and after applying the intervention (Gregory-Smith et al., 2017; Salvatierra & Walters, 2015; Weiler et al., 2017; Wells et al., 2015).

Psychological Constructs

The most common aim in the literature is to elicit other constructs that affect respondents' intentions and behaviours, from perceptions to motivations. Intention is the most common psychological construct included in the analysis. This construct targets mainly 3 groups of behaviours: (1) pro-environmental or environmentally responsible behaviours (e.g., (Buonincontri et al., 2017; Chow et al., 2019; Forleo et al., 2019; Goldberg et al., 2018; Kim et al., 2018; Wells et al., 2015)); (2) pro-heritage or heritage protection behaviours (e.g., (Lwoga, 2016; Mustafa, 2015, 2019; Nian et al., 2019)); (3) travel behaviours, including loyalty and intention to revisit (e.g., (Bergel & Brock, 2019; S. Huang et al., 2015; Mehmood et al., 2018; Piramanayagam et al., 2020; Soliman & Abou-Shouk, 2017)). The third group, on travel behaviours, represents around 50% of the analysed publications.

On average, each questionnaire relates four psychological constructs. Respondents' perceptions are a recurrent factor, approached in 36% of the studies, in the context of perceived authenticity and outstanding value of heritage (Nian et al., 2019; Ramkissoon & Uysal, 2011; Soliman & Abou-Shouk, 2017), perceived tourism impacts, and perceived benefits of visitation (Weiler et al., 2017; Q. Yuan et al., 2019), for instance. Motivations (the reasons that pull people to perform certain behaviours, such as lifestyle, economic, social integration, etc. (Ramkissoon & Uysal, 2011; Soliman & Abou-Shouk, 2017; C. Wang et al., 2019; Yuangang Zhang & Wang, 2019)), satisfaction (e.g.: (Chow et al., 2019; S. Huang et al., 2015; Ramkissoon, 2015; Ramkissoon et al., 2013; Rani et al., 2014)), and place attachment (e.g., (Buonincontri et al., 2017; Chow et al., 2019; Nian et al., 2019; Ramkissoon, 2015; Q. Yuan et al., 2019)are also common constructs in the literature.

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Interventions for Behavioural Change

The study conducted by Salvatierra and Walters (Salvatierra & Walters, 2015) designed an intervention to assess the impact of media on travellers' image perception and intentions about a destination. Results show that the public is increasingly aware of environmental sustainability practices, and of those that can affect image perception and intention to visit. This study also outlines previous knowledge and educational background of moderators of this relationship. Furthermore, Weiler et al. (Weiler et al., 2017) used a pre-post experimental design methodology to analyse the effect of communication interventions to shift public perceptions. The results show an increased perception of the benefits of natural parks after exposed to persuasive communication in the short-term. The research of Wells et al. (Wells et al., 2015) applies a pre-/post-experimental intervention to measure changes in the perceived satisfaction of employees when introduced to a "sustainability toolkit" that allows them to determine their sustainability plan and priorities. The findings support that being exposed to information provided knowledge to employees and increased their awareness on environmental issues. The proxy measure of actual behaviour showed a reduction in energy consumption during the period of the intervention. The evaluation of the experiment (Gregory-Smith et al., 2017) elaborates that realistic interventions are partial and context-tailored but confirms that educational mechanisms may tackle knowledge and belief gaps. It states, however, that the effects of social interventions tend to decline as time passes, and suggests monitoring, empowerment, and support as tools to guarantee long-lasting effects.

Practical Implications

At a theoretical level, the analysed publications contribute to establishing internal attitudes and motivations as a key factor for sustainable conservation behaviours (Soliman & Abou-Shouk, 2017; C. Wang et al., 2019; Q. Yuan et al., 2019; Yang Zhang et al., 2019; Yuangang Zhang & Wang, 2019). Despite not focusing on instigating practitioners' behavioural intentions and behavioural change for the sustainable conservation of the built heritage, the publications analysed provided several theoretical managerial contributions to the heritage field.

The research of Bergel and Brock (Bergel & Brock, 2019) concluded that engagement contributes to more positive attitudes for tourists, and that the willingness to pay for more sustainable services is affected by affective components, resulting from feelings and emotional ties to destinations. Furthermore, Zhang and Wang (Yuangang Zhang & Wang, 2019) point out the emotional connection with the destination as one of the main factors determining tourists' intentions to revisit. Both studies suggest that marketing strategies need to build affective connections to engage visitors and attract customers.

Place attachment, i.e., the affective relationships between individuals and specific places, also plays a role in residents' intentions and behaviours. Yuan et al. (Q. Yuan et al., 2019) demonstrate that both cognitive and affective attitudes are determinant for residents' support of tourism development. This proves the need for authorities "to enhance the relationship between residents and the city" (Q. Yuan et al., 2019), supporting the sense of identity through long-term continuity of residents, and respecting communities' emotional bonds with tangible and intangible attributes.

The research of Goldberg et al. (Goldberg et al., 2018) shows that the sense of identity is also important for increasing the perceived individual responsibility, affecting the decision to take actions to protect the environment. As such, facilitating people's connections to nature may have practical implications on conservation outcomes. The research of Nian et al. (Nian et al., 2019) found a positive intention to protect heritage when visitors recognise and emotionally connect to the attributes identified as outstanding universal value (OUV) in the World Heritage Site (WHS) listing, evidencing the need for participatory processes that recognise community values in the WHS evaluations. Ramkissoon and Uysal (Ramkissoon & Uysal, 2011) proved that authenticity may have different meanings and connotations according to site and experience and that it mediates tourists' choices.

Several authors point out the benefits of behavioural approaches to increase cooperation between stakeholders and to inform policies and strategies for sustainability (Buonincontri et al., 2017; Lwoga, 2016; Yuangang Zhang & Wang, 2019). According to Forleo et al. (Forleo et al., 2019), the contribution of these approaches to identify the most valuable attributes for communities, can support managers to find synergies and reduce trade-offs. Furthermore, Zhang et al. (Yang Zhang et al., 2019) point out that knowledge of the particular behaviours associated with different groups of stakeholders contributes to better understand their roles in decision-making processes. This knowledge is fundamental to assist managers to plan more effectively for the maximization of the conservation response (Goldberg et al., 2018; Ramkissoon & Uysal, 2010), since understanding the audience ensures that the information is conveyed and meets the desired goals (Goldberg et al., 2018).

The literature also suggests the meaningful role of education, and the potential of persuasive communication to raise levels of knowledge and awareness, inspiring positive attitudes and behavioural change (Forleo et al., 2019;

Gregory Smith et al., 2017; Lwoga, 2016; Salvatierra & Walters, 2015; Weiler et al., 2017; Wells et al., 2015). The research of Gregory-Smith et al. (Gregory-Smith et al., 2017) shows that educational mechanisms can tackle knowledge and belief gaps in organizational environments. Likewise, Forleo et al. (Forleo et al., 2019) suggest that education can be determinant to increase awareness, attitudes, and preservation behaviours in natural areas. In the context of archaeological heritage, Mustafa (Mustafa, 2015) recommends education, and in particular behavioural education, to enhance responsible behaviours. Further, Lwoga (Lwoga, 2016) suggests that communicating conservation benefits and empowering communities with knowledge and skills, has the potential to elevate positive attitudes and thus increase conservation behaviours.

2.4 Discussion

The literature review corroborates claims for the existence of a performance gap between planning and implementation (Miralles i Garcia, 2015; Shi et al., 2019; Yasin, Abdullah, Ibrahim, Khalid, & Wahab, 2018). According to Shi et al. (Shi et al., 2019), because a building is a complex system, it is not possible to ensure performance in every aspect exactly as intended at the design stage. At the territorial planning level, Miralles i Garcia (Miralles i Garcia, 2015) points out profitability and land policies as some of the factors in the failure of the implementation of any plan. Further, other studies (Gonçalves, Mateus, & Silvestre, 2019; Perovic, Coffey, Kajewski, & Madan, 2016; Roy & Kalidindi, 2017) have pointed out different challenges in built heritage conservation, such as insufficient knowledge and skills, that are consistent with low perceived behavioural control. The awareness of this gap between intended and actual performance contributed, in the building and construction field, to the continuous development of modelling and simulation techniques to improve the accuracy of predictions. In this context, the concept of behaviour is used to focus on one particular actor: the building. In almost one-third of the results, behaviour is used as a synonym of performance and used to refer to buildings' structural characteristics or hygrothermal and thermal performance. Despite the variety of stakeholders involved in the complex processes of building conservation, no significant number of studies were found analysing their behaviours leading to the implementation (or not) of planned intentions. Occupants' behaviour is an exception in the building and construction sector and it is often referred to by its impact on the energy performance of buildings (Berg & Donarelli, 2019; Brás, Valença, & Faria, 2017; Caro & Sendra, 2020; Galiano-Garrigós, González-Avilés, Rizo-Maestre, & Andújar-Montoya, 2019; Love & Bullen, 2009; Orbell, Hodgkins, & Sheeran, 1997). However, the literature review points occupant behaviour as a factor—one of several things that influence the results, but not as the core of the detailed analysis.

It is in the tourism and hospitality field that most results relating socio-psychological constructs of behaviour and heritage sustainability can be found, predominantly in the perspective of residents and tourists. While no studies were found concerning practitioners and designers engaged in conservation processes, the research with residents and tourists evidences the potential of behavioural sciences to contribute to a better understanding of factors affecting intentions towards heritage conservation. In 1974, Ajzen theorised that knowledge about attitudes improves the prediction of behaviours, but intervening factors may attenuate this relation (Ajzen & Fisbbein, 1974). This is confirmed by the studies analysed in the literature review that evidence attitudes as a fundamental factor in the formation of intention (Soliman & Abou-Shouk, 2017; C. Wang et al., 2019; Q. Yuan et al., 2019; Yang Zhang et al., 2019; Yuangang Zhang & Wang, 2019), but also the role of norms and perceived control in this relation (Lwoga, 2016; Mustafa, 2019). Most of the analysed publications aim at identifying and assessing factors affecting behaviours, such as place attachment, authenticity, perceptions, or motivations. The behaviours analysed are related to destination choice but also with pro-environmental and pro-heritage behaviours. The affective components of attitude—resulting from feelings and emotions, as opposed to cognitive attitudes based on knowledge and information—seem to play an important role in behaviours related to heritage conservation (Bergel & Brock, 2019; Goldberg et al., 2018; Ramkissoon, 2015; Ramkissoon & Uysal, 2010; Yuangang Zhang & Wang, 2019).

No studies were found addressing the cognitive dissonance between intentions and behaviours. This may explain the small percentage of studies using the TRA and the TPB as theoretical frameworks, the most common frameworks to tackle this issue in other fields (Ajzen et al., 2009; Ajzen & Fisbbein, 1974; Sheeran, 2002; Sheeran & Webb, 2016). In common with the previously identified literature addressing the inconsistency between intention and behaviour (Section 1.1), the publications presenting interventions for behavioural change used two-wave methodologies, with pre-/post-experimental designs. This approach allows for accurate measurement of two phenomena: inconsistency of intentions and behaviours (Orbell et al., 1997; van Hooft et al., 2005); and rate of implementation after the intervention (Fennis et al., 2011; Salvatierra & Walters, 2015; Weiler et al., 2017; Wells et al., 2015). While Sheeran and Webb (Sheeran & Webb, 2016) recommend implementation intentions as one of the main tools to increase intention realization, no studies were found in the heritage field about this topic. On the other hand, the role of training and education is found repeatedly in the literature on the heritage field: Gregory-Smith et al. (Gregory-Smith et al., 2017) suggest that educational mechanisms may tackle knowledge and belief gaps; Weiler et al. (Weiler et al., 2017) demonstrate that being exposed to information, through persuasive communication, increases the perception of the benefits of natural parks; Salvatierra and Walters (Salvatierra & Walters, 2015) found knowledge and educational background as moderators of intention and image perception; Lwoga (Lwoga, 2016) suggests that empowering residents with knowledge about conservation benefits may increase positive attitudes and social pressure. This knowledge is essential for planners and decision-makers to find effective managerial solutions for sustainable conservation.

2.4.1 Future Research

In this review, evidence suggests the need for a new approach in the study of practitioners' behaviours towards a sustainable conservation of the built heritage. Sustainable heritage is a multidimensional and subjective concept that varies across contexts. However, by looking at it from a behavioural perspective, it is evident that it has been approached more often in the scope of residents' and tourists' environmental behaviours. A gap was found in the study of the interrelation between intention and behaviour of practitioners involved in conservation processes.

From the results of this review, a future line of research has been developed, proposing to identify which psychological constructs (attitude, norm, perception of control) is more determinant to convert designers' intentions into actual conservation practices. By understanding these factors, it should be possible to shed light on the reasons why sustainable conservation approaches are not more widely implemented in built heritage.

Drawing from Ajzen's TPB (Ajzen, 1985, 1991), this approach has the goal of going beyond good intentions and proposes a behavioural intervention to tackle the issues found and contribute for the implementation of sustainable conservation behaviours. The diagram in Figure 2.3 shows the sequential steps of the purposed pre-/post-experimental methodology (Ajzen, 2002): (1) identification of modal accessible beliefs; (2) measure of the existing intention–behaviour inconsistency; (3) design of the intervention according to the most influent psychological constructs; (4) measurement of the intention–behaviour inconsistency after the intervention.

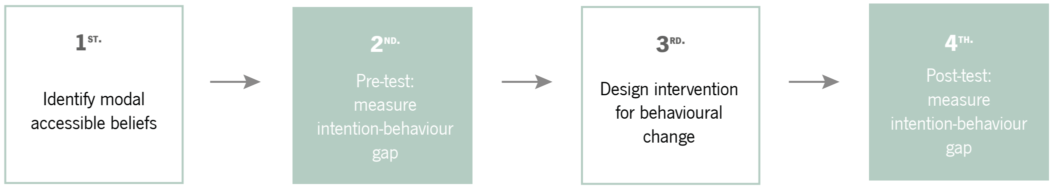

FIG. 2.3 Methodological steps to test an intervention to reduce the intention-behaviour gap

The contribution of such an approach is to facilitate the identification of factors affecting the implementation of good practices for sustainable conservation, so that future research on policies and design tools can be directed towards the fundamental cognitions that hinder implementation. Decision-making includes conscious and unconscious processes. The effective change towards a more sustainable conservation of the built heritage depends on the unveiling of the underlying psychological processes.

One of the limitations of this research is that only one bibliographic database was used, which may have suppressed some relevant results. Further research can expand this study with other bibliographical search engines.

2.5 Conclusions

The literature review proved that a behavioural perspective on sustainable heritage is a very recent topic, even if the theoretical framework has been applied in other fields for decades. The results show that, in the construction sector, behaviour is mostly understood as performance, focusing on the building itself; occupants' behaviour is mentioned as a factor that affects performance, but no significant studies were found about a deeper analysis of the socio-psychological factors affecting occupant behaviour in heritage buildings. This socio-psychological perspective has been mostly introduced in the heritage field by the domain of tourism and hospitality management.

The main goal of this research was to understand the contributions of the TPB to increase the implementation of good practices on sustainable conservation. No studies were found using the TPB or the TRA in the scope of practitioners' behavioural change in the built heritage field. The existing literature does not allow to identify the main factors undermining the implementation of sustainable conservation practices in the built heritage. However, the research addressing other stakeholders involved in heritage management processes—such as tourists and residents—proves the potential of the theoretical framework for a better understanding of behaviours of the different stakeholders and to find managerial solutions for sustainable transitions This literature review demonstrates the novelty of utilizing behavioural approaches in sustainable heritage conservation. Furthermore, this review also allows for a clearer understanding of the more common trends adopted by pioneering researchers in the field, encouraging its development. Using the TPB as a theoretical framework to analyse practitioners' intentions and behaviours is a unique and innovative line of research that may clarify the reasons of the lack of implementation of sustainable practices and open the path for effective behavioural change.

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3 Challenges in professional practice

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ABSTRACT

The increase in urban rehabilitation in the last decade has contributed to a greater public awareness of the need to disseminate the knowledge produced in academy to professional practice. The purpose of this study was to recognize the main problems and opportunities that stakeholders experience in the context of professional practice and identify obstacles to the application of good practices. A participatory methodology was used, focused on the experience of multiple actors in the rehabilitation processes. The results show that the main problems identified are related to the lack of information, the economic constraints, the social perception, and the qualification of the stakeholders. Decision making is a key moment in the process and the weight of the economic factor in decisions is considered excessive by professionals. For good rehabilitation practices to be applied effectively it is necessary to improve the dissemination of knowledge to professional practice, developing new tools to support multi-criteria decision making.

3.1 Introduction

3.1.1 Safeguarding Historic Dwellings

The house is the fundamental mean through which man relates to the world, as stated by Pallasma (2016). This research is oriented to the study of the specifically built heritage destined to inhabit, hereby referred to as Historic dwellings.

From the second half of the 20^{th} century, there is a widespread agreement about the importance of dwelling on the history of architecture and construction. According to Conde (2011), “microcosm of society, the house, urban or rural, common or qualified, is profoundly revealing of that, of the spaces and times in which it rose and continued”. It reveals “social structures, mentalities, techniques and economic organization “of the society of its time.

This notion allowed, over time, to an extension of the Heritage concept, as defined internationally by the UNESCO and ICOMOS charters. In 1964, in the Venice Charter, the concept of “monuments and sites” integrates “not only the single architectural work but also the urban or rural setting in which is found the evidence of a particular civilization, a significant development or a historic event” (ICOMOS, 1964).

The “Recommendation concerning the Safeguarding and Contemporary Role of Historic Areas” (UNESCO, 1976) and the “Convention for the Protection of the Architectural Heritage of Europe” (Council of Europe, 1985) add to the historical, artistic, and scientific interests the social and technical ones. These documents consider the human dimension of the dwelling as “part of the daily environment of human beings everywhere, that they represent the living presence of the past which formed them” (UNESCO, 1976). Thus, the importance of safeguarding historical buildings and “their integration into the life of contemporary society” (UNESCO, 1976) is consolidated, as an “ an irreplaceable expression of the richness and diversity of Europe’s cultural heritage, bears inestimable witness to our past and is a common heritage of all Europeans” (Council of Europe, 1985).

3.1.2 Sustainable Rehabilitation of the Built Heritage

In parallel with a growing interest in ancient buildings that represent cities' historic centres, there is an increased awareness of the dangers of the consumer society, not only in terms of economy but also for the environment. In 1987 the Brundtland Report defines sustainable development as the "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (World Commission on Environment and Development, 1987). Like the concept of Heritage, the concept of Sustainability refers to the legacy left to future generations, not only in the environmental but also in the economic and social dimensions.

Despite this relationship between the two concepts, only in 2011, the publication of the "Principles for the Safeguarding and Management of Historic Cities, Towns and Urban Areas" (ICOMOS, 2011) articulates the issue of sustainable development with the principles of safeguarding historic heritage, in recommendations widely accepted internationally. This document recognizes that "sustainable development has gained such importance that many directives on architectural planning and interventions are now based on policies designed to limit urban expansion and to preserve urban heritage" (ICOMOS, 2011). In this sense, this document argues that interventions in the historic cities are opportunities to improve the quality of urban life, based on the respect for the environmental balance. In the Proposals and Strategies to be adopted, it encourages the reuse and recycling of non-renewable resources and the implementation of strategies to improve energy efficiency: "All interventions in historic towns and urban areas, while respecting historic heritage characteristics, should aim to improve energy efficiency and to reduce pollutants" (ICOMOS, 2011).

In 2013, UNESCO's report "Placing Culture at the Heart of Sustainable Development Policies" also states the need to consider culture as an essential pillar of sustainable development, as "a system of values and a resource and framework to build truly sustainable development, the need to draw from the experiences of past generations" (UNESCO, 2013). It recognizes that the safeguarding of historical areas, together with traditional knowledge and practices, "reduces the environmental footprints of societies, promoting more ecologically sustainable patterns of production and consumption and sustainable urban and architectural design" (UNESCO, 2013).

3.1.3 Good Practices for Rehabilitation

The recognition of built heritage and the growing concern with its sustainability (economic, environmental, and social) has generated in the last decades abundant literature on regulations, recommendations of good practices and principles for intervention (UNESCO, 1968; 1976; Council of Europe, 1975; ICOMOS, 1987; 2003). The "Recommendation concerning the Preservation of Cultural Property Endangered by Public or Private works" (UNESCO, 1968) proposes a series of preservation measures applicable to historic quarters, mostly of a political and administrative nature. The Washington Charter (ICOMOS, 1987) also states that "the conservation of historic towns and other historic urban areas should be an integral part of coherent policies of economic and social development" through conservation plans that systematize archaeological, historical, and architectural, technical, and socio-economic information.

However, these documents mostly present top-down approaches, proposing legal and administrative measures that are insufficient to deal with the technical training gap of agents for integrated heritage preservation, already identified by the European Charter of the Architectural Heritage (Council of Europe, 1975). Considering that architectural heritage "it is threatened by ignorance, obsolescence, deterioration of every kind and neglect", this document identifies the dangers of "Misapplied contemporary technology and ill-considered restoration" and, above all, of land and property speculation that "land and property speculation "brings to naught the most carefully laid plans".

By stating that "It is not enough to simply superimpose, although co-ordinating them, ordinary planning regulations and specific rules for protecting historic buildings" (Council of Europe, 1975), the Declaration of Amsterdam reinforces the need for the formulation of technical mechanisms capable of acting in the training of professionals involved in the practice of heritage intervention. The "Recommendations for the analysis, conservation and structural restoration of architectural heritage" (ICOMOS, 2003) establish a coherent methodological basis for "appropriate intervention in cultural contexts", although recognizing that it cannot "replace in any way, the specific knowledge acquired in cultural and scientific publications".

According to Vítor Cóias, president of the Heritage Guild of Portugal, "good rehabilitation practices are not sufficiently widespread, although the necessary know-how is available" (Pedro, 2017). This statement corroborates the problem identified by Appleton (2011): the results of studies and research carried out in academia do not often reach "the final users, namely designers and builders".

The present research aims to understand the reasons for the gap in the transmission of knowledge to professional practice in the rehabilitation sector so that the development of alternative solutions can start from the recognition of real needs of the different actors.

3.2 Methodology

It was intended to investigate the motivations, needs and decisions of the collective of professionals involved in the rehabilitation of historic dwellings to obtain information about the specific context of the professional practice and to raise questions for future investigations. With the defined goal, a qualitative methodology was used, with participatory techniques, such as the survey and focus group.

3.2.1 Survey to Professionals

The survey on the rehabilitation of historic dwellings was carried out online to teams of designers in Portugal with the tool Google Forms. About 500 professionals were contacted by email, using the database of the Portuguese Association of Architects (Ordem dos Arquitectos) and the dissemination through social networks and contact lists of professional communities (online platform Reabi(li)tar and INTBAU – Portugal).

The results of the first phase, which took place between March 20 and April 12, 2017, included the analysis of 57 responses, 94.7% of which from architects, and allowed to recognize the inspection procedures used in professional practice of building conservation (Gonçalves et al., 2017).

In the present research, qualitative data not considered before is analysed, including those from the open and subjective response fields, which allowed respondents to share experiences not covered by the close-ended questions. Since participation was voluntary only 82 responses were obtained in the period between March 20 and September 14, 2017, and those were considered in this analysis.

All respondents to the survey belong to professional fields related to the construction sector: 78% are architects, 16% are engineers and the remaining 6% represent diverse areas such as archaeology, construction companies or conservation and restoration technicians. There were representative responses from all Portuguese territory, although with a greater concentration in the districts of Lisbon (40.2%), Porto (17.1%) and Braga (14.6%).

3.2.2 Focus Group

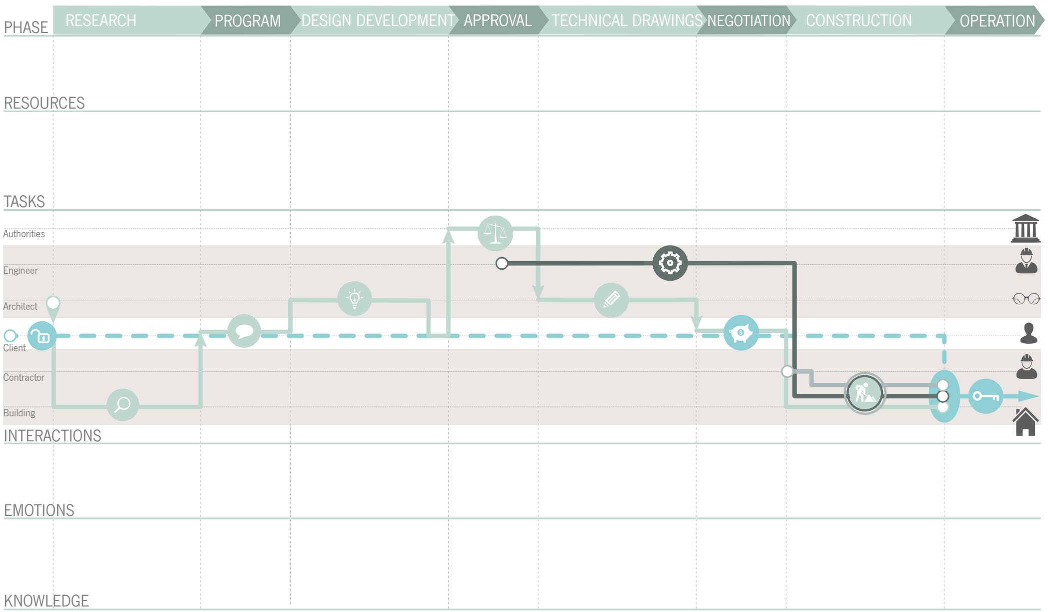

FIG. 3.1 User journey map of the conservation process

To validate the results of the survey with a wider range of actors in the rehabilitation process and to encourage divergent and more detailed responses, a focus group was conducted. It took place on 8th July 2017, within the framework of the 5th Meeting of Traditional Architecture and Sustainability, organized by the Palombar Association, in Vimioso, Portugal.

The focus group consisted of 26 international participants, interested and actively engaged in the rehabilitation of traditional architecture: 34.6% of the participants were architects, 11.5% construction and restoration technicians and artisans,

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and 30.7% represented inhabitants, owners or small private developers. Portugal was the most represented country (46%), followed by Spain (19%) and France (11.5%). Also represented were Guinea-Bissau, Italy, Mexico, Tunisia and Germany.

The discussion was structured around a map, diagrammatically representing the processes of rehabilitation and the points of interaction between the multiple actors (Figure 3.1). The map is understood as “a mean for reflection, socialization of knowledge and practices, and the promotion of collective participation” (Risler & Ares, 2014). The result of this action was a user journey map, built collectively, with the potential to “distinguish priorities and resources when it comes to designing transformative practices” (Risler & Ares, 2014).

3.2.3 Qualitative Analysis

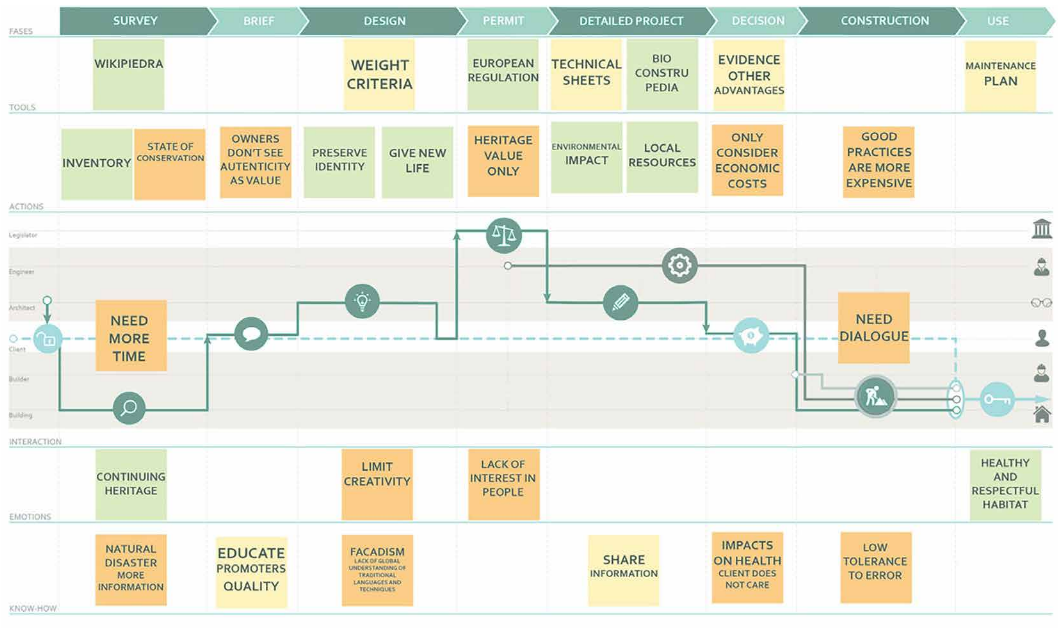

FIG. 3.2 Summary of the user journey map resulting from the focus group

The information presented in §3 results from the intersection of the two procedures described: the survey and the analysis of the focus group. A thematic and content analysis of the collected data was carried out.

To organize the information, the methodology proposed by Turner (1981) was used. The information was classified in thematic groups and related to each other, to establish connections between the emerging concepts and the existing theories. To hierarchize the information, the categories of analysis proposed by Krueger (1994) were considered, using only the analysis of emerging keywords, the frequency of contents, the intensity of expressed emotions and main ideas.

In the analysis of the results of the focus group, only the written results added to the map by the participants were considered. Ambiguous or not perceptible information was eliminated, with a limit of 2% of total participation.

The results of the survey were crossed to those of the focus group, to construct a complete and more detailed map of the rehabilitation process, synthesizing data and graphically describing the considered variables and results obtained (Figure 3.2).

3.3 Results

3.3.1 General Observations

The analysis of the data allowed to distinguish different thematic categories, that group the subjects that emerge transversally from the opinions of participants. These categories tend to constitute the criteria considered for decision-making, by the different actors, at each project phase. It was possible to distinguish 8 thematic categories capable of grouping all fragments of qualitative information collected, as presented in Table 3.1.

TABLE 3.1 Thematic Categories (ordered by frequency and intensity)

Category	Description
Information	Documentation to support daily practice
Economy	Issues such as cost and investment
Social	Cultural aspects that influence decision
Qualification	Education of the technical community
Time	Deadlines and tasks' duration
Occupation	Role of inhabitants and final users
Heritage values	Value assessment and identity
Environment	Impact on the environmental sustainability

Information, Economic Criteria, Social Criteria and Qualification stand out as more problematic issues, both in the survey and in the focus group. These four criteria appear to be at the top of the agenda when considering the frequency with which subjects are approached by participants.

Concerning the intensity of the emotions expressed, the aspects considered more negative are, once again, the information and the economic criterion highlighted in relation to the social question and the qualification of the technicians. It is also the category Information that raises the most urgent suggestions and needs in the participants. The topics considered most positive are the Heritage value and the environmental criterion. Table 3.2 systematizes the main indicators collected for each thematic category.

TABLE 3.2 Main indicators by thematic category (ordered by frequency and intensity)

Category	Indicators
Information	Lack of technical information.
	Existing information is scattered and difficult to access.
	Insufficient resources to support decisions.
	Lack of knowledge sharing among institutions and the professional community.
	Established hierarchies create communication barriers between stakeholders.
	Existing procedures and methodologies are too complex.
Economy	Real estate developers only consider the economic criterion in decision making.
	Good practices are too expensive and financial availability is limited.
	Rehabilitation projects are unprofitable.
	There are no tools to support decision making that allow considering criteria other than economic.
	Speculation dominates the market, both real estate and materials' trade.
Social	Structural cultural problem: neither technicians nor clients are informed.
	Prejudice still guides the processes, favouring the integral demolition.
	Low tolerance for error in the application of traditional techniques.
	Need to educate promoters through examples of good practice.
	There is increased awareness and concern of policymakers and more private investments.
Qualification	Disqualified intervention leads to the destruction of Heritage typo-morphologies.
	Training of technicians and builders is insufficient.
	Formal education disregards traditional know-how.
Time	Good practices are too time-consuming.
	Project deadlines are very tight.

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TABLE 3.2 Main indicators by thematic category (ordered by frequency and intensity)

Category	Indicators
Occupation	Traditional techniques and natural materials have a positive contribution to the inhabitants' health.
	Legislation and project disregard the role of the inhabitants in Built Heritage.
Heritage	Enthusiasm to engage in the continuity of place's identity and history.
	Overly conservative criteria hinder innovation.
Environment	Reduce environmental impact by reusing existing structures.
	Traditional techniques using natural materials have lower environmental impacts.
	Customers still do not recognize the bioconstruction as an alternative.

The participants negatively highlighted the existing resources, considered too complex or insufficient, but also pointed out alternative proposals to fulfil their needs. Interactions among multiple actors in the process are also considered a critical moment, revealing communication problems that influence decision making.

The keyword analysis reveals the main concerns of stakeholders. On the one hand, the results of the survey are more focused on the problems, highlighting the cost, information, and time. The mapping expresses the participants' intentions to consider environmental concerns and the well-being of the inhabitants.

3.3.2 Observations about Information

In the category Information, participants identified two key issues that hinder the implementation of good practices: scarcity of information and communication of existing information.

For 43.7% of respondents to the survey, the lack of technical information on traditional solutions is one of the main problems. Although the focus group affirms that "university teaching consider traditional techniques obsolete and disregard artisan knowledge", the respondent participating in the survey recognize and use reference publications at the national level (Appleton, 2011; Cóias, 2009; Freitas, 2012). 48,3% claim to find the information they seek, mostly in academic works available at the institutions' repositories.

However, the existing information is considered scattered and difficult to access by 36.6% of the respondents. The question of accessibility is related to the Time factor: the search is considered too time-consuming (46.6%) because it is necessary to consult several literature with unstructured data (44,8%). In addition, information is not readily available when and where it would be needed during the project phase, but also in on-site procedures. The participants in the focus group also point out that the information is “closed in academic institutions”, considering urgent to improve the communication so that knowledge is effectively disseminated.

The need to improve communication of knowledge to professional practice was one of the ideas most emphasized throughout the debate, in line with what had already been evidenced by the results of the survey: “the bibliography is very valid, but it is not enough to make decisions”. This statement further reinforces the decision-making phase as one of the most critical in the process. Participants emphasized the need for tools to support thoughtful decision making, considering, for example, long-term maintenance needs and costs, environmental impacts, and health effects for the inhabitants.

3.3.3 Observations about Economic Criteria

The explicit need for tools to support decision-making criteria is directly related to the second theme considered most problematic: barriers to the application of good practices due to economic constraints.

Most respondents consider that one of the priority problems encountered in professional practice is that developers only or predominantly meet economic criteria, disregarding the heritage value of buildings. This option gathers 64.8% consensus among the respondents and was also highlighted by the focus group.

At the same time, they consider that rehabilitation retaining artisanal techniques tends to be more expensive than current practice (as indicated by 49.3% of respondents). Focus group participants consider the main reasons for this difference to be the fact that skilled labour is more expensive, but also “unfair competition with the market for industrialized materials”.

In addition, practitioners consider that the application of good rehabilitation practices, by rigorous metric surveying or assessing the building’s condition, is too complex, time-consuming, and costly for the small-scale rehabilitation projects of historic dwellings. 23.3% of the respondents admit that they do not regularly carry out condition surveys, in the case of residential projects. The main reason given is the limited financial availability (54.5% of answers). Even respondents who comply with these procedures consider them too time-consuming (50%) or too expensive (44.8%).

Considering the predominance of the economic criterion in decision making and the higher costs tied up to good practices, it is possible to conclude that, despite the motivation to work with heritage buildings, professionals consider that “rehabilitation projects offer low profitability”, necessary for the sector’s professional viability.

3.3.4 Observations about Social Issues and Qualification

The two previous problems - information and economic constraints - are related to cultural aspects involving the different actors in the various phases of the processes. As stated by one of the respondents to the survey in the open-ended question: Rehabilitation is not only a technical problem but also a cultural problem and, “without customers, technicians, and informed workers, and without a scale that allows to reduce costs and attract investment, the proper characterization of the building is not possible, and the resulting learning is only casuistic (…)”.

The difficulty of access to information is aggravated by the lack of training of technicians - both builders and designers. The results of the survey indicate the lack of knowledge of the builders regarding the intervention procedures as a problem for 56.3% of respondents. But respondents assume that training of technicians (architects and engineers) is also insufficient to prescribe traditional construction techniques, with 57.7% of responses. The focus group also raises this question by considering that formal education is insufficient for skills training and qualified labour.

Related to the issue of qualification, the focus group highlights the dangers of Facadism, derived from the “lack of comprehension of the overall methods, languages and techniques of traditional architecture”, and “resulting in the destruction of what is intended to be preserved”. This problem stems from the qualification issues mentioned, but also from cultural issues and bias rooted in the multiple actors that continue to favour the complete demolition of the interior of buildings.

The main reasons given for preferring demolition are the risk of unforeseen contingencies during the construction (for 40.8% of respondents), the advanced state of degradation of buildings - even before the rigorous inspection, considered inconsequential for 24.1% of respondents - and the belief that traditional techniques generate problems and discomfort (16,9%). The focus group also notes that “There is less tolerance for error when dealing with traditional techniques, by both builders and customers”, creating social barriers to the application of good practices.

3.4 Discussion

The problem initially identified - the lack of application of good rehabilitation practices by professionals - has its roots in the following causes:

1. Availability of information: scattered, not structured and insufficient for decision-making.
2. Economic constraints: good practices are considered more expensive and there is a prevalence of economic criteria in decision-making.
3. Social perception: generalized disqualification of actors (technicians, builders and developers), leading to uninformed decisions based on prejudice.
4. Limited time: very tight deadlines do not allow to apply good practices considered time-consuming or to investigate information to substantiate the decision.

These problems coincide with the ones encountered in other international studies on the challenges in the management of heritage conservation projects, which confirms the validity of the results at a global scale. Roy et al. (2017) identified, in India, problems related to “competence of agencies; problems in estimation; inadequate and unviable documents; resource constraint; capacity of the client; lack of know-how; stakeholder problems; and problems in restoring functional buildings”. Despite the different category designations, common indicators are easily identified: selection of agencies based only on bidding, lack of traditional know-how among conservation professionals, lack of skilled labour with traditional techniques, technical specifications not available for traditional items, delays, and limited funds. Also, in Australia, the research of Perovic et al. (2016) identified that project failure in Heritage conservation was related to lack of time for investigation work, documentation not reliable and incomplete, unrealistic time frames and specific knowledge required to deal with heritage values.

Decision-making is a key moment in the process and the weight of the economic factor in decisions is considered excessive by professionals. For changes to take place in professional practice, it is essential to have information that allows “to substantiate the decision on a consistent basis” (Bertuglia et al., 1974), with the aim of “bring objectivity and transparency to the process of allocating scarce resources to construction works” (Bana e Costa & Oliveira, 2002).

The results confirm Genin’s (2017) statement on professional qualification: “There is a lack of Heritage education and adequate training for key stakeholders”, leading to demolitions and Facadism in buildings with heritage value. The fact that the gap in technical training is more often identified by professionals with intermediate experience in rehabilitation (10-20 years) points to the need for a lifelong learning offer. In the younger strata of professionals with up to 5 years of professional experience, the non-identification of this problem may suggest greater attention given to these issues, which is already a specific discipline of academic discussion in Europe (Musso & de Marco, 2008).

The concentration of results around existing resources confirms Appleton's statement: "progress in recent years is still not sufficient to ensure the availability of project tools" (Appleton, 2011). The development of information systems that exploit "the increasing capacity of computer media" (Appleton, 2011) is now essential to make the dissemination of knowledge more efficient for professional practice, creating "a valuable database that enables to obtain, with the expected speed, important data for making the right decisions" (Flores & Brito, 2001).

The practical experience of the professionals confirms the perception of Ferraz et al. (2016), who concluded that existing procedures for inspection and diagnosis of the state of conservation of the buildings are too complex. The development of computer tools to support technicians during the on-site inspection and diagnostic procedures, as proposed by these authors, but also by Pedro et al. (2012), can make procedures quicker and less expensive, to meet the concerns expressed by participants. Above all, "by automatically applying the method of summarizing results" (Pedro et al., 2012), it is possible that the inspection procedures of the conservation status will be considered by the technicians as consequent for the project results.

The results evidenced mainly the generalized concern with the weight of the economic factor in the decision making. As stated by Roy et al. (2017), the "selection of agencies through price-based bidding, and procurement of works through traditional contracts leads to poor performance of the projects in terms of time, cost, quality, and safety". In fact, "the initial costs and profitability of the short-term investment cannot be, for the Real Estate Developer/Owner, the only concern" (Flores & Brito, 2001), which confirms the need to demonstrate the added value of regular maintenance to capitalize the investment by "ensuring the commercial value of the property and the sustainability of its use over the expected life cycle" (Flores & Brito, 2001).

Because of the "lack of sufficient time for investigation work and to assess the condition of the building" (Perovic et al., 2016), estimations of tasks and costs are often unreliable which links conservation projects with time and budget overruns. However, more time before the construction starts "will lead to enormous savings in the time and project cost" (Perovic et al., 2016). Above all, the concept of time should be considered in its relativity: "old buildings embody in material form historical and social institutions and make cultural evolution understandable. We experience a thick and haptic (tactile) time that roots us comfortably in the continuum of culture and time" (Pallasma, 2015). As stated in the research of Perovic et al. (2016), while dealing with Heritage, conservation professional should question "what are two months in two hundred years?".

3.5 Conclusions

Social barriers reinforce the two main problems identified: information and weight of the economic factor. The information and the qualification gap of the various actors lead to decisions based solely on the initial investment, disregarding other criteria relevant to the participants in this study: inhabitants' health, maintenance costs, the environmental impact of the intervention, respect for traditional know-how and heritage value.

The use of participatory methodologies, in addition to detecting and describing problems, made it possible to establish concrete needs and collect suggestions for solving the problems identified by professionals in the rehabilitation sector. This reflection emphasized the importance of communicating information in an open system: to transpose into professional practice the knowledge produced but not disseminated; and to enable the professional community to conduct research that meets the needs of its practice.

The results of this research open several lines for future research, such as:

1. Demonstrate long-term economic benefits from the application of good rehabilitation practice (return on investment, durability, and maintenance costs).
2. Assess the impact of exposure to good practice on the qualification of real estate developers.
3. Quantify the benefits of rehabilitation and traditional techniques for reducing the environmental impacts associated with construction.
4. Verify the contribution of traditional techniques and natural materials to improve comfort and wellbeing.
5. Develop multicriteria tools to support decision making, considering not only the economic, technical and heritage criteria but also environmental impact, health issues and social function of the places to be preserved.

These studies are essential for informing new urban policies to promote sustainable rehabilitation through a legal framework that ensures informed decision making and aligns environmental sustainability to the continuity of heritage values.

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4 Intention-Behaviour gap

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ABSTRACT

This research applies the theory of planned behaviour (TPB) to measure the gap between designers' intentions towards heritage conservation and the actual design decisions. It aims at contributing to identify which psychological constructs (attitude, norm, perception of control) are hindering the implementation of sustainable conservation approaches in practice. The results suggest that attitudes have a significant correlation with performed behaviour, and that norms, despite impacting intentions, do not necessarily correlate with the performed actions. Using the TPB to analyse designers' behaviours is an innovative methodological approach that opens new possibilities for the design of interventions targeting behavioural change towards the implementation of sustainable conservation practices in built heritage.

4.1 Introduction

The Sustainable Development Goals (SDG) defined on the global agenda for sustainable development (UN, 2015) endorses for the first time at the international policy level the role of heritage and its conservation to achieve sustainable development. Despite being often approached as opposite or incompatible concepts in the last decades (Dornelles, Gandolfi, Mercader-Moyano, & Mosquera-Adell, 2020; Lidelöw, Örn, Luciani, & Rizzo, 2019), sustainability and heritage conservation can today be understood in their shared goal of conserving valuable resources for future generations (Gonçalves, Mateus, Silvestre, & Roders, 2019).

According to Dornelles et al. (Dornelles et al., 2020), a coherent and legible urban landscape depends on urban and architectural interventions that are sensitive to social memory and heritage values since these interventions can have potential harmful effects on the ways of life and community welfare. The importance of heritage for sustainability surpasses the social dimension. As a driver of sustainable development (Janssen, Luiten, Renes, & Stegmeijer, 2017) heritage benefits range from the contribution to local economies and economic growth (Icomos, 2011) to the knowledge capital on the environmental dimension (Unesco, 2013). The research of Vardopoulus (Vardopoulos, 2019) identifies and prioritises critical sustainable development factors affected by the adaptive reuse of buildings: improvement of quality of life; community empowerment; environmental management; land conservation; local culture and identity conservation; public awareness and education; and cultural heritage protection.

Despite the generalised perception of the positive contributions of heritage to sustainable conservation, the literature points to a lack of information on the nature of these contributions (Lidelöw et al., 2019). In a systematic literature review, Lidelöw et al.(Lidelöw et al., 2019) show that approaches that consider the conservation of built heritage is, in itself, an energy efficiency measure (by saving embodied energy, reducing waste, and taking advantage of passive systems), are still scarce. It also identified that the assessment of cultural values is rarely explicit, referring to generic conservation principles, without a clear and transparent assessment method that supports practitioners' decisions towards sustainable conservation (Lidelöw et al., 2019).

Current literature on the challenges of heritage conservation (Ashley, Osmani, Emmitt, Mallinson, & Mallinson, 2014; Gonçalves, Mateus, & Silvestre, 2019; Perovic, Coffey, Kajewski, & Madan, 2016; Roy & Kalidindi, 2017) identifies a performance gap between conservation intentions and its actual implementation in the design and construction stages. In common, these studies point to the behaviour of the different stakeholders in the process — from decision-makers to occupants — as the leading cause for the performance gap. Notwithstanding, a behavioural approach in the sustainable heritage field is a very recent topic (Gonçalves, Mateus, Silvestre, & Roders, in press). In specific for built heritage, behaviour is frequently mentioned as a synonym of "performance", referring to physical characteristics of the building. While in the construction sector, in general, there is raising awareness of the role of occupants' behaviour for sustainability and energy efficiency (Chen, Ding, Bai, & Sun, 2020; Gianfrate, Piccardo, Longo, & Giachetta, 2017; Laaroussi, Bahrar, El Mankibi, Draoui, & Si-Larbi, 2020; Pombeiro, Santos, Carreira, & Silva, 2019), in the specific field of built heritage, occupants' behaviour is only mentioned as a factor that affects performance, without a more in-depth analysis of the underlying socio-psychological factors (Berg & Donarelli, 2019; Caro & Sendra, 2020; Galiano-Garrigós, González-Avilés, Rizo-Maestre, & Andújar-Montoya, 2019; Mutani, Todeschi, Kämpf, Coors, & Fitzky, 2018). A systematic literature review on behaviour and heritage conservation found no results targeting practitioners' behaviour towards the implementation of sustainable conservation practices (Gonçalves et al., in press).

This research applies the Theory of Planned Behaviour (TPB) (Icek Ajzen, 1985, 1991) to measure the gap between designers' intentions towards heritage conservation and the actual design decisions, and to identify which psychological constructs (attitudes, subjective norms, perception of control) are hindering the implementation of sustainable conservation approaches in practice. The unveiling of the latent psychological factors affecting the decision process will contribute to future research on policies and design tools targeting effective behavioural change for sustainability.

4.2 Background

Social psychological models can be used to predict human behaviour and to understand its relationship with other psychological constructs, such attitudes, or intentions. The TPB (Icek Ajzen, 1985, 1991) is based on the premise that the intention to perform a behaviour is the immediate antecedent of the behaviour itself (Icek Ajzen & Fisbbein, 1974; Sheeran, 2002). According to this theory, three main factors affect the formation of intentions, and thus, behaviour: attitudes, subjective norms, and Perceptions of Behavioral Control (PBC). According to Sheeran (Sheeran, 2002), the gap between intention and behaviour is mainly caused by those that having an intention to act, fail to implement their intentions (inclined abstainers). While intentions are a reliable predictor of behaviours, the consistency between intention and behaviour is not always absolute, due to low facilitating conditions and intervening events (Icek Ajzen & Fishbein, 2010; Triandis, 1980) that affect the actual behavioural control.

Sheeran (Sheeran, 2002) classifies the factors affecting behavioural control in two main categories: 1) factors related to self-efficacy (knowledge, ability), and 2) factors related to controllability (resources, availability, opportunity, and cooperation). These factors, presented in Figure 4.1, can be defined as follows:

FIG. 4.1 Factors affecting behavioural control according to Sheeran (2002)

- Knowledge: be aware of the information
- Ability: have the necessary skills to use that information
- Resources: the existence of the resources required to implement the intention
- Availability: have access to the necessary resources
- Opportunity: have the chance to act
- Cooperation: be able to negotiate with different actors
- Unexpected situations: factors related to controllability

Several studies analyse the challenges in the conservation of built heritage, showing that despite the good intentions in the field, inclined abstainers fail to implement their intentions. The research of Yung & Chan (Yung & Chan, 2012) interviews practitioners about the main challenges of applying sustainability goals in the adaptive reuse of built heritage in Hong Kong. While demonstrating that practitioners are aware of the importance of heritage for sustainable development in the social, economic, and environmental dimensions, this study also states that the challenges of incorporating sustainability in practice “are still unresolved” (Yung & Chan, 2012). Ashley et al. (Ashley et al., 2014) interviewed representatives of the different stakeholders involved in the conservation of built heritage in Sudan, from governments to major investors, such as UNESCO, but also local investors, architects, engineers, and end-users. The findings show financial restrictions, stakeholder collaboration, and knowledge and awareness as primary problems.

Further, the research of Ashley et al. (Ashley et al., 2014) identifies a dissociation between stakeholder groups, which attribute responsibility to each other. In Australia, Perovic, Coffey & Kajewski (Perovic et al., 2016) used interviews in real practice case studies to research the repeating issues affecting heritage-listed conservation projects. It points the difficulty to reach a clear assessment of the significance of the place as one of the main problems, together with the reliability of documentation, unexpected situations, and the necessary qualified knowledge. The research of Roy & Kalidindi (Roy & Kalidindi, 2017) interviewed conservation professionals in India to investigate the reasons for project failure in terms of time, cost, and quality. As Ashley et al. (Ashley et al., 2014), it identifies, resource constraints, lack of know-how, and stakeholders’ cooperation among the main issues. An earlier research used a focus group with different stakeholders to identify the main challenges in professional practice (Gonçalves, Mateus, & Silvestre, 2019). Accordingly, in that study, the authors concluded that the knowledge and qualification gap among all the stakeholders in the process leads to decisions based solely on the initial investment, disregarding heritage values and sustainability principles.

These studies allow identifying modal accessible beliefs, common amongst practitioners working in heritage conservation processes around the world. As theorised by Sheeran (Sheeran, 2002), challenges in the implementation can be related to the low perception of behavioural control, also in the field of heritage conservation. All the factors defined by Sheeran (Sheeran, 2002) were identified in practitioners’ discourse about challenges in conservation, with knowledge, ability, resources, and cooperation as the most outstanding, as shown in Table 4.1. Recurrently, the challenges identified in the literature are associated with an external locus of control: practitioners tend to externalise responsibility of the failure to other stakeholders in the process, from policy-makers to clients.

TABLE 4.1 Challenges pointed out by professionals hindering implementation

Category	Factors	Literature
Knowledge	A gap in conservation knowledge and awareness of all the stakeholders	(Gonçalves, Mateus, & Silvestre, 2019) (Ashley et al., 2014)
	Lack of technical information	(Gonçalves, Mateus, & Silvestre, 2019)
	Knowledge gap on traditional know-how	(Gonçalves, Mateus, & Silvestre, 2019) (Perovic et al., 2016)
	Low awareness of private owners	(Gonçalves, Mateus, & Silvestre, 2019) (Perovic et al., 2016)
Ability	Procedures and methodologies are too complex	(Gonçalves, Mateus, & Silvestre, 2019) (Perovic et al., 2016)
	Technical capacity of all actors	(Ashley et al., 2014) (Roy & Kalidindi, 2017)
	Contractors without experience in conservation	(Roy & Kalidindi, 2017) (Perovic et al., 2016)
	Insufficient training of technicians	(Gonçalves, Mateus, & Silvestre, 2019)
Resources	Unsuitable deadlines	(Gonçalves, Mateus, & Silvestre, 2019) (Roy & Kalidindi, 2017) (Perovic et al., 2016)
	Conservation practices are too time-consuming	(Gonçalves, Mateus, & Silvestre, 2019) (Perovic et al., 2016)
	Limited financial availability	(Gonçalves, Mateus, & Silvestre, 2019) (Ashley et al., 2014) (Roy & Kalidindi, 2017)
	Conservation is unprofitable	(Gonçalves, Mateus, & Silvestre, 2019) (Yung & Chan, 2012)
	Decisions only consider economic criteria	(Gonçalves, Mateus, & Silvestre, 2019) (Perovic et al., 2016)
Availability	Existing information is difficult to access	(Gonçalves, Mateus, & Silvestre, 2019)
	Insufficient tools to support decision-making	(Gonçalves, Mateus, & Silvestre, 2019)
	Technical specifications are not available for traditional technologies	(Roy & Kalidindi, 2017)
	Lack of documentation on the original building, local history and community narratives	(Roy & Kalidindi, 2017) (Roy & Kalidindi, 2017; Yung & Chan, 2012)
	Limited sourcing of compatible materials	(Roy & Kalidindi, 2017) (Perovic et al., 2016)
Opportunity	Regulations limit innovative design	(Roy & Kalidindi, 2017) (Perovic et al., 2016) (Ashley et al., 2014) (Gonçalves, Mateus, & Silvestre, 2019) (Yung & Chan, 2012)
	Building codes not compatible with heritage conservation	(Perovic et al., 2016) (Yung & Chan, 2012)
Cooperation	Lack of coordination between stakeholders	(Roy & Kalidindi, 2017)
	Segregation between different expertise or project disciplines	(Gonçalves, Mateus, & Silvestre, 2019) (Roy & Kalidindi, 2017)
	Competing priorities of different stakeholders	(Perovic et al., 2016) (Ashley et al., 2014) (Yung & Chan, 2012)
	Lack of consultation of different stakeholders	(Perovic et al., 2016)
	Private ownership	(Roy & Kalidindi, 2017) (Ashley et al., 2014)
	Changes in the client brief	(Perovic et al., 2016)
Unexpected situations	Unpredictable works due to building decay and latent conditions	(Roy & Kalidindi, 2017) (Perovic et al., 2016) (Ashley et al., 2014)

In the present study, the research population were architecture students of the Heritage and Design studios, at the TU Delft, Netherlands. The aim was to clearly isolate the factors affecting the gap between intention and implementation. By researching in a controlled environment where designers are free to explore their own limits, without dealing with clients and regulations, will allow understanding if the cooperation between multiple stakeholders, and the normative regulations, pointed by the literature, are the most determinant factors affecting the implementation of conservation intentions.

4.3 Materials and Methods

This study adapted and applied techniques used in social psychology to understand and measure the intention-behaviour gap. The objective of these techniques is to bypass conscious defences and gather the tacit knowledge. Therefore, the participants can provide unchanged views of their feelings and attitudes, which is not possible with more direct questioning.

This study was thus divided in a sequence of three research steps: intention questionnaire, generative artefacts, and self-assessment of behaviour. Initially, a TPB questionnaire (I Ajzen, 2017) was distributed amongst the participants, to identify their intentions for the design phase. Then students developed their design process, for eight weeks. It was considered that the design process is a generative technique that allows participants to express visually and spatially their priorities and attitudes towards valuable attributes of the building. After the submission of the final design projects, the same group of students answered a questionnaire with the aim of self-assessing their actual design decisions towards the building attributes defined in the intention questionnaire.

The study took place between September 2019 and February 2020, within the scope of the Heritage & Architecture master studios, offered by the faculty of Architecture and the Built Environment, at the Delft University of Technology, the Netherlands. The students were asked to give informed consent to start the survey. The questionnaire was distributed among 63 students. A return rate of 62% was achieved (see Table 4.2). The questionnaire was distributed by two groups of students: group 1 working on the American Embassy building, in Den Haag, and group 2 working on the Huys te Warmond estate, both in the Netherlands.

The American Embassy is an exemplar of the 20th-century heritage, designed by Marcel Breuer in 1959, and declared as a national monument in 2017 (Galema & Hooimeijer, 2008). The Huys te Warmond is a historic estate and country house, listed as a national monument since the year 2000 (Riepema, 2020).

TABLE 4.2 Response rate

	Students on list	Responses Phase 1	Responses Phase 2	Response rate
1) American Embassy	25	20	15	60%
2) Huys te Warmond	38	28	24	63%
Total	**63**	**48**	**39**	**62%**

4.3.1 TACT: target, action, context, and time

To develop the intention survey, the behaviour of interest was defined in it its Target, Action, Context and Time (TACT) elements (I Ajzen, 2017; Icek Ajzen & Fishbein, 2010). Context and time are common to all groups of questions, referring to the specific buildings used as case studies in the design studios. Target and Action refer to the conservation actions towards the valuable attributes of a building. In the context of this research, the list of attributes was defined according to the seven building layers adapted by Kuipers & de Jonge (Kuipers & De Jonge, 2017) from Brand (Brand, 1995). Accordingly, these seven layers are defined as follows (Figure 4.2):

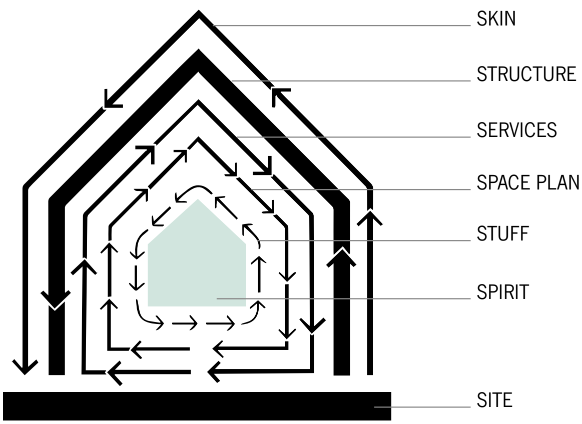

FIG. 4.2 Seven building layers adapted by Kuipers & de Jonge

TOC

- Site: relation of the building with the surrounding urban landscape;
- Skin: the building envelope and interface with the exterior;
- Structure: the support construction systems;
- Services: the infrastructures, such as plumbing, electrical systems, heating and ventilation;
- Space Plan: the interior layout and distribution of spaces;
- Stuff: furnishings and furniture;
- Spirit of the Place: intangible aspects related to building's meanings over time .

This conceptual framework used by the master students as a guideline for the analysis and design process was also used as the theoretical framework of this research, since it allows a gradual approximation to the building, from site to spirit, ensuring that the questions are easily understandable by the research population.

4.3.2 Development of the questionnaire

According to the theoretical model (Figure 4.3), the intention survey was developed with four groups of questions: attitudes ("I consider it to be"), subjective norms ("is expected of me that"), perception of control ("it is easy for me to") and intention ("I intend to"). All the questions use a 5-point Likert scale.

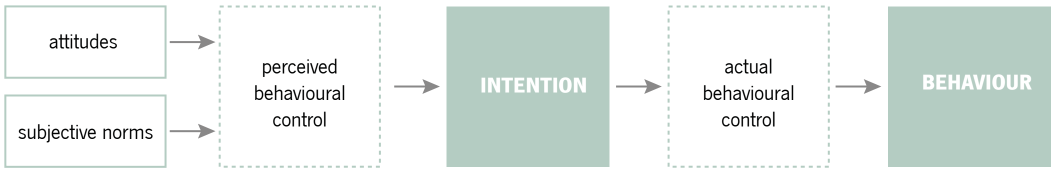

FIG. 4.3 Theoretical model based on the TPB

The first group of questions aims at identifying the attitudes of the participants towards the attributes of the building. This group allows collecting data about the participant's value assessment of the building. The second group aims to identify the presence of social pressure over the performance of the action, namely the opinion of colleagues and tutors. It allows identifying on which building attributes the formation of intentions is affected by the opinions of significant others. This data is essential to further understand, in the analysis of results, which intentions may not have been applied due to the tutor intervention. The third group of questions intended to measure perceptions of behavioural control. For reasons of feasibility, not all the factors identified by Sheeran (reference) were considered, focusing only on self-efficacy (knowledge /skill). Finally, in the fourth group, standard direct measures of intention were collected for each attribute of the building, to establish a baseline for comparison with the final design interventions.

In the follow-up questionnaire, students were asked to self-assess their designs ("in my design I decided to"), reporting on the level of conservation of the same list of attributes, in a similar 5-point Likert scale. The questionnaire was tested and reviewed by a selected group of tutors and master students to ensure its simplicity and clarity.

4.3.3 Data analysis

Data were analysed using SPSS Version 26.0 (SPSS Inc., Chicago, IL, USA). Descriptive statistics, including percentages, arithmetic means, and standard deviation were used to summarize the choices of the students towards conservation, in the different groups of questions and for each building attribute.

This questionnaire was validated for reliability and internal consistency, measuring the Cronbach alpha for each variable group (attitude, subjective norms, perception of control, intention, and behaviour), with alpha being higher than 0,6 in all cases (Table 4.3), as recommended by the literature (Hair, Black, Babin, Anderson, & Tatham, 2006; Nunnally & Bernstein, 1994). Considering that the questionnaire proved to be internally consistent, data was merged into the main variable groups, to run the bivariate correlation analysis with a sufficient sample.

TABLE 4.3 Internal consistency and reliability of the measuring scale

	Cronbach's alpha	N. of items
Attitudes	0,803	26
Subjective norms	0,955	30
PBC	0,651	20
Intention	0,736	26
Behaviour	0,688	23

The relation between behaviour and the other variables was analysed using linear regression modelling, followed by multiple regression with backwards elimination (Icek Ajzen, 2002). The final model was obtained by eliminating variables associated with a P-value greater than 0.20, with low statistical significance. Collinearity among variables in the model was measured by the variance inflation factor (VIF). No multicollinearity was detected (VIF<2). Results are expressed as the Beta coefficient with their confidence intervals at 95% (95% CIs).

In the last question of the self-assessment questionnaire, respondents were asked to identify the main reason that led them not to conserve the attributes that they previously expressed intention to. The results of this question were analysed qualitatively, using content and thematic analysis.

4.4 Results

4.4.1 Descriptive statistics

In the first part of the questionnaire, respondents were given the option to choose the parts of the building they consider more relevant for their case study. Respondents prioritize the site, the structure, the "skin" and the "spirit of the place". The layers services (related to infrastructures), space plan, and stuff (related to movable objects and fixed furniture) are considered less important in the context of heritage conservation by more than half of the respondents (Table 4.4).

Some differences emerge when analysing the two groups separately, that may be related to the specific features of the case studies. For instance, focusing on the attitudes towards the conservation of building attributes, the relation with street seems to be much more relevant in the American Embassy (76,5% "very valuable" responses) than in the Huys te Warmond (18,2% "very valuable" responses). Contrarily, the roof is considered more important in the Huys te Warmond (considered "very valuable" or "valuable" for 86% of responders) than in the American Embassy, where all the respondents show a neutral (30%) or even negative attitude (70%).

TABLE 4.4 Relevance of building attributes according to respondents

	1) American Embassy		2) Huys te Warmond		Total	
Layer	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
Site	17	77,3%	22	73,7%	39	81,3%
Structure	16	72,7%	24	80%	40	83,3%
Skin	20	90,9%	21	70%	41	85,4%
Services	3	13,6%	4	13,3%	7	14,6%
Space Plan	4	18,2%	19	63,3%	23	47,9%
Stuff	2	9,1%	6	20%	8	16,7%
Spirit of the Place	14	63,6%	24	80%	38	79,2%

In the American Embassy group, results show strong positive attitudes (around 53% of the responses) and high levels of perception of control (pointed out by about 61% of the respondents). The layer "skin" consistently presents average positive replies, with positive attitudes and perception of high expectations, but also good levels of control (for 80% of respondents). In the other extreme, "spirit of the place" has the lowest values. Even if there is a positive attitude towards the conservation of the spirit of the place, it presents the lower value on the positive attitudes in the analysed building layers (Table 4.5). The "spirit of the place" is also highlighted by respondents as not particularly subject to social pressure and, at the same time, the one where levels of control are lower (on average for 43% of respondents).

TABLE 4.5 Average values according to the building layer in the American Embassy group

	Attitudes[1]		Subj. Norms[2]		PBC[3]		Intention[4]		Behaviour[5]	
Layer	Pos.	Mean (SD)	High	Mean (SD)	High	Mean (SD)	Pos.	Mean (SD)	Pos.	Mean (SD)
Site	51%	2.4 (0.8)	44%	2.5 (1.0)	70%	2.1 (0.7)	64%	2.3 (1.2)	75%	2 (1.1)
Structure	69%	2.1 (1.0)	67%	2.1 (1.0)	71%	1.9 (0.9)	78%	2.1 (1.2)	67%	1.9 (0.9)
Skin	66%	2.2 (0.8)	59%	2.4 (1.0)	80%	1.9 (0.8)	67%	2.4 (1.2)	67%	2.2 (0.9)
Spirit of Place	57%	2.4 (1.1)	44%	2.6 (1.2)	57%	2.2 (1.0)	45%	2.7 (1.1)	57%	2.5 (1.3)
Average	53%	2.3 (0.9)	46%	2.4 (1.0)	61%	2 (0.9)	54%	2.4 (1.2)	57%	2.2 (1.0)

1 *on a scale from 1:5 where 1 is "very valuable" and 5 is "worthless";*
2/4 *on a scale from 1:5 where 1 is "extremely likely" and 5 is "extremely unlikely";*
3 *on a scale from 1:5 where 1 is "strongly agree" and 5 is "strongly disagree";*
5 *on a scale from 1:5 where 1 is "~100%" and 5 is "~0%"*

At the indicator level, the results allow identifying priorities on the decision-making process. The conservation of the facade, for instance, is seen for 100% of the respondents as valuable; 90% feel social pressure to conserve this element, and 84% show high levels of perceived behavioural control. As a result, 84% of the respondents indicate the intention to conserve the façade, and all the respondents (100%) self-report high percentages of conservation of the building attributes. Other indicators with similar positive reactions are the "skin" materials and the relation with the street. Contrarily, the indicators that concentrate more negative reactions are the conservation of the roof, the relation with topography, and religious expressions. The respondents do not feel social pressure for the conservation of these aspects, but recognise low perception of control, not having enough knowledge to support the conservation of these elements (Table 4.6).

TABLE 4.6 Main positive and negative indicators in the American Embassy group

		Attitudes[1]		Subj. Norms[2]		PBC[3]		Intention[4]		Behaviour[5]	
	Indicator	Freq.	Mean (SD)	Freq.	Mean (SD)	Freq.	Mean (SD)	Freq.	Mean (SD)	Freq.	Mean (SD)
positive	Facade	100%	1.2 (0.4)	90%	1.4 (0.8)	84%	1.7 (0.7)	85%	1.6 (1.2)	100%	1.4 (0.5)
	Skin materials	90%	1.6 (0.7)	80%	1.8 (0.8)	84%	1.8 (0.8)	90%	1.8 (1.0)	79%	1.9 (0.9)
	Relation with street	88%	1.4 (0.7)	71%	1.8 (0.9)	94%	1.6 (0.6)	88%	1.6 (1.1)	78%	1.7 (1.0)
negative	Roof	100%	4.3 (0.9)	90%	3.9 (1.1)	21%	2.3 (0.9)	90%	4.1 (1.3)	71%	3.2 (1.4)
	Relation with topography	94%	3.8 (0.8)	82%	3.4 (1.3)	75%	2.9 (0.7)	82%	3.7 (1.3)	33%	2.2 (1.2)
	Religious expressions	64%	3.4 (1.6)	79%	3.6 (1.3)	62%	2.7 (1.3)	85%	3.6 (1.2)	72%	3.4 (1.6)

[1] *on a scale from 1:5 where 1 is "very valuable" and 5 is "worthless";*
[2/4] *on a scale from 1:5 where 1 is "extremely likely" and 5 is "extremely unlikely";*
[3] *on a scale from 1:5 where 1 is "strongly agree" and 5 is "strongly disagree";*
[5] *on a scale from 1:5 where 1 is "~100%" and 5 is "~0%"*

In the Huys te Warmond group, respondents show, in general, more positive attitudes towards conservation than in the American Embassy (65% instead of 53%). They also point out higher social pressure (60% instead of 46%). However, on average, levels of perceived behavioural control, intention, and behaviour do not vary significantly in the two groups. As in the first group, the layer "skin" consistently presents positive replies but is surpassed in the second group by the layer structure, with 90% positive attitudes, 88% high perceived norms, and 85% of perceived control, also converting it in the layer with highest levels of intention and behaviour (Table 4.7). Once again, "spirit of the place" is the building layer with more negative replies, being considered less valuable for more than one-third of the respondents (38%), and with lower perceived control (for 42% of respondents).

At the indicator level, results are very similar in the American Embassy and the Huys te Warmond groups, with the conservation of the façade as one of the main priorities, and the conservation of religious expressions as the least important indicator. Nevertheless, also some differences emerge, e.g. the relation with the surroundings being more important than the relationship with the street, or the roof being considered valuable for the majority of the respondents (Table 4.8).

TABLE 4.7 Average values according to building layer in the Huys te Warmond group

	Attitudes[1]		Subj. Norms[2]		PBC[3]		Intention[4]		Behaviour[5]	
Layer	Pos.	Mean (SD)	High	Mean (SD)	High	Mean (SD)	Pos.	Mean (SD)	Pos.	Mean (SD)
Site	65%	1.9 (0.9)	69%	1.9 (0.9)	80%	2.0 (0.9)	79%	1.8 (0.9)	55%	2.2 (1.2)
Structure	90%	1.0 (0.7)	88%	1.7 (0.7)	85%	1.7 (0.7)	88%	1.0 (0.8)	77%	1.2 (0.9)
Skin	85%	1.9 (0.7)	78%	1.9 (0.9)	79%	2.0 (0.7)	79%	1.6 (0.9)	73%	1.6 (0.9)
Spirit of the Place	62%	2.1 (1.0)	48%	3 (1.2)	58%	2.4 (1.2)	44%	2.8 (1.2)	56%	2.2 (1.2)
Average	65%	1.8 (0.8)	60%	2.1 (0.9)	64%	2 (0.9)	61%	1.8 (1.0)	56%	1.8 (1.0)

1 *on a scale from 1:5 where 1 is "very valuable" and 5 is "worthless";*
2/4 *on a scale from 1:5 where 1 is "extremely likely" and 5 is "extremely unlikely";*
3 *on a scale from 1:5 where 1 is "strongly agree" and 5 is "strongly disagree";*
5 *on a scale from 1:5 where 1 is "~100%" and 5 is "~0%"*

TABLE 4.8 Main positive and negative indicators in the Huys te Warmond group

		Attitudes[1]		Subj. Norms[2]		PBC[3]		Intention[4]		Behaviour[5]	
	Indicator	Freq.	Mean (SD)	Freq.	Mean (SD)	Freq.	Mean (SD)	Freq.	Mean (SD)	Freq.	Mean (SD)
positive	Facade	100%	1.2 (0.4)	100%	1.4 (0.8)	95%	1.7 (0.7)	86%	1.6 (1.2)	88%	1.4 (0.5)
	Surroundings and context	100%	1.6 (0.7)	95%	1.8 (0.8)	100%	1.8 (0.8)	95%	1.8 (1.0)	86%	1.9 (0.9)
	Shape	100%	1.4(0.7)	86%	1.8 (0.9)	90%	1.6 (0.6)	81%	1.6 (1.1)	82%	1.7 (1.0)
negative	Religious expressions	58%	4.3 (0.9)	75%	3.9 (1.1)	62%	2.3 (0.9)	88%	4.1 (1.3)	74%	3.2 (1.4)
	Relation with topography	50%	3.8 (0.8)	50%	3.4 (1.3)	50%	2.9 (0.7)	45%	3.7 (1.3)	60%	2.2 (1.2)
	Local traditions	46%	3.4 (1.6)	54%	3.6 (1.3)	54%	2.7 (1.3)	50%	3.6 (1.2)	63%	3.4 (1.6)

[1] *on a scale from 1:5 where 1 is "very valuable" and 5 is "worthless";*
[2/4] *on a scale from 1:5 where 1 is "extremely likely" and 5 is "extremely unlikely";*
[3] *on a scale from 1:5 where 1 is "strongly agree" and 5 is "strongly disagree";*
[5] *on a scale from 1:5 where 1 is "~100%" and 5 is "~0%"*

4.4.2 Intention-behavior gap

The bivariate correlation analysis confirms the correlations predicted by the theoretical model (Ajzen, Sheeran, etc.). Intention has a moderately positive correlation with behaviour, with the correlation coefficient (r= 0.366) evidencing a statistically significant (p= 0.036) effect of the increase of positive intentions in the increase of positive behaviours. Attitudes, however, present a stronger correlation with behaviour than with intentions (r=0.580; p=0.000), suggesting that, in the scope of this study, attitudes are a more reliable predictor of behaviour, than the expressed intentions. Subjective norms – the expectations of tutors and peers - seem to affect the formation of attitudes on the students, and to mediate expressed intentions. Nevertheless, no correlation was found between subjective norm and actual behaviour. In the scope of this research, perceived behavioural control does not appear to have a significant correlation with any of the analysed psychological construct (Table 4.9).

Simple linear regression was carried out to investigate further which layers of the building have a stronger relationship with conservation behaviours. The results showed a significant relationship between the attitudes towards the "skin" of the building and the conservation behaviour (p=0.001). The R2 value was 0.333, meaning that 33% of the variation in conservation behaviours can be explained by the model containing only attitudes towards the skin. Structure and skin are the building layers where the relationship with conservation behaviour was proven to be more significant (p<0.1), predicting the self-reported behaviours (Table 4.10). In the opposite direction, the layer "spirit of the place" presents less significant results in predicting conservation behaviour.

TABLE 4.9 Pearson correlations among analysed psychological constructs

		Intention	Behaviour	Attitudes	Subj. norms	PBC
Intention	Pearson Correlation (r)	1	.366*	.351*	.337*	.131
	Sig. (2-tailed) (p)		.036	.017	.022	.387
	N	46	33	46	46	46
Behaviour	Pearson Correlation (r)	.366*	1	.580**	.335	.182
	Sig. (2-tailed) (p)	.036		.000	.057	.310
	N	33	36	33	33	33
Attitudes	Pearson Correlation (r)	.351*	.580**	1	.407**	.009
	Sig. (2-tailed) (p)	.017	.000		.004	.955
	N	46	33	47	47	46
Subj. norms	Pearson Correlation (r)	.337*	.335	0.407**	1	-.045
	Sig. (2-tailed) (p)	.022	.057	0.004		.765
	N	46	33	47	47	46
PBC	Pearson Correlation (r)	.131	.182	.009	-.045	1
	Sig. (2-tailed) (p)	.387	.310	.955	.765	
	N	46	33	46	46	46

TABLE 4.10 Single linear regression between independent variables and "conservation behaviour"

		Beta coefficient	Sig. (p)	R^2
Site	Attitudes	0.221	0.246	0.053
	Subj. Norms	0.216	0.212	0.062
	Intentions	0.223	0.08	0.118
Structure	Attitudes	0.366	0.076	0.121
	Subj. Norms	0.363	0.064	0.131
	Intentions	0.31	**0.034***	**0.167**
Skin	Attitudes	0.542	**0.001***	**0.333**
	Subj. Norms	0.312	0.057	0.128
	Intentions	0.148	0.298	0.04
Spirit	Attitudes	0.103	0.617	0.01
	Subj. Norms	-0.047	0.737	0.004
	Intentions	-0.117	0.409	0.026

* *significant at level p<0.05*

Considering the results of the single linear regression, multiple regression with backwards elimination was performed to find out the model that better explains the reported behaviours towards conservation of built heritage. The final model indicates that 38% of the variance on behaviour (R2=0.376) can be explained by one single variable: attitudes towards the skin (B=0.538; p=0.005). The final predictive model was:

Conservation Behaviour = 0.780 + (0.538*Attitudes-Skin)

Given the relevance of the attitudes towards the skin for conservation behaviours, another multiple regression was carried out, to identify which indicators within this building layer have a more substantial impact in the formation of the attitudes.
The final predictive model includes six indicators (Table 4.11), that explain 88% of the variance on the attitudes (R2=.877). While the conservation of the materials (B=0.310; p=0.000) and the detailing (B=0.277; p=0.000) contributed significantly to the model, the conservation of the roof does not (B=0.057; p=0.072). The final predictive model for the attitudes towards the skin was:

Attitudes towards Skin = -0.612 + (0.057*Roof) + (0.310*Materials) + (0.134*Colours) + (0.183*Openings) + (0.258*Shape) + (0.277*Detail)

TABLE 4.11 Multiple linear regression model explaining “attitudes towards skin”

Indicators	Beta coefficient	Sig. (p)
Conservation of the roof	0.057	0.072
Conservation of the materials	0.310	0.000
Conservation of the colours	0.134	0.008
Conservation of the openings	0.183	0.004
Conservation of the shape	0.258	0.004
Conservation of the detailing	0.277	0.000

4.4.3 Reasons for the intention-behaviour gap

The analysis of the reasons pointed out by respondents for the gap between expressed intentions and self-reported behaviours towards conservation of building elements, results in 3 main groups of reasons: program requirements and adaptation to new functions; sustainability and performance standards; and aesthetics and design concepts. Some respondents also found out during the design process that the previous value assessment was inaccurate, with building elements found “not as special” as previously stated. Only one respondent identifies “lack of time and skill” as the main reason behind the performance gap. While the response “program requirements and new functions” suggests an external locus of control, with a situation not directly manageable by the respondent, the responses under “design concept” evidence higher levels of personal control and responsibility for the decision. On several occasions, the expression “old” is used with a pejorative meaning, as opposed to “modern” or “innovative”. After program requirements, the compatibility with sustainability standards is the most common reason identified by respondents to not perform conservation intentions.

4.5 Discussion

The main aim of this research was to reveal and discuss the factors behind the intention-behaviour gap in the conservation of built heritage. While existing literature focusing on practitioners pointing out controllability as the main factor, this study hypothesised that in an environment with more creative freedom and less involved stakeholders, the PBC levels should be higher. Thus, the intention-behaviour gap should tend to zero. The results confirm the first premise of the hypotheses: PBC levels are high and do not correlate with the self-reported behaviours. However, even with high levels of PBC, the results show that there is no perfect fit between intention and behaviour, with a correlation coefficient around 0.3 instead of 1 (Icek Ajzen, 2002). This suggests that, despite practitioners’ perception of their low control on built heritage conservation, other psychological constructs can be behind the intention-behaviour gap.

The results of this research show that attitudes matter for built heritage conservation, presenting a stronger correlation to behaviour than to intentions. One of the possible reasons for this, is that expressed intentions are mediated by a social desirability bias (Fisher, 1993; Grimm, 2010) — as demonstrated by the fact that a correlation was found between subjective norms and intentions, but not between subjective norms and behaviours. These findings corroborate the theoretical model defined by Sheeran (Sheeran, 2002), that states that attitudinal controlled intentions have a greater likelihood of performance than normative controlled intentions, that result from external pressures and have poorer motivation impact. This suggests that policies, norms, and new building codes for conservation, even if necessary, may not be sufficient to ensure the implementation of sustainable conservation practices. The qualitative analysis also corroborates attitudes as strong determinants of behaviours. Whereas the literature focusing on practitioners tends to evidence low perceived behavioural control and an external locus of control (Ashley et al., 2014; Gonçalves, Mateus, & Silvestre, 2019; Perovic et al., 2016; Roy & Kalidindi, 2017; Yung & Chan, 2012), the design students in the present research point more often to self-chosen and autonomous decisions, derived from personal beliefs, such as the design concept. +Even if heritage conservation and sustainability share the common goal of preserving valuable resources for future generations, sustainability is frequently pointed out by participants as one of the main reasons why intentions were not implemented, evidencing respondent's personal "evaluative dispositions" (Icek Ajzen & Fishbein, 2010). This result demonstrates the importance of developing tools and educational mechanisms aimed at tackle knowledge gaps and increase the awareness of the role of heritage conservation for sustainability – not only in the social dimension, but also in the aspects related to the material conservation of resources (Ross & Angel, 2019).

The descriptive statistics indicate a predominant interest in the conservation of physical, tangible attributes, such as the structure or the building envelope ("skin"). The building's façade is also considered valuable for all the respondents. However, the results show that this particular positive attitude is not statistically significant to represent the general attitude towards the "skin". This suggests that a protective attitude of the façade does not necessarily convert into positive conservation behaviours of other building attributes and values. Targeting other indicators related to the "skin" of the building, such as materials and detailing, raising awareness to its value, seems to be more likely to convert in positive conservation attitudes and, thus, positive conservation behaviours. "Spirit of the place" is the layer on which respondents state to have less perceived control, and, in specific, less knowledge. This building layer, as the perceived behavioural construct, does not present any correlation with behaviour, suggesting that the low perceived behavioural control makes the behaviour towards the "spirit of the place" particularly unpredictable, according to the developed model. This corroborates the research of Lidelow (Lidelöw et al., 2019) that found that existing literature on the assessment values is unclear and insufficient to guide the practitioner's decision-making.

While interventions to change behaviour can be directed to one or more of its determinants, according to Ajzen (Icek Ajzen, 2002) "it may be safer to target predictors that account for significant variance in intention and behaviour". The results of the present study suggest that, in the case of built heritage conservation, behaviours are deeply rooted in the personal set of values of the designer, and behavioural change interventions need to target attitudes, strengthening existing positive beliefs and creating new ones. As a result of different learning experiences, beliefs can be formed by observation (direct experiences); information (learned from outside sources); or inferred (from other beliefs) (Icek Ajzen & Fishbein, 2010).

This means that knowledge and information do not only affect perceived control but also have a role in the formation of attitudes. This explains why persuasive communication is considered by several authors (Icek Ajzen, 2002; Icek Ajzen & Fishbein, 2010; Weiler, Moyle, Wolf, de Bie, & Torland, 2017; Wells, Manika, Gregory-Smith, Taheri, & McCowlen, 2015) as one of the most effective intervention methods for behavioural change. In the specific scope of heritage conservation, the researches of Wells et al. (Wells et al., 2015), Gregory-Smith et al. (Gregory-Smith, Wells, Manika, & McElroy, 2017), Salvatierra (Salvatierra & Walters, 2015), and Lwoga (Lwoga, 2016) suggest the importance of the availability of information, knowledge, and awareness to increase positive attitudes and the performance of pro-environmental and pro-heritage behaviours.

4.5.1 Limitations and Future Research

The presented results should be interpreted within the scope of the defined TACT and are not intended to be generalised. The descriptive statistics results show that the case study affects the priorities of the respondents. While in a modern building from the 20th century in an urban context, the roof is not a design priority, the same does not happen when dealing with a historic neoclassic house in the countryside. In the same way, the lack of interest concerning “religious expressions” does not necessarily mean a general indifference to this indicator but may be related to the fact that religion is not a central topic given the functions of the case studies. Behavioural beliefs are not innate but instead acquired through subjective experiences (Icek Ajzen & Fishbein, 2010), and the presented results reflect a pilot study with a small sample in a particular cultural context. This study, as recommended by Ajzen (Icek Ajzen, 2002) “provides a snapshot of the behaviour’s cognitive foundation in a given population at a given point in time”. Despite its limitations, it allows for gaining insight on the determinant factors behind the gap in the implementation of sustainable conservation behaviours in built heritage.

In this research, the generative artefacts created by the participants (the design results of the students) were not evaluated, and the analysis relies on participants self-reports. The risk of social desirability bias was reduced by ensuring confidentiality and anonymity of the responses, to maximize accuracy. While the literature points out that self-reports can be as reliable and valid as direct observations (Icek Ajzen & Fishbein, 2010), future research could monitor decisions during the design process and consider the actual conservation actions expressed in the design. For that, a cross-sectional study (compare different students over the years) or even a longitudinal study (comparing the same students while they progress over the years), would allow to increase the level of detail and the statistical significance of the results. A more significant sample of respondents would also allow for further statistical analysis, such as Structural Equation Modelling (SEM) to explore with more accuracy the relationship between the different variables affecting conservation behaviours (Lwoga, 2016; Soliman & Abou-Shouk, 2017; Zhang, Lee, & Xiong, 2019).

This study presents the analysis of the correlation between intention and implementation in design decisions related to built heritage conservation. It represents a steppingstone for future research aiming at behavioural change, since it will allow to compare the effects of different interventions (such as sustainability, significance, and state of conservation assessments) with the baseline situation. It would also be essential to apply the developed methodology in professional practice, measuring how real conditions affect perceived behavioural control and if attitudes maintain their relevant correlation with behaviour.

The most recent guidelines and international recommendations for heritage conservation, such as the UNESCO Recommendation on Historic Urban Landscape (Unesco, 2011), highlight the importance of participatory processes and community engagement, opening the decision-making processes to a broader range of stakeholders In this setting, the use of mixed-methods with the insights of behavioural sciences have a growing potential as a field of research in the heritage context, not only for a better understanding of decision-making processes at the design level, but also to understand the background factors affecting communities values and attitudes towards heritage conservation. To that end, segmentation studies aimed at profiling different stakeholders, would have much to gain by applying the theoretical framework proposed in the present research, to achieve more effective behavioural change towards sustainable conservation.

4.6 Conclusion

This paper presents the results of the exploratory application of the Theory of Planned Behaviour (TPB) to measure the intention-behaviour gap in built heritage conservation. Although the literature focusing on practitioners is pointing out for low behavioural control challenges, the application of this theoretical model in a controlled environment shows that the dissonance between conservation intentions and self-reported conservation actions persists, even with high levels of perceived behavioural control. The results suggest that conservation behaviour is attitudinally controlled: norms have a role in the formation of intentions, but self-reported behaviours present a stronger correlation with the personal attitudes of the respondents. This means that despite the importance of policies and international regulations on sustainability and heritage conservation, deeper change is more likely to be achieved by targeting practitioners' internal set of values, through engagement in persuasive learning experiences about the value of heritage for a sustainable future. Using the TPB to analyse designers' behaviours is an innovative methodological approach to understand the performance gap in built heritage conservation. The identification of the most determinant psychological constructs, and the most significant indicators at the building scale, opens new possibilities for the design of interventions targeting behavioural change towards a more significant role of the cultural heritage and its conservation in the sustainable development of cities and buildings.

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5 Selection of core indicators

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ABSTRACT

This paper presents and discusses the selection of a set of core indicators for the sustainable conservation of built heritage. This core set of indicators was selected by following a two-step methodology: 1) first, a comparative analysis of indicators of two building sustainability assessment (BSA) tools with different approaches was performed by using content analysis to identify common priorities; 2) second, a selection of the indicators according to scale, stage of the life cycle, and coverage of core aspects for sustainable development, following the criteria established by the International Organization for Standardization. The results show that even if current methodologies have different structures, terminology, and priorities, they share common principles that promote a more sustainable built environment. However, by being mostly oriented to the intervention and operation phases, these methods do not have direct application as an assessment framework for the sustainable conservation of the built heritage. To overcome this situation, this research presents a concise set of indicators that can support the development of an assessment tool to ensure the sustainable conservation of existing

5.1 Introduction

The evolution of the concepts of “heritage” and “sustainability” shows that they are related both in their common scope — focusing on the ecosystem inherited from the past — and in their aims — to preserve this ecosystem for future generations (Gonçalves, Mateus, Silvestre, & Roders, 2019). The “100% heritage” approach (Pottgiesser, 2019; Roders, 2019; Roders & Pottgiesser, 2020), “where resources are, by rule, to be conserved as part of a broader ecosystem” (Roders, 2018) demands clearer definitions of what matters (attributes) and why it should be preserved (values). Having such clearer definitions requires effective significance assessments that are able to provide information on a broader scope of values and attributes than the traditional historic and aesthetic values (Veldpaus, 2015). A concise framework to assess the sustainability of heritage buildings could be a useful tool to inform decision-making and to ensure that future impact assessments of the conservation of heritage buildings has a baseline for comparison.

In the last two decades, several methods have been developed to assess buildings’ sustainability. Some market-oriented certification systems, such as BREEAM (Building Research Establishment Environmental Assessment Method), have been adapted to cover existing buildings and favouring building reuse and compact development (Balson, Summerson & Thorne, 2014). However, as found by Appendino (2018), current sustainability certification systems and urban assessment tools consider heritage indicators only in a partial and shallow way. Since building codes and regulations are mostly developed for new buildings or major renovations, they do not reflect the specific features of ancient buildings (Ornelas, Miranda Guedes, Sousa, & Breda-Vázquez, 2020). Additionally, voluntary certification systems of sustainable performance, even if applicable to existing buildings, do not embrace the full complexity of heritage conservation (Boarin, Guglielmino, Pisello, & Cotana, 2014). Despite being a central aspect for sustainable development, according to international standards (ISO, 2011), culture-related indicators are rarely mentioned in general building assessment tools, such as BREEAM, LEED (Leadership in Energy and Environmental Design) or SBTool (Sustainable Building Tool) as evidenced by da Silva & Ramos (2010). The LBC (Living Building Challenge) assessment framework, even if not specifically developed for heritage buildings, can also be applied to them to determine the impact of conservation projects (Living Future Institute, 2019), since requirements can be adapted to the context, as long as the main goals remain constant.

With a more theoretical approach, some methods have been developed to assess the sustainability of heritage buildings, often based on the set of indicators of the market-oriented certification systems. In a study, Shetabi (2015) selected indicators from the LEED rating system that were proven suitable to assess heritage buildings, to include environmental indicators in significance assessments. Similarly, the GBC Historic Buildings (Boarin, Guglielmino, & Zuppiroli, 2014) added a new category – Historic Value – to the existing LEED ones. The goal of the GBC Historic Buildings is not to select sustainability indicators for heritage buildings, but to ensure that the assessment of conservation projects in historic contexts includes criteria linked to historical and cultural aspects. In another study, Da Silva & Ramos (2010) combined indicators from BREEAM, LEED and SBTool, to obtain a more comprehensive set of indicators for built heritage.

The current literature shows that tools to assess the sustainability of heritage buildings are essential to support decision-making at the policy level and to implement sustainability objectives in the management of heritage properties (Leus & Verhelst, 2018; Ornelas et al., 2020). Such tools can also be used to assess the sustainability of conservation projects of heritage buildings, taking into consideration the protection of historic and cultural values (Boarin, Guglielmino, & Zuppiroli, 2014). For example, the GBC Historic Buildings framework (Lucchi, Boarin, & Zuppiroli, 2016) requires a preliminary baseline report on the condition of the building, based on the principle that the historic building performance must be assessed according to a reference condition rather than to normative performance levels (Boarin et al., 2014). However, the framework does not establish guidelines or indicators that allow measuring this reference condition, contrary to other frameworks and sets of indicators (da Silva & Ramos, 2010; Shetabi, 2015; Havinga, Colenbrander, & Schellen, 2019).

Appendino (2018) concluded that the existing sets of indicators for built heritage "are still far from offering a holistic measurement of the advantages of heritage on an environmental, economic and social level". Also, Ornelas et al. (2020) stated that current methods are partial and do not offer an integrative approach to the different issues involved in heritage conservation. On the one hand, according to Havinga (2019), most literature on heritage refurbishment does not include the systematic evaluation of heritage values. On the other hand, Shetabi (2015) concluded that sustainability indicators are missing in the significance assessment of heritage buildings. According to Correia et al. (2013), although there are different multicriteria approaches for heritage buildings, there is still a gap in the integration of different sustainability aspects in terms of their significance assessment, since most of the studies focus on the quantitative aspects, such as the hygrometric performance. However, most frameworks proposed by the aforementioned authors are not comprehensive enough. The set of indicators developed by Shetabi (2015) solely focus on environmental issues, while the framework proposed by Havinga (2019) assesses valuable attributes to establish limits of change for future interventions but does not include environmental indicators. In Ornelas' (2020) framework – covering resident perceptions, safety and degradation, and valuable attributes of the building – the environmental indicators are absent.

As such, the literature shows that general methods for building' sustainability assessment do not sufficiently cover the complexity of heritage conservation (Boarin, Guglielmino, Pisello, et al., 2014). Specific methods developed to assess heritage buildings lack a balanced integration of environmental and cultural issues that are an essential part of sustainable conservation processes (Correia, Carlos, Merten, Viana, & Rocha, 2013).

While an assessment framework for the sustainable conservation of built heritage is useful to support significance assessments and design-related decisions in conservation projects, it requires a concise set of indicators, with sufficient coverage of the central aspects of sustainability (ISO, 2011) and heritage values, so as to set the analysis of existing buildings. Such set of indicators shall enable: the measurement of the value of heritage buildings in the scope of the sustainable development (Shetabi, 2015); the definition of limits of acceptable change (Havinga et al., 2019); and the identification of aspects that can be improved in the intervention (da Silva & Ramos, 2010). The set of indicators shall provide a common language to be used between stakeholders (Leus & Verhelst, 2018) and ensure that intervention assessments are carried out in relative terms by comparing the building's performance with its initial situation (Boarin, Guglielmino, & Zuppiroli, 2014; da Silva & Ramos, 2010).

This paper presents a theoretical analysis of existing assessment frameworks aiming at identifying common indicators and priorities for the sustainable conservation of built heritage. It aims at compiling a core set of indicators, simple to use and understand, that allow quantification, simplification, and communication (ISO, 2011) of decisions in conservation processes.

5.2 Materials and Methods

This study is comprised of two parts (Figure 5.1): in the first part, the indicators of the VerSus framework and the Living Building Challenge (LBC) are compared, extracting the first set of indicators. In the second part, this set of indicators are analysed according to key variables identified in the ISO Standard 21929 on "Indicators for Sustainability in Building Construction" (ISO, 2011). These two parts allow to identify priority indicators, eliminate redundancies, and filter the indicators that apply to existing buildings, while covering the fundamental aspects of sustainable development.

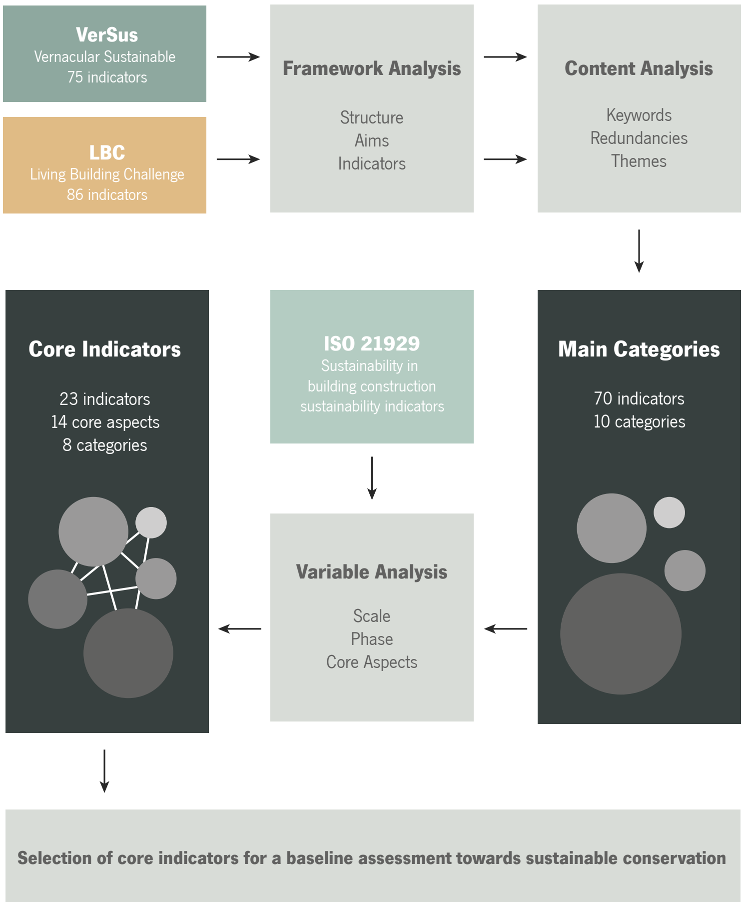

FIG. 5.1 Diagram of the study design

5.2.1 Comparative analysis of two methods

This research integrated indicators from two types of frameworks: 1) general methods for building sustainability assessment and, 2) specific methods for heritage buildings. Figure 5.2 presents the criteria for the selection of the two methods analysed, including the coverage of cultural values and environmental indicators, the scope, and the scale.

	Heritage specific	Single Buildings	Existing Buildings	Before intervention	Cultural values	Environmental indicators	Regenerative design
BREEAM		●	●	○		●	
LEED		●	●	○		●	
SBTOOL		●	●	○	○	●	
LBC		●	●	○	●	●	●
VERSUS	●	●	●	●	●	●	
Leus et al.	●			●	●	●	
Boarin et al.	●	●	●		●	●	
Shetabi	●	●	●	●		●	
Havinga et al.	●	●	●	●	●		
Ornelas et al.	●	●	●	●	●		
Da Silva et al.	●	●	●	●	○	●	

● Central to the methodology ○ Mentioned but not detailed

FIG. 5.2 Criteria for the selection of the methods to analyse

In the group referring to general methods, the Living Building Challenge (LBC) framework was chosen, because of the integration of indicators that cover cultural, social, historic, aesthetic, and ecological values of the Built Heritage, under the category "Beauty and Inspiration" (Living Future Institute, 2019). The LBC is originally designed for the assessment of buildings in the operation phase. For this reason, most of the indicators can be used to assess the current condition of existing buildings before the intervention. This choice also allows extending the comparison of indicators and categories to a methodology not previously addressed in the scope

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of Built Heritage (Boarin, Guglielmino, & Zuppiroli, 2014; Shetabi, 2015) and to overcome the limitation of indicators related to cultural issues, already identified by Da Silva & Ramos (2010). In the Heritage-specific methods, VerSus was chosen, since it proposes a holistic understanding of sustainability, covering tangible and intangible aspects of the social, environmental and economic dimensions (Correia et al., 2015).

In the selection of the methods to analyse, the authors tried to ensure enough range of diversity, by covering different approaches. In this way, it was possible to select methods that have the following characteristics:

- They are at the same time theoretical frameworks and market certification tools;
- They are focused on general buildings and specifically on heritage buildings;
- They are based on qualitative and quantitative assessment processes;
- They are based on prescriptive or performance-based approaches;
- They have the goal of sustainable or regenerative design.
- The two chosen methods have in common the following properties:
- Spatial scale: applicable to single-buildings;
- Temporal scale: focusing on existing buildings;
- Results: descriptive/informative results.

In the first part of the study, a framework analysis was performed, to identify differences and similarities between the structure and terminologies of the two methods. That allowed to clarify redundancies and identify repeated indicators. This processapplied an inductive content analysis, by identifying keywords that allow to cluster indicators in common categories according to the intent or with the issue tackled. Affinity diagramming was used to synthesize findings and identify general trends (Martin & Hanington, 2012).

5.2.2 Classification of the indicators

The selected indicators were classified according to three variables specified in the ISO 21929 (ISO, 2011). The first two variables are related to the type of indicators: the scale of analysis and the life-cycle phase. For the final set of indicators, only the ones applicable to existing buildings were selected – excluding design phase, new buildings, and operation phase. Concerning the scale, this study is limited to indicators directly related to the building. For that reason, only indicators focused on the building and the building-plot are considered, excluding those related to location and processes.

The third variable considered in this research is related to the scope, ensuring that the selected indicators cover all the core aspects considered "essential from the viewpoint of assessing the contribution of a building to sustainability" (ISO, 2011). Being the primary goal of this research to establish a concise set of indicators, only the ones aligned with the core aspects defined by the ISO 21929 are included in the final set of indicators. The remaining indicators were excluded, even if potentially relevant to the assessment of existing buildings.

5.3 Background

5.3.1 Versus and Living Building Challenge

The two methodologies, VerSus and Living Building Challenge (LBC) differ but do share a focus on single buildings (scale) and on a range of life cycle phases, from design to operation (see Table 5.1).

TABLE 5.1 Factsheets on VerSus and of the LBC

	VerSus	LBC
Title	Vernacular Heritage Sustainable Architecture	Living Building Challenge
Author	VerSus	Living Future Institute
Year	2012-2014	2006-2019
Context	European research project	International building certification system
Target	Vernacular heritage	Buildings in operation
Aim	Eco-responsible architecture	Regenerative design
Approach	Prescriptive	Performance-oriented
Process	Qualitative	Quantitative
Scale	Single-buildings	Single-buildings
Phase	From design to operation	From design to operation

The VerSus methodology is the result of a European research project developed between 2012 and 2014 by a European network of academic institutions. The project aimed at "creating a reliable technical tool with a high dissemination potential" (Correia, Dipasquale, & Mecca, 2015) to raise awareness of the value of vernacular heritage for sustainability. That research project identified strategies of integration of vernacular heritage to the natural and socio-economic environment in several case studies across the world (Correia et al., 2015). The identified strategies were then systematized into low-technology principles to be integrated into contemporary architecture. An operative approach was developed as an “instrument to assess the sustainability of building interventions”, through a set of guidelines to evaluate the existing situation and provide information to plan future interventions.

The Living Building Challenge (LBC) is a commercial international building certification method applied in more than 25 countries worldwide. It was initially launched in 2006 by Cascadia Green Building Council (GBC) — a coalition between the Canada and US Green Building Councils. The idea behind the LBC was to improve the LEED rating system (from the US GBC) by moving “beyond merely being less bad and to become truly regenerative” (Living Future Institute, 2019). Regenerative design is an emerging concept defined by Cole (2013) as a method that emphasises “a co-evolutionary, partnered relationship between humans and the natural environment”. This definition connects with that of sustainable conservation (Gonçalves, Mateus, Silvestre, et al., 2019), as heritage is a co-evolutionary process of the environment, made of intangible, tangible, and natural aspects. One of the main differences with other certification tools, such as LEED or BREEAM, is that LBC’s indicators are entirely focused on existing buildings and the assessment is based on the actual performance.

5.3.2 ISO 21929: Sustainability in building construction — Sustainability indicators

The ISO 21929 standard defines principles for sustainability in building construction and establishes guidelines for the development of sustainability indicators within a common framework, allowing for transparency and comparability. According to the aims of development and application, indicators can be classified in eight types: the object of assessment; stage of the life cycle; type of information; degree of influence; complexity; assessment process; spatial boundaries; and temporal boundaries (ISO, 2011). In the scope of the present research, only the object of assessment and stage of the life cycle were considered for the classification.

The object of assessment is related to the scale of the indicator. Indicators can be related to location, site, building or processes. The location differs from the site over its broadness: the former refers to the neighbourhood in an urban or regional scale while the latter refers to the immediate surroundings of the building and to the physical land where it was built. Process-related indicators include management, operation, and procurement indicators that, by their dependence upon the stakeholders involved in the processes, are dynamic by nature. Indicators can also be classified according to the life stage, as typically for new buildings, for existing buildings or the operation stage (ISO, 2011). Commonly, indicators related to the operation stage are process related.

For sustainable development, seven areas of protection against potential impacts of the building sector are defined in the ISO 21929, namely: ecosystem, natural resources, health and well-being, social equity, cultural heritage, economic prosperity, and economic capital. These areas of protection can be affected by several aspects of a building, demonstrating the multi-effect of indicators and their interdependence for the three sustainability dimensions. Considering this factor, the standard establishes a set of priorities – core areas of performance - for building assessment, that are directly related to the core areas of protection (ISO, 2011):

1. Emissions to air: global warming and ozone depletion potential, considering embodied energy and energy flows;
2. Use of non-renewable resources: the amount of non-renewable resources used, including extraction and disposal of natural resources and reuse of materials, and energy consumption and efficiency;
3. Freshwater consumption: use and onsite management of water;
4. Waste generation: the amount of waste produced by demolition and avoided by reuse, recycling and maintenance;
5. Change of land use: choice of place, avoid construction in greenfield and redevelopment of existing built environment;
6. Access to services: urban density and proximity; open spaces accessible to the public and access to public transportation and essential services;
7. Accessibility: equitable access for users, including with physical disabilities;
8. Indoor conditions and air quality: considering thermal, visual, and acoustic conditions and air quality;
9. Adaptability: flexibility for change of use according to new needs and resilience to climate change;
10. Costs: life cycle costs, considering initial cost, operation, maintenance, and end-of-life costs;
11. Maintainability: quality of the building and durability, scale, and timing of maintenance measures;
12. Safety: including structural stability, resistance to weather, and safety in use;
13. Serviceability: functionality of the building and ability to fulfil user requirements;
14. Aesthetic quality: integration with surroundings, impact on the cultural value of the site, architectural quality, and attractiveness.

According to the ISO standard, a framework of core indicators must consist of indicators that represent all of the 14 aspects and they must be related to one or more core areas of protection. Assuming that this does not result in a sufficiently comprehensive list of indicators and hence additional indicators may be needed according to each specific case. Additionally, the standard identifies some secondary aspects that may be considered in more detailed frameworks, including the use of renewable resources, ecological quality of the site, nuisance to the neighbourhood, and community participation (ISO, 2011).

5.4 Results

5.4.1 Comparative analysis

Structure

Versus and LBC share the aim of improving the sustainability of existing buildings and both follow a similar sequence (see Figure 5.3). The VerSus framework follows a structure based on the three dimensions of sustainability - environmental, social, and economic. The environmental dimension deals with the impacts on the environment; the socio-cultural dimension relates to the community and to the sense of belonging and is “more linked to the processes than to the physic reality itself” (Correia et al., 2015); and the socio-economic dimension, in which the idea of cost is related to the concept of effort, which is considered a more suitable approach in the context of vernacular heritage. The three sustainability dimensions are then subdivided in fifteen (15) principles that describe the goals towards sustainability. Furthermore, each principle is subdivided into a set of strategies: the indicators that define if a certain principle is being addressed. In total, the VerSus framework is composed of seventy-five (75) strategies, organised in fifteen (15) principles and three (3) sustainability scopes.

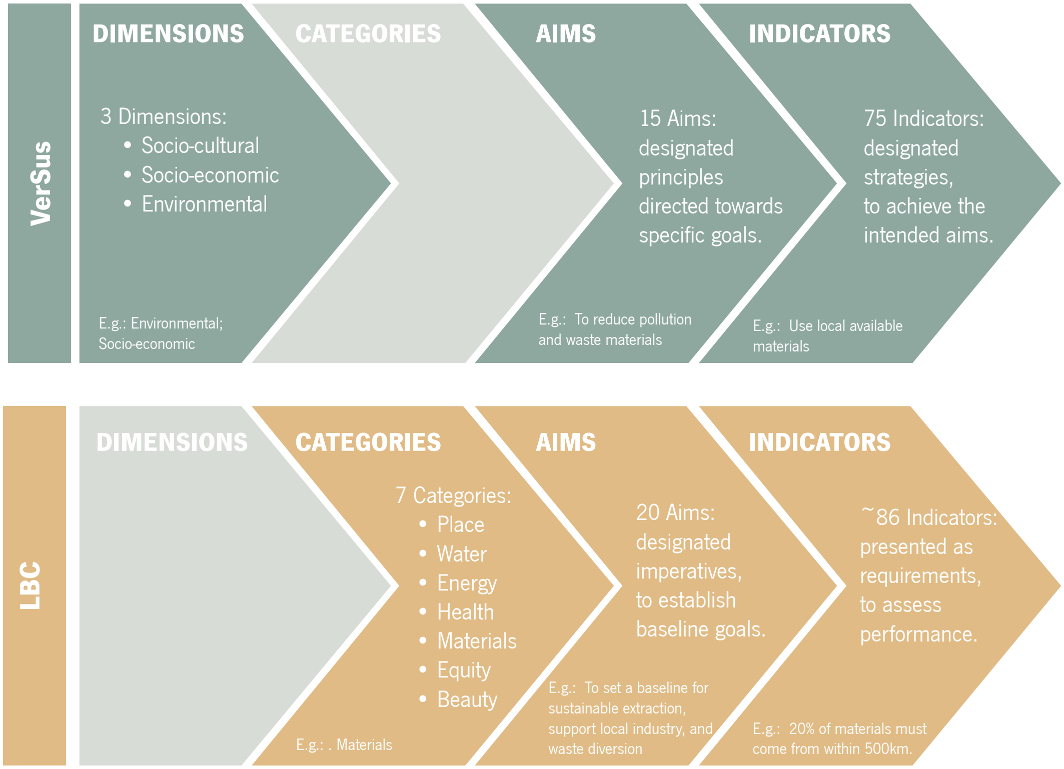

FIG. 5.3 Structure flow and terminology of VerSus and LBC

The LBC framework is organised in seven performance areas: place, water, energy, health and happiness, materials, equity, and beauty. The framework uses the metaphor of the flower, designating each performance area as a “Petal” that contributes to the whole. Each Petal is subdivided into twenty (20)“imperatives” (equivalent to the principles in VerSus) that establish specific baseline goals for every project. Within each imperative, some requirements or parameters are established to assess the performance. Since not all the parameters are mandatory, the total number is flexible but tends to amount eighty-six (86). The following definitions were inferred from the analysis of the structure of the two methods:

— Sustainability Dimensions: refer to the three pillars of sustainable development as defined in the Brundtland Report (WCED, 1987) and includes the economic, the social and the environmental dimension;
— Categories: constitute the main organising themes of the indicators according to their scope and area of influence;

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- Aims: or principles or imperatives, establish fundamental rules towards sustainability goals to achieve by the building;
- Indicators: or strategies or requirements, establish the criteria to assess the performance of the building concerning each aim.

This common structure and terminology allowed identifying their common priorities, even when using different terminology. For example, the indicator concerning the use of local resources is common to both methodologies, aiming at reducing pollution and waste, but also at supporting local industry (LBC) and autonomy (VerSus).

The following example illustrates the differences in assessment processes, which is primarily qualitative with VerSus and quantitative with LBC. The same indicator can be assessed with a single "yes/no" question (VerSus) or quantified according to established numerical criteria (LBC). The indicator "using local materials" in VerSus, is assessed in LBC as "living economy sourcing", which establishes the following detailed parameters: "20% of materials within 500 km", "30% of materials within 1000 km", "25% of materials within 5000 km". Thus, the LBC framework allows to differentiate between the level of performance by establishing different grades for each indicator– the use of local materials.

In the VerSus framework, the categorisation under sustainability dimensions leads to the double-counting of indicators that can influence different dimensions simultaneously, like the environmental and socio-economical dimensions, for example. In the LBC, the aggregation of indicators within categories that crosscut the three dimensions of sustainability evidences a holistic approach that considers the multi-effect of indicators, avoiding redundancies.

The aim of this comparative analysis of the structure of the frameworks is to identify and eliminate the "double counting" of indicators in each framework so as to reach a narrower set. The process allowed to reduce the initial set of indicators from 161 (75 indicators from VerSus and 86 indicators from LBC) to a set of 109 indicators (52 indicators from VerSus and 57 indicators from LBC).

Main categories

In the first phase of the content analysis, 20 sustainability themes were deduced from the pool of indicators: site, indoor pollution, indoor comfort, water, energy, building scale, building techniques, carbon footprint, waste reduction, materials, resilience, maintenance, transportation, production, certification, collective welfare, community engagement, ecological values, tangible values and spiritual values.

These themes were then clustered into groups, considering the affinity of the problems approached in the indicators This process resulted in 10 main categories, defined as follows:

- Site: land management according to ecological site features;
- Energy: reduction of consumption and onsite production;
- Water: reduction of use and onsite management;
- Construction: building scale, techniques and solutions;
- Materials: sources, embodied energy, reuse and recycle, waste diversion;
- Indoor environment: avoid pollution sources and ensure a comfortable indoor environment;
- Durability: strategies for maintenance and resilience to extend building lifetime;
- Processes: not directly related to the building, but related to the construction and operation, such as food production or transportation;
- Community: related to community welfare – including physical features of the environment, and with community engagement and inclusion;
- Values: cultural identity, the spirit of the place and connection with nature.

The alluvial diagram in Figure 5.4 shows how the indicators of the two methodologies were clustered in the main categories. By following the connections on each side of the diagram, it is possible to identify the indicators that are repeated, or that are very similar in scope in the two methods. For instance, in the indoor environment category, LBC includes the indicator "views outside and daylight", while the VerSus proposes "natural light and sun radiation" in the commonly occupied spaces. In these situations, where the scope of the indicators was found redundant, the indicators were merged.

When researching the relationship of the indicators in each framework with the main categories, the most important difference found was the implicit weighting of the indicators towards the overall assessment of sustainability. In both methods, there are no explicit weights applied to each indicator, and the importance of the categories is determined by the number of indicators used for the overall assessment. By directly targeting heritage buildings, the VerSus tool considers more indicators related to cultural values than the LBC tool does. Hence, for example, passive solutions, at the building and building techniques scales, are more emphasised in VerSus. Similarly, in LBC there is more weight given to the responsible sourcing of materials or to the onsite production of energy.

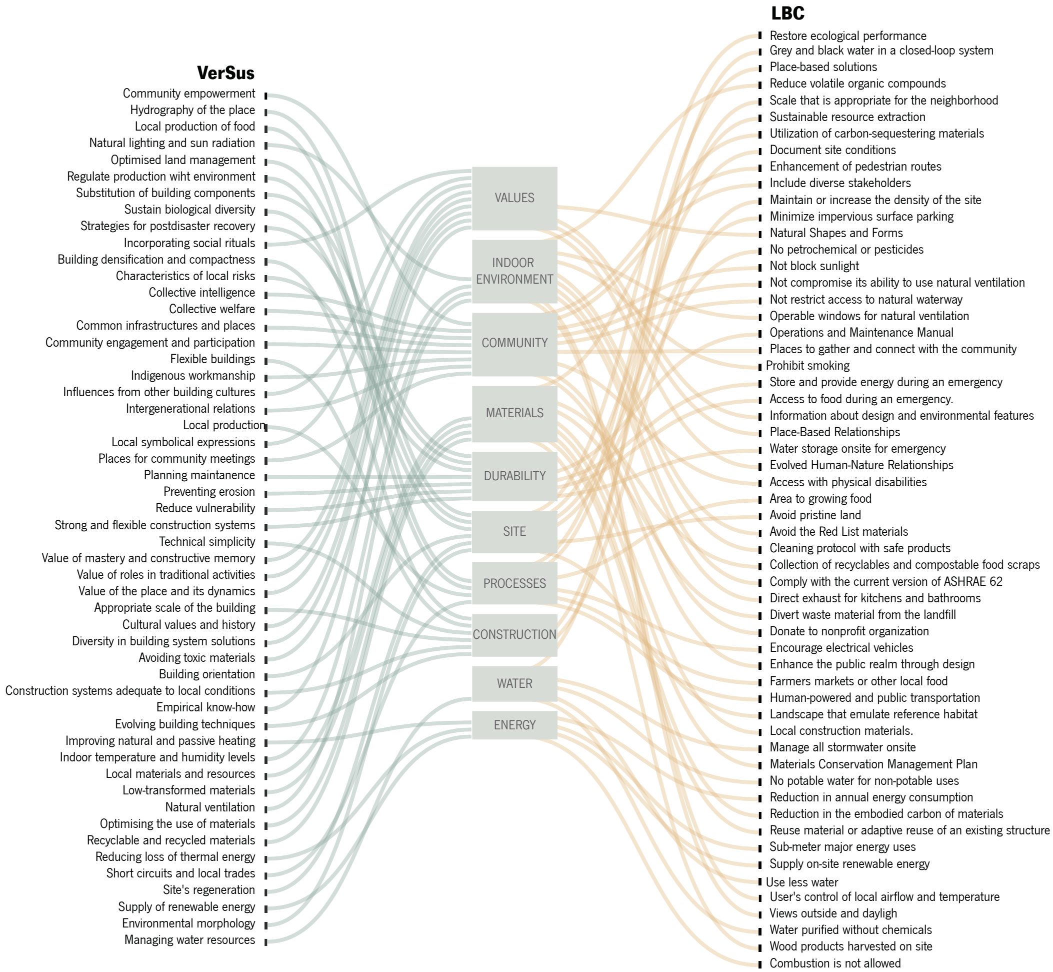

FIG. 5.4 Alluvial diagram with the identification of common themes in VerSus and LBC

A few “umbrella indicators”, due to their broad description, allowed to cover two or more detailed indicators. In these cases, only the broader indicator was kept. Accordingly, the indicator “reduce embodied carbon”, was kept as an umbrella indicator that considers, as sub-indicators, “reduce embodied carbon in structural materials” and “use indoor materials with low carbon footprint”. From this stage of the analysis, after clearing double-counting, redundancies, and sub-indicators, the original set of indicators was reduced to seventy (70), which were subsequently classified according to the ISO 21929 (ISO, 2011).

5.4.2 Classification of indicators

Object of assessment

The chart in Figure 5.5 presents the distribution of indicators according to the category and object of assessment. From the set of 70 indicators previously selected, only a small percentage refers to location-related indicators (such as “facilitate public transportation”). Almost a third (34%) of the indicators is related to dynamic processes, which are not directly measurable in the building or in the site (such as “enhance community engagement and participation” or “purify water without using chemicals”).

The set of indicators that results from this classification includes thirty-seven (37) indicators, exclusively focused on the assessment of the building and to its immediate surroundings. The remaining indicators were excluded from the next steps of the analysis.

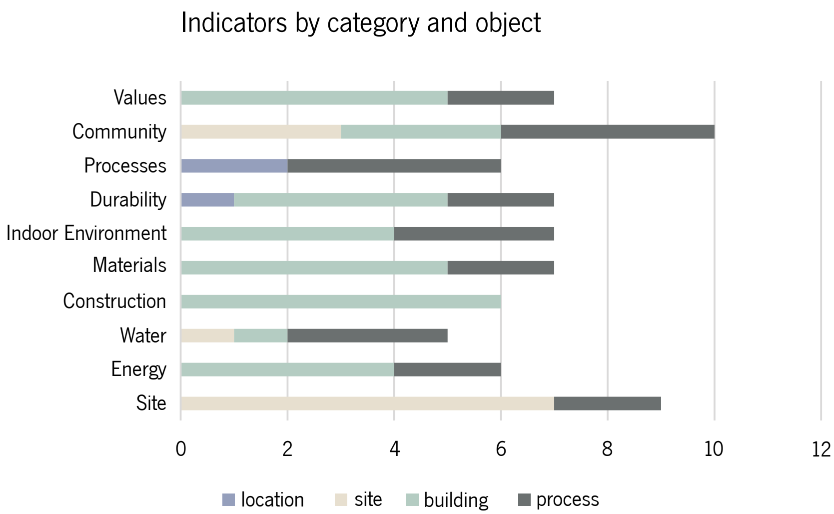

FIG. 5.5 Number of indicators by category and object of assessment

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Life cycle stages

Most of the indicators previously selected proved to be technically adequate to assess both new and existing buildings, even if in some cases, upon application, some may not be considered relevant to assess the significance of heritage buildings. The indicators related to the operation phase are always connected to dynamic processes and were previously excluded in the classification by the object of assessment.

The diagram in Figure 5.6 summarises the set of indicators that apply to existing buildings and that can be assessed at the building and site scale, organised according to the categories that emerged in the analysis. Considering the life cycle stage and the object of assessment, the category “processes” previously identified was removed. Only three (3) indicators remained in the category “durability”, that could be thematically integrated within other existing categories, without losing their focus. As such, the indicator “onsite water storage” was included in the category “water”; the indicator “energy autonomy for emergencies” was included in “energy”; and the indicator “strong and durable building systems” was included in “construction”. After this process of selection, 34 indicators organized in 8 categories, were classified according to the core aspects of sustainable development (ISO, 2011).

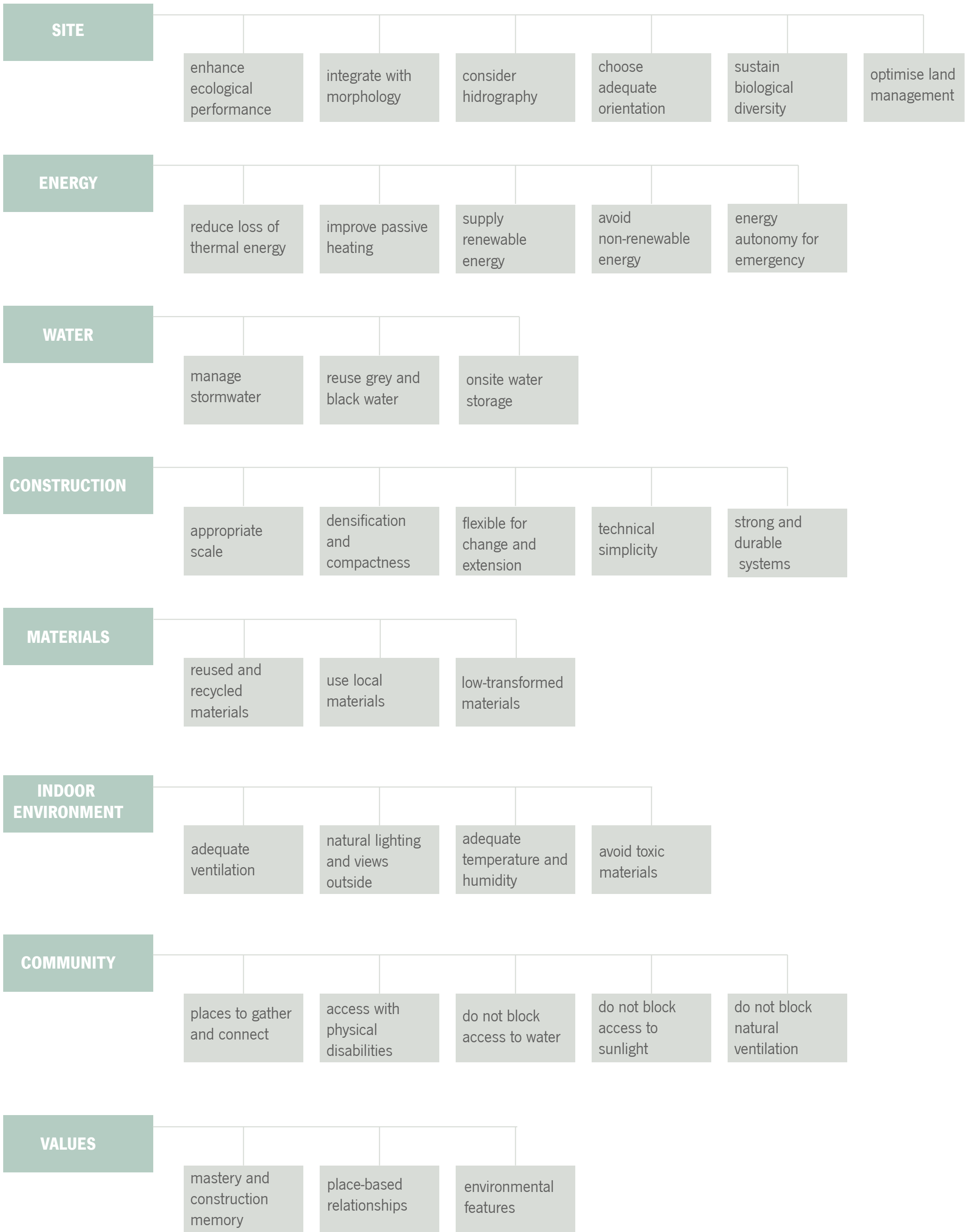

FIG. 5.6 Indicators that apply to existing single-buildings divided by category

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Core aspects of sustainable development

Both the core areas of protection and the core aspects that affect those areas of protection can be related to the categories deduced by the content analysis in section 4.1. However, this relation is not always direct, since sometimes the categories can cover more than one aspect or area of protection. For instance, while the category “water” can be immediately related to aspects such as freshwater consumption, or the indoor quality with indoor conditions and air quality, other categories, such as energy or materials, can cover aspects related to emissions to air, use of non-renewable resources, waste generation and costs. For this reason, in this phase of the analysis, the indicators were disaggregated from the previous categories and analysed individually.

The diagram in Figure 5.7 shows the distribution of the indicators according to the core aspects as defined by the ISO 21929. The indicators were kept when they provide useful information about the performance of the building, even if they did not perfectly match the indicators recommended by the ISO. Indicators related to secondary aspects or not mentioned in the standard were excluded. The core set of indicators resulting from this analysis consists of 23 indicators.

The indicators “mastery and construction memory”, “place-based relationships”, and “environmental features” – related with values – were included because of their relationship to the aesthetical quality as further defined in the ISO 21929: “integration and harmony of the building with the surroundings; impact on the cultural value of a site, neighbourhood, local heritage and built environment” (ISO, 2011). The indicator of “mastery and construction memory” is related to the cultural and heritage significance of the site. The indicators “place-based relationships” and “environmental features” reflect the integration of the building with the surroundings, covering both tangible (colour, materials, views, light, space) and intangible (geographic, historic, cultural, ecological connections with the spirit of the place) dimensions of this relationship (Kellert, Heerwagen, & Mador, 2011).

	Emissions	Resources	Water	Waste	Land Use	Access	Accessibility	Indoor Quality	Adaptability	Cost	Maintainability	Serviceability	Safety	Aesthetic
1. Optimise land management					●									
2. Reduce energy needs	●	●								●				
3. Avoid non-renewable energy	●													
4. Energy autonomy for emergencies		●							●					
5. Reuse grey and black water			●											
6. Onsite water storage			●						●					
7. Appropriate scale					●					●	●	●		
8. Densification and compactness					●	●								
9. Flexible for change									●					
10. Technical simplicity										●	●			
11. Strong and durable systems											●		●	
12. Reuse and recycle materials				●										
13. Us local materials	●	●								●				
14. Use low-transformed materials	●									●				
15. Ensure adequate ventilation								●						
16. Natural lighting and views outside								●		●		●		
17. Adequate temperature and humidity								●		●		●		
18. Avoid toxic materials								●						
19. Places to gather and connect						●						●		
20. Access with physical disabilities							●							
21. Mastery and construction memory														●
22. Place-based relationships														●
23. Environmental features														●

FIG. 5.7 Distribution of indicators according to core aspects of sustainability

5.4.3 Set of core indicators for sustainable conservation

The results of the analysis show that the organisation of the indicators according to the sustainability dimensions (social, economic, environmental) is not suitable for a holistic framework that aims at integrating such dimensions (ISO, 2011). By using an approach where indicators are categorised according to the three dimensions of sustainability, the VerSus framework promotes the double-counting of indicators. The organisation of indicators according to the core aspects as suggested by the ISO 21929 increases the complexity of the analysis, since most of the indicators can be related to more than one aspect. However, while this system of organisation is oriented towards the outcomes, the approach of the LBC framework – distributing indicators according to main categories - proves to be clearer and more effective to avoid redundancies. As such, the set of indicators for the assessment of sustainable conservation of heritage buildings proposed in this research were reorganized according to the categories that emerged in the content analysis. This option allows merging the operative approach of the LBC framework with the inputs on priorities deduced from the combination with the VerSus framework.

The resulting set of twenty-three (23) core indicators, presented in Table 5.2, considers indicators that cover the essential principles of sustainable development, according to the international standard (ISO, 2011). By excluding indicators related to design and operation stages, and by focusing only on identifiable features in existing buildings, this set of indicators is adequate to a baseline survey of heritage buildings before conservation interventions. The focus on indicators at the single-building scale, make it adequate to identify sustainable values that can be addressed in the design stage, supporting decisions related to elements to preserve, change or remove, according to their sustainability value.

TABLE 5.2 Set of indicators for the assessment for sustainable conservation of heritage buildings

Site
Optimise land management
Energy
Reduce energy needs
Avoid non-renewable energy sources
Ensure energy autonomy in emergency
Water
Treat and reuse grey and black water onsite
Ensure water storage onsite
Construction
Assure appropriate scale of the building
Promote building densification and compactness
Flexible for possible changes and extensions
Enhance technical simplicity in building processes
Use strong and durable construction systems
Materials
Reuse and recycle materials
Use locally sourced materials
Use low-transformed materials with low embodied carbon
Indoor environment
Ensure adequate ventilation
Guarantee proper natural lighting, sun radiation and views outside
Ensure adequate levels of indoor temperature and humidity
Avoid toxic materials
Community
Provide places for occupants to gather and connect with the community.
Safeguard access for those with physical disabilities
Values
Value of mastery and construction memory
Connected to place and culture through place-based relationships
Incorporate environmental features, light and space, and natural shapes and forms

5.5 Discussion

The complex interdependencies between social, environmental, and economic dimensions of sustainability must be taken into account when developing a set of indicators for sustainability assessment (ISO, 2011). The VerSus methodology proposes a holistic approach to sustainability and ensures that the three dimensions of sustainability are considered in the study of objective architectural indicators (Correia et al., 2013). However, by explicitly distributing indicators in the three dimensions, it loses the opportunity for deeper integration of the three pillars of sustainability, while increasing the double-counting of indicators. This is the case, for example, with the indicator “use of local materials” that is addressed both in the economic dimension and in the environmental dimension. This proves the multi-effect of the indicator, but also increases the complexity of the assessment, since the data could be collected only once and considered in a holistic perspective for its contribution to sustainability. The set of indicators developed by Leus (2018), starts from the three dimensions of sustainability – social (people), planet (environment), and economic (profit) – and adds to them the dimensions policy and patrimony, related with planning and legal constraints, and with heritage significance, respectively. This mixed approach in the organisation of the indicators – between the sustainability dimensions and the performance areas -, does not seem to solve the problem identified in the VerSus framework, since some aspects measured by the indicators affect more than one dimension.

The approach of the LBC framework, organising indicators in key areas of performance, seems to be more effective at avoiding the double-counting of indicators while proving the interdependency of the three dimensions of sustainability. Also, the set of indicators developed by Shetabi (2015)(based on the LEED assessment system), and the one developed by Da Silva & Ramos (2010)(merging BREEAM, LEED and SBTool) structure the indicators according to categories. Despite the different approaches, structures, and objects of assessment of the two tools analysed, their indicators can be clustered in similar categories. Da Silva & Ramos (2010) proposes a set of 50 indicators, organised in 9 categories: place, transport, water, energy, materials, emissions, indoor environment, use, and cultural, economic, and social aspects. The set of 45 indicators developed by Shetabi (2015) are organised in 6 categories: site and location, urban setting and linkages, water efficiency, energy and resources, envelope and fabric, and indoor environmental quality.

Figure 5.8 illustrates the categories that emerged in the present research in comparison to the sets of indicators developed by Da Silva & Ramos (2010) and Shetabi (2015), confirming the existence of cross-cutting priorities for sustainable development, not only in the two methods analysed (LBC and VerSus) but also in other BSA tools. Site, energy, water, materials, and indoor environment are common key areas of performance. Transport and urban setting were excluded from this research for being outside the boundaries of single buildings. The remaining categories, even if with different aggregation and designations, also cover common issues, such as emissions and construction.

Da Silva & Ramos (2010)	Shetabi (2015)	**Current study**
sustainable place	site and location	site
sustainable transport	urban setting and linkage	
resources - water	water efficiency	water
resources - energy	energy and resources	energy
environment - emissions	envelope and fabric	materials
resources - materials		construction
interior environment	indoor environmental quality	indoor environment
sustainability in the use		community
cultural, economic, social		values

FIG. 5.8 Comparison of the main categories of indicators with Da Silva & Ramos and Shetabi

In the framework developed by Shetabi (2015), the indicators related to materials and construction are merged in the category “envelope and fabric”. The same approach, organising the assessment according to building attributes or components, is used by Ornelas et al. (2020). This option points out to an important possibility for future research to structure indicators according to building attributes for a more intuitive approach during the building survey. It would also allow to immediately relate the sustainability performance with the value of each attribute of the building, establishing priorities for intervention and limits of acceptable change, as suggested by Havinga (2019).

To use the set of indicators for an efficient evaluation, it is also important to consider both the clear phrasing of indicators and the desired methodological approach – qualitative or quantitative. In this aspect, lessons can be learned from both VerSus and LBC frameworks. On the one hand, in the VerSus framework, indicators are formulated in a layman's language, easily understandable and sufficiently open to be applicable in different buildings and contexts (depending on scale, age, state of conservation, typology, classification, or budget). As an example, the indicator "ensuring adequate ventilation" allows the result to be measured, observed, simulated or deduced; the equivalent indicator in the LBC framework "Sufficient operable windows to provide natural ventilation for at least six months of the year", limits the evaluation to a certain attribute – windows – excluding the potential of vernacular ventilation systems that could be found in heritage buildings, and implies measuring and monitoring the performance during the occupation stage – not feasible or relevant in vacant buildings, for instance. On the other hand, the LBC framework provides more detailed parameters that are useful to guide the evaluation process and detail levels of performance, contributing to more objective results. As an example, the already mentioned indicator on the use of local resources is subdivided in several parameters (20% of materials within 500 km, 30% of materials within 1000 km, 25% of materials within 5000 km) to allow presenting the results in a scale of intervals, such as a Likert scale, as proposed by Ornelas et al. (2020). That would allow each indicator to provide a complete evaluation result, concerning its value to sustainability, and compare the performance of different buildings, solutions, or interventions.

The set of indicators proposed in the present research is limited to twenty-three (23) indicators, significantly fewer than other sets developed for heritage buildings. Da Silva & Ramos (2010) developed a set comprising fifty (50) indicators. It includes indicators that exceed the core aspects defined in the ISO (e.g., renewable resources, water management, etc.), the boundaries of the building (e.g., transport and location-oriented indicators) and the assessment of baseline conditions (e.g., processes related to urban management, controllability, and monitoring during the operation phase). Shetabi (2015) presents a more extensive list of forty-five (5) indicators, covering some of the core aspects identified in the ISO but also secondary and tertiary environmental aspects. However, it does not address cultural heritage values, despite being a framework designed to be applied to heritage buildings. The indicators considered in these methodologies are certainly important for comprehensive assessments of the sustainability performance of heritage buildings and "can be required depending on the nature of the case" (ISO, 2011). Indicators related to technical aspects, such as safety and state of conservation (Boarin et al., 2014a; Gonçalves et al., 2018; Ornelas et al., 2020); social aspects, such as inhabitant's perceptions and community engagement (Leus & Verhelst, 2018;

Ornelas et al., 2020); and heritage values, including historical, aesthetic, artistic and political values (Havinga et al., 2019), would be important additions contributing to aa more comprehensive and detailed framework for sustainable conservation of heritage buildings. However, such an extensive tool would increase complexity and imply highly time-consuming procedures, that could discourage its uptake (Leus & Verhelst, 2018). As time and economic constraints are two of the main reasons pointed out by practitioners for the lack of application of adequate sustainable conservation practices (Gonçalves, Mateus, & Silvestre, 2019), it was a specific goal of this research to establish a set of indicators that is concise enough to ensure feasibility while broad enough to cover all the fundamental aspects of sustainable development, as defined in the international standards (ISO, 2011).

5.5.1 Future Research

The core set of indicators presented structures fundamental aspects to consider in an assessment method for sustainable conservation. Future research should address how the core set of indicators can be operationalized in a tool to assess the sustainability value of heritage buildings and support decision-making.

Future research should address, issues such as clarity and simplicity in the formulation of indicators (ISO, 2011), the relation of the selected indicators with the building attributes (Ornelas et al., 2020), and applicability under time and budget constraints (Gonçalves, Mateus, & Silvestre, 2019). Applying such tool in case studies from different categories of Built Heritage (such as industrial, vernacular, urban, modern, etc.), should be a subsequent step for further research, to validate the relevance and availability of information, and to determine the priority and weight of the core indicators suggested in this research. Future research should address the extent to which additional indicators can be added to a baseline framework for sustainable conservation, without compromising the applicability of the framework.

As stated by Cole (2012) “the most significant and necessary shift does not reside at the strategic level, but in the mindset among design team and client participants”. A common set of indicators has the potential to improve communication between the multiple stakeholders in the conservation process (Shetabi, 2015). Additionally, as demonstrated by Leus et al. (2018), it can also contribute to reaching consensus in the management of heritage places. Further research should explore the use of the assessment tool by different stakeholders to reach consensus in decision-making processes, and the contribution of a baseline assessment tool to improve the implementation rate of intentions towards sustainable conservation.

5.6 Conclusions

The awareness of the importance of Heritage for a more sustainable built environment instigated a rising number of studies developing assessment frameworks crossing heritage and sustainability. However, literature shows the lack of a method to assess the value to sustainability of heritage buildings before redesign interventions. This research aimed at developing a concise framework of indicators for the assessment of heritage buildings, covering the main aspects of sustainability – including cultural values.

The results of this current study show that, despite the differences in structure, scope and aims of the building assessments tools already available, they share common principles towards sustainable development. Site, energy, water, building solutions, materials, durability, indoor environment, community, and values emerge as the main priorities. A baseline assessment framework for sustainable conservation of built heritage requires indicators suitable for existing buildings and that are identifiable at the building scale. It cannot depend upon dynamic indicators related to users and processes that evolve with time and management. Even if indicators related to the operation can be used for detailed assessments of existing conditions before renovation interventions, they do not necessarily provide information related to the building attributes and values on a baseline assessment. Limiting the assessment to a concise set of indicators will always exclude potentially important aspects of sustainability and heritage assessment. However, this approach has the potential to make the process of assessment less time-consuming and more affordable, and, therefore, more feasible in practice.

The resulting selection of indicators for the assessment framework for sustainable conservation of built heritage presents a concise set of twenty-three (23) indicators that cover the fundamental aspects defined in the international standards for sustainability. While the outlined set of indicators is not intended for direct application as an assessment framework, it represents a steppingstone towards building a tool to support decision-making for the sustainable conservation of built heritage. It focuses on existing features of single buildings, making it adequate to inform on the condition of the building before the design stage. It includes indicators related to heritage significance, and, fundamentally, it understands sustainability as a value by itself to be recognised and preserved for future generations.

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6 Building passport for sustainable conservation

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ABSTRACT

With the raising awareness of the importance of heritage buildings for sustainable development, building sustainability assessment (BSA) tools are becoming key to support informed decisions towards sustainable conservation. Recent literature shows that existing BSA tools have been adapted and new BSA tools developed to integrate the specific aspects of heritage buildings. Some tools target existing buildings, but seldom cover cultural significance and related heritage values. Others target the after-redesign situations – aiming at assessing how sustainable the redesign intervention is. Often BSA tools are complex and time-consuming, with extensive indicators and data requirements. Instead, this research presents the development of a Building Passport for Sustainable Conservation (BPSC) as a simpler questionnaire with a set of 23 core indicators, which outcome is as a baseline assessment of heritage buildings. The aim of this tool is thus to identify priorities for future interventions and limits of acceptable change, by recognizing the contributions of heritage buildings to sustainability that can be preserved, and the fragilities that need to be improved. The resulting BPSC was applied to four different case studies of modern heritage in the Netherlands, to verify its applicability and limitations. The results suggest that this tool has the potential to contribute to an expedite assessment, reaching consensual evaluations of priorities for sustainable conservation, while reducing the time and cost of the process.

6.1 Introduction

Two decades ago, sustainability and heritage conservation were often considered as opposite or contradictory (Dornelles, Gandolfi, Mercader-Moyano, & Mosquera-Adell, 2020; Lidelöw, Örn, Luciani, & Rizzo, 2019).Today, the contribution of the conservation of built heritage to sustainability is seldom under question, and further steps have been taken on their further integration by both science and society (Fernandes, Mateus, Gervásio, Silva, & Bragança, 2019; Gonçalves, Mateus, & Ferreira, 2014; Posani, Veiga, & de Freitas, 2019). Endorsed by international doctrinal documents as the UNESCO Recommendation on the Historic Urban Landscape (Unesco, 2011) , and the UN Sustainable Development Goals (United Nations, 2015), heritage conservation is becoming a condition sine qua non for sustainable development.

Tools to support decision-making have been developed to encourage design decisions to integrate economic aspects, cultural significance, and environmental performance (Havinga, Colenbrander, & Schellen, 2019b; Ornelas, Miranda Guedes, Sousa, & Breda-Vázquez, 2020; Roders, Post, & Erkelens, 2008). Regulations, recommendations of best practices, and principles for intervention have been established internationally (Australia, 2013; Icomos, 2003, 2011a, 2011b; Unesco, 2011, 2013, 2015).

Sustainability assessment tools are essential to support design decisions in heritage conservation processes. These tools have the potential to contribute to the implementation of sustainability objectives at the management level (Leus & Verhelst, 2018; Ornelas et al., 2020), and to assess the sustainability of adaptive reuse and conservation projects in heritage buildings (Boarin, Guglielmino, & Zuppiroli, 2014). However, the literature shows that the existing sets of indicators are insufficient to ensure an adequate baseline assessment of heritage buildings to sustainability before conservation interventions (Gonçalves, Mateus, Dinis Silvestre, Pereira Roders, & Vasconcelos, 2021). This baseline assessment is of utmost importance to inform the future steps of design, with a balanced integration of environmental and cultural factors (Appendino, 2018; Correia, Carlos, Merten, Viana, & Rocha, 2013; Gonçalves et al., 2021), and to establish limits of acceptable change (Havinga, Colenbrander, & Schellen, 2019a). According to practitioners, there are insufficient tools to support decision-making in built heritage conservation, and the existing tools and methodologies are too complex, difficult to access, and very time-consuming (Gonçalves et al., 2021; Gonçalves, Mateus, & Silvestre, 2019; Perovic, Coffey, Kajewski, & Madan, 2016).

Earlier research focuses on the selection of a core set of indicators for the sustainability assessment of heritage buildings, covering all the central aspects of sustainability according to international standards (ISO, 2011). The suggested set of indicators are suitable for existing buildings, and identifiable at the building scale, providing information about the sustainability of building attributes and values on a baseline assessment. The present research relates the resulting set of 23 core indicators for sustainable conservation with the related building attributes, to build a tool for the baseline assessment of heritage buildings and support decision-making towards sustainable conservation. This tool is then applied to different case studies of 20th century heritage in the Netherlands, to test its applicability and clarity of the formulated indicators.

6.2 Materials and methods

The construction of the assessment tool was based on literature regarding sustainability and built heritage. The selection of core indicators (Gonçalves et al., 2021) crossed indicators from two BSA (building sustainability assessment) methods — one focused on heritage buildings (Versus) and one focused on regenerative design (LBC), with the recommendations from the ISO 21929-1 standard on indicators for sustainability in building construction (ISO, 2011).

To structure these indicators, this research uses as a starting point the framework of Kuipers & de Jonge (Kuipers & De Jonge, 2017), that aims at guiding the "observation of an inherited building in its present state in a coherent manner". In this framework, the building is understood as a composed interrelation of layers that determine its physical coherence, as defined by Brand (Brand, 1995). To the six general-purpose shearing layers defined by Brand (site, skin, structure, space plan, services, and stuff) Kuipers & de Jonge (Kuipers & De Jonge, 2017) add another layer, specific to heritage buildings, the spirit of place, to include the intangible features of the place. The selected core indicators for sustainable conservation were organised according to these seven building layers of heritage buildings, allowing for a gradual recognition of the building in its varied levels. The tool was developed as an online questionnaire, with Qualtrics software, through sets of binary items on a Likert scale.

The building passport for sustainable conservation (BPSC) was applied to different case studies of 20th century heritage by Heritage & Architecture students, at TU Delft, the Netherlands, in two different stages. In both stages, students applied the building passport after surveying and analysing the building, and before initiating the design process. Also in both cases, students were acquainted with the concepts and analysis methods proposed in the framework of Kuipers & de Jonge (Kuipers & De Jonge, 2017), further detailed in "Designing from Heritage". In the first stage, between May 2020 and July 2020, a group of 20 students applied the BPSC to the Priorij Emmaus, in Maarssen, Utrecht, the Netherlands, without any introductory explanations to the concepts covered. This stage of the research allowed to collect quantitative data and verify the applicability and variability of responses towards the same building. In the second stage, between March 2021 and April 2021, a group of 5 students applied the BPSC to different V&D department store buildings in the Netherlands (Leiden, Haarlem, and Maastricht). In this case, students applied the building passport twice: first, the BPSC was applied without previous knowledge of the concepts target by the indicators; later, the BPSC was applied again after discussing the scope of each indicator in a collective session. This stage allowed to collect qualitative data on the clarity in the formulation of indicators and limitations of the developed tool.

6.3 Building Passport for Sustainable Conservation

6.3.1 Indicators and building layers

In the current research, the previously selected set of core indicators was organized in a building passport for sustainable conservation (BPSC): a tool for a qualitative baseline assessment of the building values for sustainability, in a simple and accessible way. As identified in the literature (Ornelas et al., 2020; Shetabi, 2015) the indicators for sustainability assessment were organized according to building attributes or components, and then distributed in seven building layers. This option allows to immediately relate sustainability performance with the value of each building attribute, reducing complexity, and supporting the identification of limits of acceptable change. These seven layers are defined as follows:

- Site: relation of the building with the surrounding urban landscape.
- Skin: the building envelope and interface with the exterior.
- Structure: the support construction systems.
- Services: the infrastructures, such as plumbing, electrical systems, heating, and ventilation.
- Space Plan: the interior layout and distribution of spaces.
- Stuff: furnishings and furniture.
- Spirit of the Place: intangible aspects related to building's meanings over time.

In each building layer, several attributes were identified, contributing to further detail in the assessment. As such, the layer "Skin", for instance, includes the attributes "shape", "materials", and "techniques", while the layer "services" includes the attributes "water system", "energy and heating", and "ventilation" (Kuipers & De Jonge, 2017). In the layer "Spirit of Place", Kuipers & de Jonge (Kuipers & De Jonge, 2017) refer to community and place relationships. These building layers and attributes were thus related with the sustainability indicators (Gonçalves et al., 2021) as described in the diagram in Figure 6.1. As an example, the layer "spirit of place" is related with the indicators "places to gather and connect" (community and public spaces), "place-based relationships" (integration with cultural context, historical events, traditions), and "environmental features" (integration with surroundings: colours, textures, materials, views, craftsmanship) (Kellert, Heerwagen, & Mador, 2011).

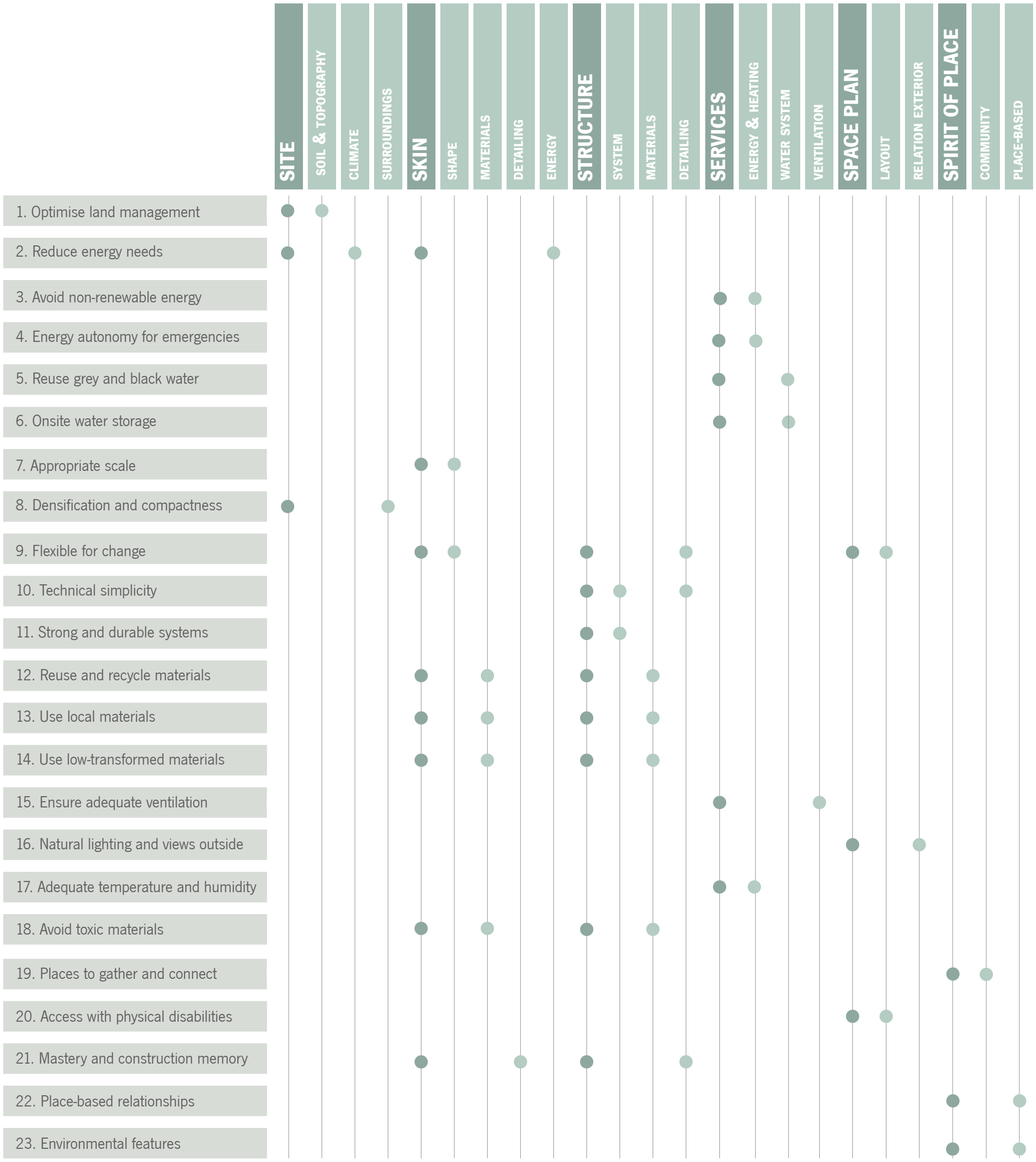


FIG. 6.1 Distribution of the indicators according to building layers and attributes

6.3.2 Structure of the tool

The BPSC seeks to tackle some of the main challenges identified by the practitioners in previous literature (Gonçalves et al., 2019), namely availability, complexity, and accessibility of information. Thus, the BPSC was developed as an online and mobile-friendly questionnaire, using a concise set of indicators that allow identifying priorities and opportunities for the redesign stage (Figure 6.2). As identified in previous assessment methods (Gonçalves et al., 2021; Living Future, 2019; Ornelas et al., 2020), the BPSC allows surveyors to assess the sustainability performance of each attribute through a 5-point Likert scale, providing more detail in the evaluation than “yes”/”no” questions in qualitative assessments (ISO, 2011).

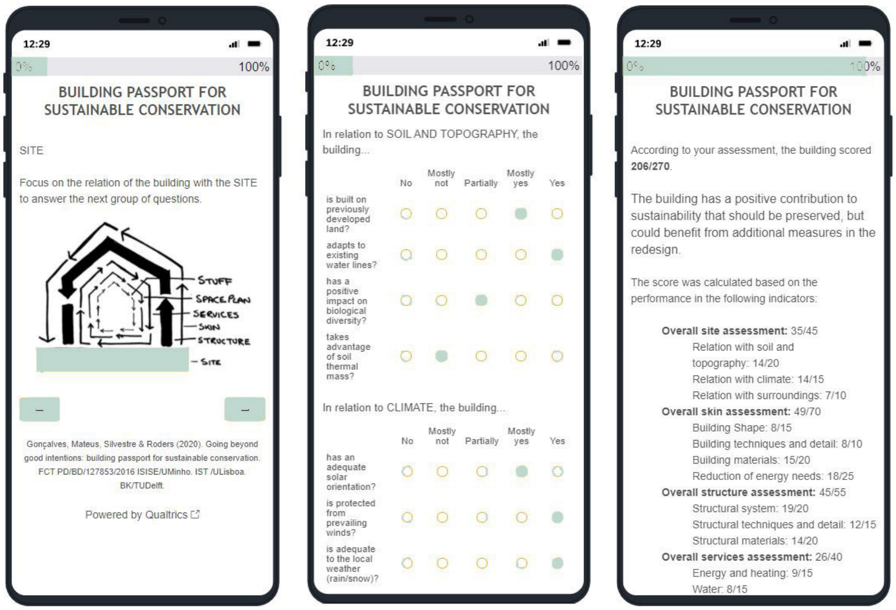


FIG. 6.2 Mobile version of the BPSC of built heritage

All the core indicators were considered as mandatory prerequisites with equal levels of importance for the sustainability assessment. The Likert scale with 5 points (“no”, “mostly not”, “partially”, “mostly yes” and “yes”) was used to establish rules of normalization, with the answer “no” rated as 1 point, and the answer yes rated as 5-points. Even though no explicit weights were applied to prioritise some indicators over others, the fact that some building layers consist of more building attributes determines the implicit weight of the contribution of each layer for the overall assessment of sustainability. The final rating, consisting of a total of 270 available points, is presented in 4 categories with descriptive labels (see Table 6.1). Together with the descriptive label, the overall assessment presents a transparent identification of the building attributes with higher and lower scores.

TABLE 6.1 BPSC rating categories

Label	A	B	C	D
Description	The building has valuable contributions to sustainability that should be preserved in the redesign.	The building has a positive contribution to sustainability that should be preserved but could benefit from additional measures in the redesign.	Despite some positive aspects, the building offers some wider redesign opportunities to improve its performance regarding sustainability.	The building presents some major issues that should be addressed in the redesign to improve its performance regarding sustainability.
Points	217-270	163-216	109-162	1-108
% score	**> 80%**	**> 60%**	**> 40%**	**< 39%**

6.4 Sustainability assessment of 20th century heritage: case studies

6.4.1 Presentation of the case studies

The BPSC was applied by Heritage & Architecture students in their design studios focused on the revitalization of 20th century heritage: the Priorij Emmaus, in Maarssen, and the V&D department stores in Leiden, Haarlem and Maastricht.

The Priorij Emmaus is a monastery designed by architect Jan de Jong and built between 1964 and 1966 in Maarssen, in the province of Utrecht, in the Netherlands. It is an exemplary of post-war religious architecture, from the “De Bossche” school, characterized by sobriety and a strict system of proportions, the “plastic number”, based on ratios found in nature (Pilz & Bergsma, 2016). The building is understood as a part of Nature, aimed at providing shelter. It is a two-storey volume flowing around a courtyard (Figure 6.3) and built against a slope, with one storey partially underground. It is mainly built with concrete, brick, and wood, materials widely available in the Netherlands. The Priorij Emmaus was listed as a national monument in May 2016 (Rijksdienst voor het Cultureel Erfgoed, 2016).

FIG. 6.3 Priorij Emmaus (source: A. Hermkens, 2020)

The V&D buildings were department stores built by the Vroom & Dreesmann company, one of the largest chains of department stores in the Netherlands, founded in 1887 and bankrupt in 2016. During the 20th century, this commercial chain built large commercial buildings with rich ornamentation representing its corporate identity, all-over the Netherlands. The strategic location in the inner-city centres and the configuration as a urban landmark is characteristic of this typology (Witkamp et al., 2021).

In Haarlem, the V&D department store was designed by Jan Kuijt in “De Amsterdamse” school style and built in 1934. In terms of materiality, the building results of a combination of concrete, limestone, red brick, and stained glass. The 8 storey-building is integrated in an urban fabric offers a contrast with an urban fabric on which small lots are predominant and is even one of the reasons the building was listed as national heritage, in November 1999 (Rijksdienst voor het Cultureel Erfgoed, 1999). In Leiden, the V&D department store was built in 1936, designed by the architects Leo and Jan van der Laan. It is built of concrete, limestone, and yellow brick. It is listed as national heritage since October 2000, as a representative of a department store of the 1930’s in the Traditionalist style (Rijksdienst voor het Cultureel Erfgoed, 2000). As the V&D in Haarlem, also the V&D in Maastricht was originally designed by Jan Kuijt, in 1932. The existing building results today of a combination of interventions overtime. The integration has a significant part of the urban fabric, the architectural integrity of the façade and the detailed ornamentation in limestone are some of the reasons for the classification as municipal heritage (Gemeente Maastricht, 2013).

6.4.2 Sustainability assessment of the Priorij Emmaus

The results of the application of the BPSC to the Priorij Emmaus building show consistency in the assessment by different users, with 53% of participants coinciding in the classification of the building in the second level of sustainability: "the building has a positive contribution to sustainability that should be preserved but could benefit from additional measures in the redesign". The small standard deviation on the overall assessment (M=2.58; SD=0.69) shows a good concentration of the values around the mean, which reflects low variability in respondents' assessments. Spirit of the place is the layer with more participants recognize positive contributions for sustainability that should be conserved (26,3% classification A; 63,2% classification B). In the opposite direction, the layer "Services" is classified as the least sustainable one by almost 80% of the respondents (68,4% classification C; 10,5% classification D), pointing the need to improve performance regarding sustainability. Table 6.2 shows the frequency of classifications according to building layers in the sustainability assessment of the case study.

TABLE 6.2 Average frequencies of the sustainability rating of the building layers

	A (1)	B (2)	C (3)	D (4)
Site	0%	73,7%	15,8%	10,5%
Skin	0%	89,5%	0%	10,5%
Structure	0%	84,2%	5,3%	10,5%
Services	0%	21, 1%	68,4%	10,5%
Space	10,5%	73,7%	5,3%	10,5%
Spirit	26,3%	63,2%	0%	10,5%
Overall	**0%**	**52,6%**	**36,8%**	**10,5%**

Figures 6.4 and 6.5 presents a resulting BPSC of the Priorij Emmaus building, with the average results assessed by the participants. This assessment tool allows identifying major opportunities for the redesign of the building, and also valuable attributes to conserve for the future generation. In the layer "Services", the major issues of the building are related with the water management (collection, storage, and reuse), while in the layer "Skin" participants reflect concerns related with

energy needs (insufficient thermal insulation and protection of windows). The layer "spirit" is considered the one with more positive contributions for sustainability, namely by offering spaces for the community to gather and connect with local culture and traditions, and with the ecological features of the place. The interior-exterior relationships (in the "space plan" layer), the use of long-lasting and durable materials (in the "structure"), and the use of materials locally produced (in the "skin") are also valued as positive contributions for sustainability in the Priorij Emmaus building.

Being accessible online, in a computer or mobile format, this tool is easily accessible, and was applied by a total of 23 students within an average 30-minute timeframe. The short time of the assessment process, however, is only possible if the work of research and documentation is previously conducted, informing the assessment. Thus, while technically the BPSC is applicable in in-situ assessments, its accuracy relies on the collection and analysis of extra information through a desk-assessment process. The BPSC seems to be a positive contribution to summarize and qualitatively assess the sustainability level of the building, after research, as stated by the participants: "the tool was very useful as it is a very systematic approach to assess value across the different layers. The result of the questionnaire was very similar to what we had achieved with our manual value assessment, so it works rather well and a lot quicker".

BUILDING PASSPORT FOR SUSTAINABLE CONSERVATION

Building Identification

Building: Priorij Emmaus

Architect: Jan de Jong

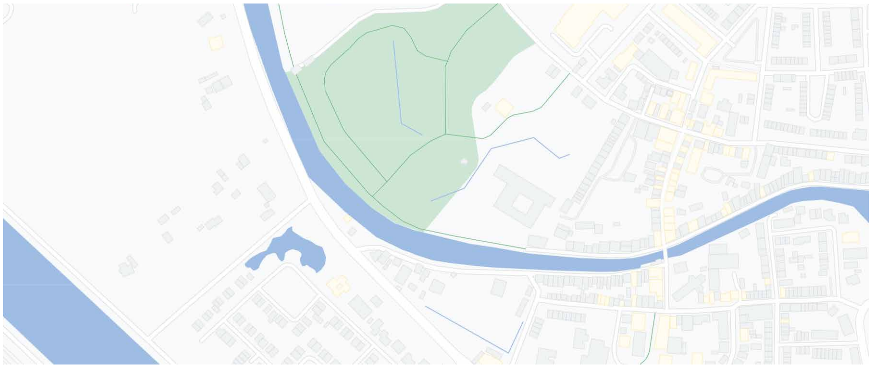
Year: 1964

Function: monastery

Monument number: 53226

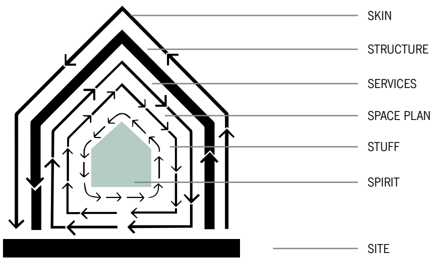
Status: national monument

Building Location



Diependaalsedijk, Maarssen, Utrecht, The Netherlands

Sustainability Assessment Summary



B

The building has a positive contribution to sustainability that should be preserved, but could benefit from additional measures in the redesign.

The most positive aspects are:

- the connection with local culture and traditions;
- the transitional spaces;
- the use of durable and long-lasting materials;
- the simplicity of the building structure.

The least positive aspects are:

- insufficient thermal insulation;
- lack of energy autonomy strategies;
- no rain water collection;
- no water treatment or reuse.

Gonçalves, Mateus, Silvestre & Roders (2021). Going beyond good intentions: building passport for sustainable conservation.
FCT PD/BD/127853/2016 ISISE/UMinho. IST /ULisboa. BK/TUDelft.

FIG. 6.4 Average result of the BPSC of the Priorij Emmaus: front page

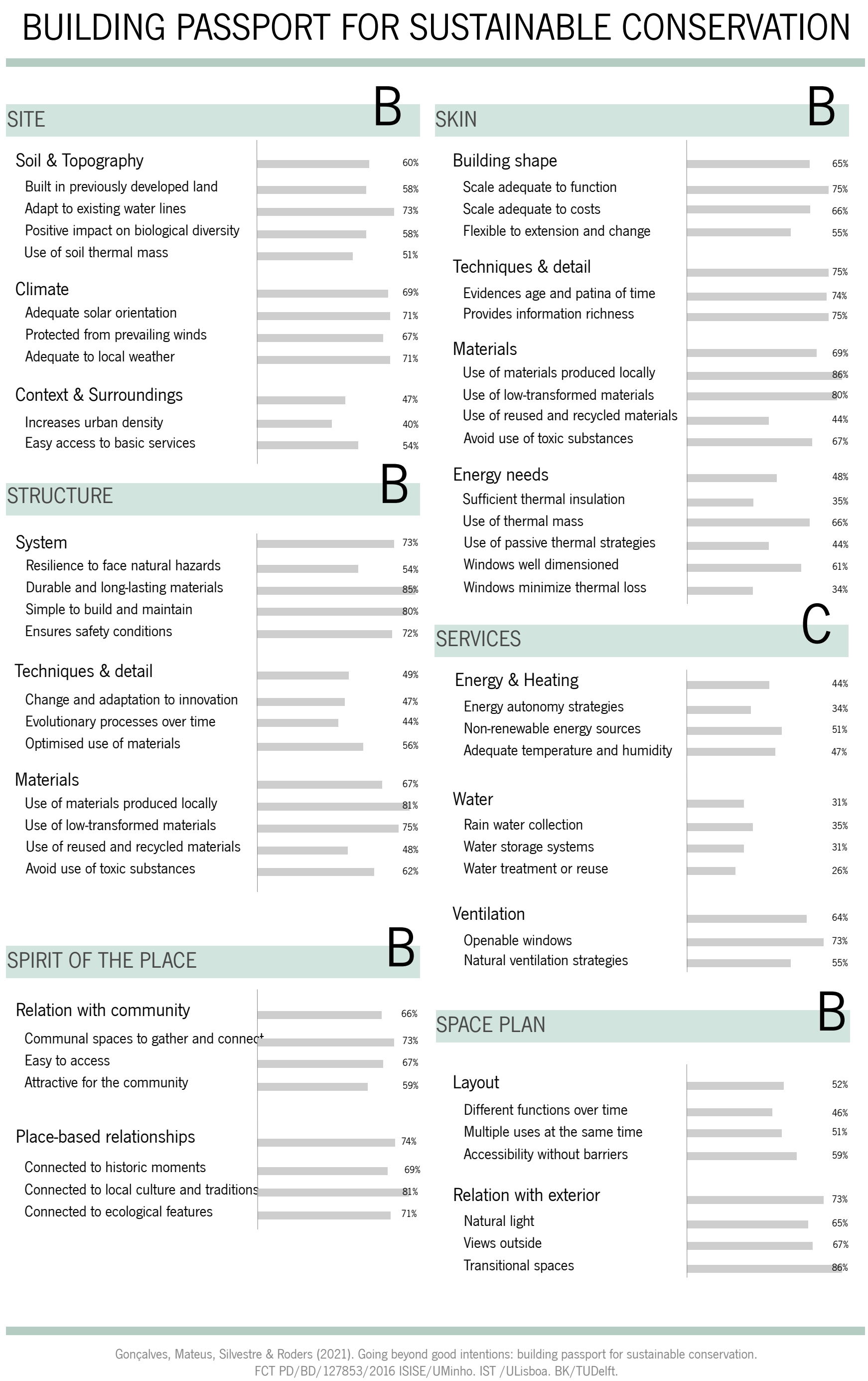


FIG. 6.5 Average result of the BPSC of the Priorij Emmaus: back page

6.4.3 Sustainability assessment of the V&D department stores

In the first application of the BPSC to the V&D department stores, without explanatory introduction to concepts and indicators, the three buildings (Leiden, Haarlem, and Maastricht) achieved a classification B, recognizing positive aspects that contribute to sustainability that should be preserved, while some fragilities need to be improved.

In the V&D Leiden the building shape, the techniques and detail (providing visual richness with a variety of textures and detailed ornaments), the place-based relationships (with connections to historic events and local identity) and the relation with the context and surroundings (located in an inner-centre, contributing to increase urban density and ease access to diverse amenities) emerge as the main positive aspects. In the other hand, the materials in the skin layer (not reused, not recycled, and considered not locally produced or low-transformed), the energy needs of the building (the inexistence of thermal insulation, double glazing, or climate control strategies) and the water infrastructure (with no systems for water collection and reuse) are pointed out as the most negative ones. Despite the survey and analysis emphasizing the significance of the V&D for Leiden's community in the past (Figure 6.6), the assessors rated the relation of the building with the community with a low score (8/15), since the building is currently vacant, and thus not accessible to the public.

FIG. 6.6 V&D Leiden
(source: M. Kopp, 2021)

In the V&D Haarlem the detailed ornaments on the façade are also rated as highly valuable (Figure 6.7). The space layout, in particular referring to the accessibility without barriers and the multifunctionality of the space, is also considered one of the positive aspects that should be preserved. As happened in the assessment of the V&D Leiden, the materials (both in skin and structure), the energy needs, and the services have the lowest rating. But unlike V&D Leiden, in the V&D Haarlem the evaluators considered the relation with the community as a valuable aspect (12,5/15). In this case, the building was not assessed in its current situation but by the potential evidenced by its past situation, before vacancy.

FIG. 6.7 V&D Haarlem (source: R. Mein, 2021)

Materials, services, and relation with community were the lowest scored indicators in the V&D Maastricht, confirming the results in Leiden and Haarlem. The most positive aspects were the building shape (scale considered adequate to the function and costs), the structure (both the system resilience to natural hazards, durability, and safety, and the details, showing evolutionary processes over time and adaptation to technical innovation), and the place-based relationships.

The three buildings share the same typological characteristics, such as scale, location in inner cities, materiality, and rich ornamentation. In common the assessment of the three buildings highlights as most positive aspects the technique and details and the place-based relationships, while materials, energy needs, and services appear as common priorities that should be addressed in future redesign interventions.

In the V&D Leiden, the two evaluators discussed the indicators and worked together in the assessment, resulting in very similar classifications (171/270, and 165/270), in the V&D Haarlem the two students analysed and assessed the building independently resulting in more discrepant results (166/270 – label B, versus 122/270 – label C). In this case, the most different results appear in the indicators “relation with the context and surroundings”, “building shape”, “space layout”, and “relation with community”. Variance in the assessment of the indicators, is explained by different interpretations of the scope of application of the BPSC, focusing on the current state of the building or in the situation before vacancy (e.g., “relation with community”, “scale adequate for function”), or different interpretation of the meaning of the indicators. For instance, in the indicator “in relation the context and surroundings, does the building allow for easy access to basic services?” was correctly interpreted by one of the evaluators as the proximity to basic services in the surroundings but interpreted by the second evaluator as the basic services provided by the building to the surroundings. A third issue emerged in the filling of the questionnaire to assess the building’s sustainability, illustrated in the layer “building shape” by the indicator “the scale is adequate for maintenance and operation costs”: when the necessary information to assess the indicator is lacking, the evaluators may assume subjective perspectives and assess the building based on assumptions (for instance, “the building is now vacant because it was too big to operate and maintain sustainably”).

The second application of the building passport, after an explanatory introduction of each indicator and the scope of the BPSC as a baseline assessment of the current situation, shows no relevant differences in the most positive and least positive layers and attributes of the building. In the V&D Haarlem, context and surroundings, detail and techniques in the layer skin, and place-based relationships are the most positive aspects identified; while materials, energy needs, and water infrastructure remain as the least positive ones. The biggest differences between the before and after application of the BPSC emerged in the layers on which previously differences between evaluators were bigger, specifically: “relation with context and surroundings”, “building shape”, “space layout”, and “community”, demonstrating that further clarifications of the indicators may be needed to ensure an objective assessment. The results show that after explanations on the scope of the tool and the indicators, the two evaluations were balanced and the differences between evaluators reduced, reaching a consensual level C (135/270 and 148/270), for the V&D Haarlem.

6.5 Discussion and conclusions

The application of the novel BPSC to the case studies showed that it successfully contributes to reveal the baseline characteristics of heritage buildings regarding sustainability while answering the challenges identified by practitioners in the field. The questionnaire format of the BPSC guides the user through complex issues using simple qualitative parameters that reflect the visible reality, minimizing the dependence on expert technical skills, and, thus, the time and cost of the process.

Distributing the assessment indicators according to building layers, allows to ease the assessment process and to identify on which building attributes need to be targeted for improvement in future interventions. This tool also allows identifying the most positive contributions of the building for sustainability, establishing limits of acceptable change. By highlighting the most positive and the least positive aspects identified in the baseline situation, the BPSC allows to systematise actionable information for the redesign processes.

The core set of indicators used is adequate for heritage buildings, allowing to recognise contributions to sustainability beyond materiality and environmental performance. By including indicators related to the three dimensions of sustainability - environmental, economic, and social – but also related with aesthetic, craftsmanship and cultural identity, the BPCS allows to unveil a broader range of values of heritage buildings. In the case of the Priorij Emmaus building, the BPSC allows recognising the contribution of the building for community welfare, by providing spaces to gather and connect with others, emphasizing the need to preserve the physical attributes that support intangible values. In the application of the BPSC in different V&D buildings results in common positive evaluations of the techniques and detail, relation with context and surroundings, and place-based relationships, suggesting the potential of the BPSC to identify and characterise ensembles of heritage buildings with similar typological characteristics.

From the experimental applications of the BPSC three main potential limitations were thus identified, that may result in variability of results of the assessment: 1) misunderstanding the scope of application of the tool as a baseline assessment; 2) misunderstanding the meaning of indicators, requiring further explanations to the users; 3) the need to make assumptions, resulting from lack of information about the existing situation, requiring further desk work.

The results of the application of the BPSC confirm the contribution of this tool to reach consensual assessments of the contribution of heritage buildings for sustainability before interventions. The BPSC of built heritage provides a common language that can be used between different stakeholders and ensures that assessment of future (and past) interventions may be carried out in comparative terms, comparing the impact of the intervention with the performance of the initial situation.

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7 Contributions to behavioural change

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ABSTRACT

Despite the recognized importance of built heritage for sustainable development, and the multiple tools, recommendations, guidelines, and policies developed in recent years to support decision-making, good sustainable conservation practices often fail to be implemented. Challenges faced by practitioners often relate to external factors, and there is a gap in the understanding of the role of the nature of the designer and the behavioural dimension of the challenges in implementation. This research applies the Theory of Planned Behaviour (TPB) to verify how a building passport for sustainable conservation (BPSC) impacts design students' intentions and actual design decisions towards built heritage conservation. This research aims to ascertain the role of the BPSC to affect attitudes, subjective norms, and intentions and ultimately change conservation behaviours. The results show that this tool has a positive contribution to reinforce existing attitudinal beliefs. Still, no significant changes were found in the overall conservation behaviours, suggesting that beliefs hindering implementation may more often be related to aesthetic reasons, creativity and innovation, and program requirements, than with beliefs regarding the sustainable performance of the building. This study demonstrates that using the TPB to analyse design processes in the context of built heritage is an innovative methodological approach that contributes to a deeper understanding of the psychological factors affecting sustainability and built heritage conservation decisions.

7.1 Introduction

Recognising that heritage conservation is becoming increasingly relevant for sustainable development (UNESCO, 2011b; United Nations, 2015), tools to support decision-making have been developed in the last decades to encourage design decisions to further integrate sustainability principles in built heritage conservation, including economic aspects, cultural significance, and environmental performance (Havinga, Colenbrander, & Schellen, 2019; Ornelas, Miranda Guedes, Sousa, & Breda-Vázquez, 2020; Roders, Post, & Erkelens, 2008). Regulations, recommendations of best practices, and principles for intervention have been established internationally (Australia, 2013; Icomos, 2003, 2011a, 2011b; Unesco, 2011a, 2013, 2015). However, as the Council of Europe report warned, “It is not sufficient simply to formulate principles; they must also be applied” (Council of, 1975). Therefore, if we have the tools, and sustainable conservation is widely promoted as best practice, why is sustainable conservation still lacking application or failing when trying?

Literature addressing the challenges faced by practitioners in the built heritage conservation consistently pointed out external factors, such as the lack of knowledge and technical capacity of the different stakeholders (Ashley, Osmani, Emmitt, Mallinson, & Mallinson, 2014; Joana Gonçalves, Mateus, & Silvestre, 2019b; Perovic, Coffey, Kajewski, & Madan, 2016; Roy & Kalidindi, 2017) behind the performance gap between conservation intentions and its actual implementation in the design and construction stages. Seldom, the nature of the designer and the behavioural dimension of these challenges, underlying socio-psychological factors, have been found discussed in the literature (Joana Gonçalves, Mateus, Silvestre, & Roders, 2020).

In the field of psychology , the Theory of Planned Behaviour - TPB (Icek Ajzen, 1985, 1991, 2002) is one of the most complete sociopsychological models of behaviour, correlating intentions with actually performed behaviours, by considering the effect of intervening events, such as low behavioural control, and facilitating conditions, such as attitudes (personal evaluative dispositions). This theory, in particular, has been used to predict and understand behaviours in the scope of health (Budden & Sagarin, 2007; Conner, Rodgers, & Murray, 2007; de Bruin et al., 2012; Ghany, Strader, Thomas, & Seeff, 2009), consumption (Paul, Modi, & Patel, 2016; Wang, Liu, & Qi, 2014), or entrepreneurship (Shirokova, Osiyevskyy, & Bogatyreva, 2016; van Hooft, Born, Taris, van der Flier, & Blonk, 2005), for instance. Also, in the context of a more sustainable built environment, the TPB has been used to analyse users behaviours in relation to green labels (Sang et al., 2019), recycling behaviours (Du Toit, Wagner, & Fletcher, 2017), or energy consumptions (Ortiz & Bluyssen, 2018). In the heritage sector, studies using the TPB commonly address factors affecting tourists destination choices (Ramkissoon & Uysal, 2010; Ramkissoon & Uysal, 2011; Zhang & Wang, 2019) and residents support of tourism development (Yuan, Song, Chen, & Shang, 2019). The TPB has also been used to analyse designers' decisions regarding sustainability, such as the factors affecting designers choices to specify sustainable materials (Lee, Allen, & Kim, 2013; Markström, Bystedt, Fredriksson, & Sandberg, 2016), or to adopt strategies towards construction waste minimization (Li, Tam, Zuo, & Zhu, 2015), highlighting the significant role of attitudes as predictors of designers' behaviours.

Earlier research with design students used the Theory of Planned Behaviour (TPB) to measure the gap between conservation intentions and decision behaviours.
By focusing on design students, this study allowed to isolate the internal factors affecting decisions in an environment with higher levels of Perceived Behavioural Control (PBC). It demonstrated that the dissonance between conservation intentions and conservation behaviours persisted, and identified the role of attitudes as one of the main factors affecting the implementation of conservation intentions by design students during build heritage conservation projects (Joana Gonçalves, Mateus, Silvestre, Roders, & Bragança, 2021). The results also show that, despite all the current literature on the contributions of heritage to sustainable development, the compatibility with sustainability standards is still one of the most salient beliefs hindering the implementation of intentions (Joana Gonçalves et al., 2021).

As identified by Lee et al. (Lee et al., 2013), target the attitudes of the designers towards sustainable practices is critical. Literature shows that education and persuasive communication have an essential role in a behavioural change towards sustainable conservation (Joana Gonçalves et al., 2020), contributing to tackle knowledge and belief gaps (Gregory-Smith, Wells, Manika, & McElroy, 2017), increase awareness and raise positive attitudes (Lwoga, 2016), and consequently lead to change behaviour-relevant beliefs, affecting the formation of intentions and their implementation (Icek Ajzen & Fishbein, 2010). There was consensus on the role of alternative events that require active participation and are directed at primary beliefs identified in the research population towards the target behaviour (Icek Ajzen & Fishbein, 2010).

Based on these recommendations, a sustainability assessment tool specifically designed for the baseline assessment of heritage buildings was developed — the Building Passport for Sustainable Conservation (BPSC) (J Gonçalves, Mateus, Silvestre, Bragança, & Pereira Roders, in press). The present research uses the TPB to test how it can contribute to a behavioural change towards a more sustainable conservation of built heritage, by targeting attitudes regarding the sustainability of built heritage. The BPCS was applied by the research population, with the ambition to strengthen positive beliefs towards the values of built heritage, and reverse the former beliefs on the incompatibility between heritage conservation and sustainability, previously identified (Joana Gonçalves, Mateus, Silvestre, Roders, & Bragança, in press). This paper presents measures of the effects of the application of the BPCS on design students' intentions and behaviours towards a sustainable conservation of built heritage.

7.2 Materials and Methods

7.2.1 TACT: target, action, context, and time

This study applies the theory of planned behaviour (TPB) to analyse the effect of the building passport for sustainable conservation in design intentions and decisions. It is based on a sequence of four steps, starting with the building survey and value assessment, followed by an intention questionnaire, the generative artefacts, with participants expressing visually and spatially their priorities through design, and finally self-assessment of behaviour, as represented in the diagram in Figure 7.1.

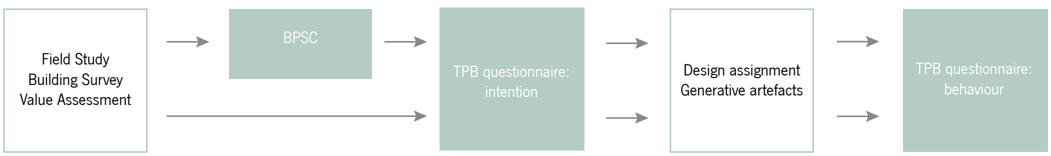

FIG. 7.1 Sequence of steps of the study

The target population were architecture students of the Heritage & Architecture design studios, offered by the faculty of Architecture and the Built Environment, at the Delft University of Technology, the Netherlands. By focusing on design students instead of practitioners, this methodology aims at isolating and identifying internal behavioural factors affecting decisions on built heritage conservation in a context with more creative freedom, less obligation of complying with norms, and reduced interaction with multiple stakeholders.

This study took place between May 2020 and July 2020. The students were asked to give informed consent to start the survey. The questionnaire was distributed among 39 students. A return rate of 90% was achieved (see Table 7.1). The sample population was divided into two groups: the test group, with 20 students, used the building passport; the control group, with 19 students, answered the intention questionnaire without using the building passport. Both groups worked on an hypothetical design assignment for the conservation and adaptive reuse of the Priorij Emmaus, in Maarsen, Utrecht, the Netherlands. The Priorij Emmaus ("Monumentnummer: 532226 Priorij Emmaus Diependaalsedijk 17A 3601 GH te Maarssen," 2020) is a 20th-century monastery, designed by Jan de Jong in 1964, listed as a national monument since 2016.

TABLE 7.1 Response rate

	Students on list	Responses Phase 1	Responses Phase 2	Response rate
1) Test group	20	20	18	90%
2) Control group	19	19	17	89,5%
Total	**39**	**39**	**35**	**90%**

In the development of the intention survey, the behaviour of interest was defined in its Target, Action, Context and Time (TACT) elements (I Ajzen, 2017; Icek Ajzen & Fishbein, 2010). Context and time are common to all groups of questions, referring to the specific building used as a case study in the design studios. Target and Action refer to the conservation actions towards the valuable attributes of a building, considering conservation as the actual action of preserving and keeping a specific building element. The building's attributes were defined as in the building passport, following the seven building layers adapted by Kuipers & de Jonge (Kuipers & De Jonge, 2017), namely: site (relation with context and surroundings); skin (building envelope); structure (load-bearing support systems); services (technical infrastructures such as plumbing or HVAC); space plan (layout and interior spaces); stuff (furnishings and furniture); and spirit of the place (building's meanings over time). The layer "stuff" was not included in the building passport since no core indicators for sustainability were related with it, and as a result, it was also excluded of the TPB questionnaire.

7.2.2 Development of the intention-behaviour questionnaire

This study applied the intention-behaviour questionnaire developed in a previous study (Joana Gonçalves et al., in press), based on the psychological constructs of the Theory of Planned Behaviour (Icek Ajzen, 1985, 1991, 2002). The TPB questionnaire was developed in a previous study (Joana Gonçalves et al., in press), that adapted the instrument developed by Ajzen ("Monumentnummer: 532226 Priorij Emmaus Diependaalsedijk 17A 3601 GH te Maarssen," 2020) to the specificities of built heritage conservation. The questionnaire contains four groups of questions: 1) attitudes ("I consider the conservation (of element x) to be"), 2) subjective norms ("is expected of me that I conserve (element x)"), 3) perceived behavioural control ("it is easy for me to conserve (element x)") and 4) intention ("I intend to conserve (element x)"), where "element x" refers to building attributes on each building layer, according to the BPSC. All the questions use a 5-point Likert scale, to assess the theory's major psychological constructs through direct measures using previously validated scales (valuable/worthless, likely/unlikely, agree/disagree, etc.). The questionnaire is provided in Appendix 1.

In the first group, questions aimed at identifying the participants' attitudes towards the building's attributes, determining their favourable or unfavourable personal evaluations about the act of keeping those attributes. The second group aims to identify social pressure over the performance of conservation actions, referring to beliefs about normative and social expectations. In the third group, questions aimed at measuring the perceived behavioural control of participants. Finally, in the fourth group, standard direct measures of intention were collected for each attribute of the building to establish a baseline for comparison with the final design interventions.

In the follow-up questionnaire, students were asked to self-assess their designs (i.e. "in my design I decided to conserve (element x)"), reporting on the level of conservation of the same list of attributes in a similar 5-point Likert scale.

7.2.3 Data analysis

Data were analysed using SPSS Version 26.0 (SPSS Inc., Chicago, IL, USA). Descriptive statistics, including percentages, arithmetic means, and standard deviation, were used to summarise the sustainability assessment results using the building passport. Descriptive statistics were also used to summarise the results of the intention-behaviour questionnaire regarding attitudes, subjective norms, perceived behavioural control, intentions, and behaviours of the students towards the conservation of each building attribute.

This questionnaire was validated for reliability and internal consistency, measuring the Cronbach alpha for each variable group (attitude, subjective norms, perceived behavioral control (PBC), intention, and behaviour), with alpha being higher than 0.6 in all cases (Table 7.2), as recommended by the literature (Hair, Black, Babin, Anderson, & Tatham, 2006; Nunnally & Bernstein, 1994). Considering that the questionnaire proved to be internally consistent, data was merged into the main variable groups to run the bivariate correlation analysis with a sufficient sample.

TABLE 7.2 Internal consistency and reliability of the measuring scales

	Cronbach's alpha	N. of items
Attitudes	0,721	20
Subjective norms	0,804	20
PBC	0,781	20
Intention	0,783	20
Behaviour	0,806	20

The Kolmogorov-Smirnov test was used to verify the normality of the distribution, confirming a significant deviation of responses in the research population ($p < 0.05$). As such, non-parametric Mann-Whitney tests were preferred instead of independent sample t-tests to compare the means of the two analysed groups.

The relation between behaviour and the other variables was analysed using linear regression modelling, followed by multiple regression with backwards elimination [36]. The final model was obtained by eliminating variables associated with a P-value greater than 0.1, with low statistical significance. Collinearity among variables in the model was measured by the variance inflation factor (VIF). No multicollinearity was detected (VIF<2). Results are expressed using the Beta coefficient with their confidence intervals at 95% (95% Cis).

In the last question of the self-assessment questionnaire, respondents were asked to identify the main reason for not keeping their previously expressed attributes. The results of this question were analysed qualitatively, using content and thematic analysis.

7.3 Results

7.3.1 Descriptive statistics

In the test group, results show a predominance of neutral or negative attitudes towards the conservation of the building (around 52% of the responses) and low levels of perception of control (pointed out by about 55% of the respondents), as presented in Table 7.3. The low average values are primarily due to the layer “services” that concentrates only on negative beliefs. This layer has the lowest values: attitudes regarding its conservation are shallow (with only 13% of positive responses) than the conservation of other layers, and intentions and self-reported behaviours are not positive for more than 80% of participants. On the other extreme, the layer “structure” presents high average replies, with positive attitudes (86%) and perception of high expectations, but also good levels of control (for 67% of respondents). Also, the layer “skin” has consistently positive responses, with 74% of the respondents expressing positive attitudes and 72% expressing positive intentions towards its conservation. Finally, in the layer “Spirit of the Place”, there is a positive attitude towards conservation, but it presents the lowest value on the perceived levels of control.

At the attribute level, the results allow identifying the most valued attributes of the building and the priorities in the design (Table 7.4). The conservation of the structural system, for instance, is seen for 86% of the respondents in the test group as valuable, and 100% feel social pressure to conserve this element, despite the low levels of perceived behavioural control (57% positive responses). As a result, 89% of the respondents self-report high percentages of conservation of the structural system. Other indicators with similar positive reactions are the structural materials, the façade, and the building shape. In the opposite direction, the conservation of the layer “services” concentrates more negative reactions, with the indicators energy and heating, ventilation and water presenting the lowest attitudes, intentions, perceived control and self-reported conservation behaviours. At the same time, more than half of the respondents does not feel social pressure for the conservation of this layer. These results show that the layer services is the least conserved by the design students in the case study.

TABLE 7.3 Average values according to building layer in the test group

	Attitudes[1]		Subj. Norms[2]		PBC[3]		Intention[4]		Behaviour[5]	
Layer	Pos.	Mean (SD)	High	Mean (SD)	High	Mean (SD)	Pos.	Mean (SD)	Pos.	Mean (SD)
Site	60%	2.3 (1.0)	49%	2.5 (1.1)	57%	2.4 (1.0)	60%	2.3 (1.0)	76%	2.1 (1.1)
Structure	86%	1.9 (0.6)	76%	2.1 (0.8)	67%	2.2 (0.9)	79%	1.9 (0.7)	86%	1.8 (0.7)
Skin	74%	2.1 (0.9)	73%	2.1 (0.9)	66%	2.2 (0.9)	72%	2.1 (0.9)	69%	2.0 (1.0)
Services	13%	3.7 (1.0)	16%	3.9 (1.1)	40%	2.9 (1.0)	18%	3.6 (1.0)	17%	3.6 (1.2)
Space Plan	55%	2.3 (1.0)	48%	2.5 (1.1)	45%	2.5 (0.9)	55%	2.4 (1.0)	50%	2.6 (1.1)
Spirit of the Place	64%	2.2 (0.9)	51%	2.5 (0.9)	38%	2.7 (1.0)	64%	2.3 (1.0)	50%	2.6 (1.0)
Average	48%	2.4 (0.9)	43%	2.5 (1.0)	45%	2.5 (1.0)	47%	2.4 (1.0)	47%	2.5 (1.0)

1 *on a scale from 1:5 where 1 is "very valuable" and 5 is "worthless";*
2/4 *on a scale from 1:5 where 1 is "extremely likely" and 5 is "extremely unlikely";*
3 *on a scale from 1:5 where 1 is "strongly agree" and 5 is "strongly disagree";*
5 *on a scale from 1:5 where 1 is "~100%" and 5 is "~0%"*

TABLE 7.4 Main positive and negative indicators in the test group

		Attitudes[1]		Subj. Norms[2]		PBC[3]		Intention[4]		Behaviour[5]	
	Indicator	Freq.	Mean (SD)	Freq.	Mean (SD)	Freq.	Mean (SD)	Freq.	Mean (SD)	Freq.	Mean (SD)
positive	Structural System	86%	1.9 (0.6)	100%	2.1 (0.8)	57%	2.4 (1.1)	71%	2.1 (0.7)	89%	1.7 (0.7)
	Structural Materials	86%	1.9 (0.6)	95%	2.1 (0.8)	76%	2.1 (0.8)	86%	1.8 (0.7)	84%	1.9 (0.6)
	Facade	91%	1.5(0.8)	86%	1.4 (0.6)	71%	2.0 (0.9)	91%	1.8 (0.9)	78%	1.8 (1.2)
negative	Energy and heating	81%	3.7 (1.2)	75%	3.9 (1.2)	76%	3.4 (1.0)	76%	3.6 (1.2)	89%	3.8 (1.2)
	Ventilation	95%	4.0 (0.9)	50%	3.9 (1.1)	67%	2.1 (0.9)	95%	3.9 (0.9)	72%	3.6 (1.1)
	Water	86%	3.5 (0.9)	54%	3.8 (1.1)	67%	3.1 (1.1)	76%	3.3 (1.0)	89%	3.4 (1.4)

1 *on a scale from 1:5 where 1 is "very valuable" and 5 is "worthless";*
2/4 *on a scale from 1:5 where 1 is "extremely likely" and 5 is "extremely unlikely";*
3 *on a scale from 1:5 where 1 is "strongly agree" and 5 is "strongly disagree";*
5 *on a scale from 1:5 where 1 is "~100%" and 5 is "~0%"*

In the control group, the descriptive statistics show results very similar to the test group, with slightly lower perception of control (40% positive responses, instead of 45%) and social pressure (41% instead of 43%). On average, levels of attitude, intention, and behaviour do not vary significantly between the two groups. As in the first group, the layer “structure” consistently presents positive replies but is surpassed in the control group by the layer “space plan”, with 87% positive attitudes, 68% high perceived norms, and 63% of perceived control (Table 7.5). This is a significant difference from the test group, on which positive attitudes towards the conservation of the layer “space plan” are expressed by only 55% of participants. The layer “services” has even lower results in the control group, with only 4% of positive attitudes. Despite that, frequencies of intention and behaviour towards “services” are similar in both groups. In the control group, participants express a very low level of perceived behavioural control in relation to the layer “services” (14% positive responses).

At the attribute level, differences emerge between the control and test groups, mainly in the more positive indicators. The relation of the building with the surroundings, the building shape, and the layout of the space plan are considered more valuable by the majority of the respondents in the control group. The control group coincides with the test group in identifying the indicators energy and heating, ventilation, and water as the most negative ones. However, despite the similar frequency of negative attitudes towards the layer “services”, the control group feels less social pressure to preserve this layer than the test group and shows lower behavioural control (Table 7.6).

TABLE 7.5 Average values according to building layer in the control group

	Attitudes[1]		Subj. Norms[2]		PBC[3]		Intention[4]		Behaviour[5]	
Layer	Pos.	Mean (SD)	High	Mean (SD)	High	Mean (SD)	Pos.	Mean (SD)	Pos.	Mean (SD)
Site	63%	2.3 (1.0)	68%	2.5 (1.1)	77%	2.1 (0.9)	77%	2.0 (0.9)	73%	2.1 (0.9)
Structure	76%	1.9 (0.6)	71%	2.1 (0.8)	53%	2.4 (0.9)	63%	2.2 (0.9)	79%	2.2 (0.9)
Skin	61%	2.1 (0.9)	52%	2.1 (0.9)	54%	2.5 (1.0)	61%	2.5 (1.0)	70%	2.2 (0.9)
Services	4%	3.8 (1.0)	4%	3.9 (1.1)	14%	3.7 (1.0)	12%	3.9 (0.9)	19%	3.4 (1.1)
Space Plan	87%	2.3 (1.0)	68%	2.5 (1.1)	63%	2.3 (0.9)	68%	2.1 (0.9)	71%	2.3 (0.8)
Spirit of the Place	67%	2.2 (0.9)	57%	2.5 (0.9)	45%	2.9 (0.8)	51%	2.5 (1.0)	38%	2.5 (0.9)
Average	47%	2.4 (0.9)	41%	2.7 (1.0)	40%	2.8 (0.9)	44%	2.6 (1.0)	46%	2.4 (0.9)

1 *on a scale from 1:5 where 1 is "very valuable" and 5 is "worthless";*
2/4 *on a scale from 1:5 where 1 is "extremely likely" and 5 is "extremely unlikely";*
3 *on a scale from 1:5 where 1 is "strongly agree" and 5 is "strongly disagree";*
5 *on a scale from 1:5 where 1 is "~100%" and 5 is "~0%"*

TABLE 7.6 Main positive and negative indicators in the control group

		Attitudes[1]		Subj. Norms[2]		PBC[3]		Intention[4]		Behaviour[5]	
	Indicator	Freq.	Mean (SD)	Freq.	Mean (SD)	Freq.	Mean (SD)	Freq.	Mean (SD)	Freq.	Mean (SD)
positive	Surroundings	90%	1.9 (0.6)	84%	2.1 (0.8)	90%	2.4 (1.1)	90%	2.1 (0.7)	94%	1.7 (0.7)
	Shape	84%	1.9 (0.6)	53%	2.1 (0.8)	68%	2.1 (0.8)	74%	1.8 (0.7)	88%	1.9 (0.6)
	Layout	95%	1.5(0.8)	68%	1.4 (0.6)	68%	2.0 (0.9)	68%	1.8 (0.9)	82%	1.8 (1.2)
negative	Energy and heating	100%	3.7 (1.2)	100%	3.9 (1.2)	90%	3.4 (1.0)	95%	3.6 (1.2)	94%	3.8 (1.2)
	Ventilation	90%	4.0 (0.9)	92%	3.9 (1.1)	90%	2.1 (0.9)	95%	3.9 (0.9)	77%	3.6 (1.1)
	Water	95%	3.5 (0.9)	90%	3.8 (1.1)	79%	3.1 (1.1)	74%	3.3 (1.0)	71%	3.4 (1.4)

1 *on a scale from 1:5 where 1 is "very valuable" and 5 is "worthless";*
2/4 *on a scale from 1:5 where 1 is "extremely likely" and 5 is "extremely unlikely";*
3 *on a scale from 1:5 where 1 is "strongly agree" and 5 is "strongly disagree";*
5 *on a scale from 1:5 where 1 is "~100%" and 5 is "~0%"*

7.3.2 Comparative analysis of intentions and behaviours on test and control groups

Nonparametric Mann-Whitney tests were used to measure the difference in the intentions and behaviours of the test and the control group. The null hypothesis was "the two groups have equal means on attitudes, subjective norms, perceptions of control intentions and behaviours regarding the conservation of the building attributes". The tests were performed at the broader and detailed levels. The results at the broader level of the psychological constructs are insufficient to reject the null hypothesis: the test group presents lower mean values (in a scale from 1 to 5, where 1 is the most positive value) on subjective norms, perceived behavioural control, and intention, than the control group, though results are not statistically significant ($p>0.1$). The Mann-Whitney test also suggests that attitudes are, on average, more negative in the test group. Table 7.7 presents the results of the Mann-Whitney test at the psychological construct level, on which "T.mean rank" refers to the test group and "C.mean rank" refers to the control group; the U-value compares the differences between the two groups, and Sig. refers to the statistical significance or probability value (p).

TABLE 7.7 Mann-Whitney test results at the psychological construct level

Construct	T. mean rank	C. mean rank	U	Sig. (p)
Attitude	21.95	17.95	151	0.273
Subjective norms	19.75	20.26	185	0.888
PBC	19.63	20.39	182.5	0.833
Intention	19.02	21.03	170.5	0.584
Behaviour	18.61	17.35	142	0.716

However, at the building layer and attribute levels, the analysis of frequencies shows that the test group presents more positive results than the control group in 53% of the indicators, even if not always statistically significant. Further, the Mann-Whitney tests evidence statistically significant differences between the two groups, particularly in the layers "skin" and "space plan". While in the layer "skin", the test group concentrates more positive responses, in the layer "space plan", the control group expresses stronger positive attitudes and conservation behaviours. On the one hand, attitudes towards the conservation of the skin, particularly the façade, the materials and the detailing, are significantly more positive in the test group. Additionally, this group manifests a more robust perception of social pressure (subjective norms) to preserve the abovementioned indicators of the "skin" and more positive intentions towards the conservation of the materials. However, no significant differences were found in the self-reported behaviours towards this layer.

On the other hand, the control group (that did not use the building passport) shows more positive attitudes towards the conservation of the space plan, both of the layout and the interior-exterior relationships. Thus, even though no significant differences were found in the intentions towards the conservation of the space plan, the control group self-reports to have conserved more of the space plan layout. Table 7.8 summarises the attributes in which statistically significant differences were found between the control and the test group.

TABLE 7.8 Significant differences at the building layer and indicator level

Construct	Layer. Indicator	T. mean rank	C. mean rank	U	Sig. (p)
Attitudes	Skin	15.83	24.39	106.5	0.018*
	Conservation of the facade	15.65	24.58	103	0.008**
	Conservation of the materials	16.80	23.37	126	0.042*
	Conservation of technique and detailing	16.52	23.66	120.5	0.039*
	Space Plan	25.23	14.50	85.5	0.003**
	Conservation of the layout	25.75	13.95	75	0.001**
	Conservation of the relation with the exterior	23.43	16.39	121.5	0.042*
Subj. Norm	Site	23.0	16.84	130	0.088
	Conservation of the relation with climate	22.2	17.68	146	0.201
	Skin	15.93	24.29	108.5	0.021
	Conservation of the facade	15.60	24.63	102	0.007**
	Conservation of the roof	16.93	23.24	128.5	0.076
	Conservation of the materials	17.18	22.97	133.5	0.085
	Conservation of technique and detailing	15.73	24.50	104.5	0.010**
	Services	17.75	22.37	145	0.194
	Conservation of energy and heating system	17.60	22.53	142	0.150
	Conservation of ventilation system	17.58	22.55	141.5	0.147
	Space Plan	22.73	17.13	135.5	0.118
	Conservation of the layout	22.68	17.18	136.5	0.120

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TABLE 7.8 Significant differences at the building layer and indicator level

Construct	Layer. Indicator	T. mean rank	C. mean rank	U	Sig. (p)
PBC	Site	23.98	15.82	110.5	0.023*
	Conservation of the relation with climate	22.38	17.50	142.5	0.149
	Conservation of the relation with topography	23.38	16.45	122.5	0.044*
	Skin	17.75	22.37	145	0.204
	Conservation of the materials	16.68	23.50	123.5	0.045*
	Conservation of technique and detailing	17.40	22.74	138	0.123
	Conservation of building shape	17.70	22.42	144	0.172
	Services	16.85	23.32	127	0.071
	Conservation of energy and heating system	17.48	22.66	139.5	0.140
	Conservation of ventilation system	16.48	23.71	119.5	0.040*
	Space Plan	22.38	17.50	142.5	0.172
	Conservation of the layout	22.28	17.61	144.5	0.181
Intention	Site	23.18	16.66	126.5	0.071
	Conservation of the relation with climate	22.78	17.08	134.5	0.089
	Structure	18.38	21.71	157.5	0.346
	Conservation of the structural materials	17.48	22.66	139.5	0.127
	Skin	16.58	23.61	121.5	0.053
	Conservation of the facade	17.80	22.32	146	0.171
	Conservation of the materials	16.73	23.45	124.5	0.048*
	Services	17.98	22.13	149.5	0.246
	Conservation of the energy and heating system	17.63	22.50	142.5	0.163
	Space Plan	22.60	17.26	138	0.136
	Conservation of the layout	17.11	22.75	135	0.102
Behaviour	Skin	16.28	19.82	122	0.303
	Conservation of the facade	15.83	20.29	114	0.171
	Space Plan	18.92	17.03	136.5	0.578
	Conservation of the layout	13.32	22.42	73.5	0.004**

* *Correlation is significant at the 0.05 level (2-tailed).*
** *Correlation is significant at the 0.01 level (2-tailed).*

7.3.3 Measuring the intention-behaviour gap in the test and control groups

To further understand the differences identified through the Mann-Whitney tests, bivariate correlation analysis was performed to observe differences in the correlation between the psychological constructs in the test and control groups. This analysis supports the correlations predicted by the theoretical model (Icek Ajzen, 1985, 1991; Icek Ajzen & Fishbein, 2010; Sheeran, 2002; Sheeran & Webb, 2016; Webb & Sheeran, 2006), demonstrating the role of attitudes, subjective norms, and perceived behavioural control in shaping conservation intentions. However, while the theoretical model strongly supports the prediction of intention, the same does not happen with the prediction of behaviour, which is not statistically significant (see Table 7.9). Although in the scope of this research, conservation behaviours are not directly correlated with expressed intentions, the results show a positive correlation between attitudes and behaviours, both in the test ($p=0.039$) and in the control group ($p=0.069$).

TABLE 7.9 Pearson correlations among analysed psychological constructs

		Intention		Behaviour	
		Test	Control	Test	Control
Intention	Pearson Correlation (r)	1	1	0.370	0.332
	Sig. (2-tailed) (p)			0.130	0.193
	N	20	19	18	17
Behaviour	Pearson Correlation (r)	0.370	0.332	1	1
	Sig. (2-tailed) (p)	0.130	0.193		
	N	18	17	18	17
Attitudes	Pearson Correlation (r)	0.880**	0.653**	0.490*	0.451
	Sig. (2-tailed) (p)	0.000	0.002	0.039	0.069
	N	20	19	18	17
Subj. norms	Pearson Correlation (r)	0.825**	0.825**	0.576*	0.473
	Sig. (2-tailed) (p)	0.000	0.000	0.012	0.055
	N	20	19	18	17
PBC	Pearson Correlation (r)	0.554*	0.664**	0.381	0.088
	Sig. (2-tailed) (p)	0.011	0.002	0.119	0.736
	N	20	19	18	17

* *Correlation is significant at the 0.05 level (2-tailed).*
** *Correlation is significant at the 0.01 level (2-tailed).*

Some differences emerge between the two groups, namely regarding the strength of moderating beliefs in the formation of intentions. In the test group, attitudes have a stronger positive correlation with intentions ($r=0.880$, $p<0.001$) than in the control group ($r=0.653$, $p<0.001$), evidencing that an increase of positive attitudes increases positive intentions after implementing the passport. In the test group, subjective norms and perceived behavioural control present positive correlations with intentions too, but to a lesser degree than attitudes. In the control group, however, subjective norms ($r=0.825$, $p<0.001$) and perceived behavioural control ($r=0.664$, $p=0.002$) are stronger predictors of intention than attitudes ($r=0.639$, $p<0.001$). Interestingly, subjective norms present the same correlation with intentions in the test and the control groups, suggesting that tutors' expectations have an important moderation effect on personal evaluations.

Since no correlation was found between intentions and behaviours, the effect of applying the building passport was analysed by comparing the most determinant variables for conservation intentions through single linear regression. Table 7.10 presents the results of the single linear regressions, on which "B" stands for beta coefficient (the degree of change in the outcome variable for every unit of change in the predictor variable), "R2" refers to R-squared (goodness-of-fit measure for the model), and "Sig." refers to the statistical significance, through the probability value (p).

The results showed a significant relationship between the attitudes towards the "services" ($R2=0.294$;$p=0.013$) and the "space plan" ($R2=0.648$, $p<0.001$) and overall conservation intentions in the test group. Subjective norms also have a significant contribution in this group, moderating the conservation intentions in the layer "services" ($R2=0.582$; $p<0.001$). With an R2 value of 0.648, the attitudes towards the "space plan" have the most substantial effect on the overall expressed conservation intentions. In the opposite direction, the layer structure is the least significant in predicting the conservation intentions of the participants that used the building passport, followed by the layer "skin". This result suggests that general conservation intentions do not reflect the high attitudes towards structure and skin. However, they tend to be moderated by the lower valued layers, such as the services and the space plan.

Almost symmetrically, in the control group, the attitudes towards the layer "skin" have the most significant correlation with conservation intentions ($R2=0.511$; $p=0.001$), while the attitudes towards the "services" ($R2=0.000$; $p=0.955$) and the "space plan" ($R2=0.038$; $p=0.425$) have the lowest one.

TABLE 7.10 Single linear regression between independent variables and “conservation intention”

		Control			Test		
		B coefficient	Sig. (p)	R2	B coefficient	Sig. (p)	R2
Site	Attitudes	0.274*	0,030	0.247	0.273	0.075	0.166
	Subj. Norms	0.290*	0.037	0.231	0.449**	0.000	0.534
	PBC	0.324	0.120	0.136	0.063	0.671	0.010
Structure	Attitudes	0.245	0.126	0.132	0.069	0.773	0.005
	Subj. Norms	0.430**	0.002	0.447	0.192	0.246	0.074
	PBC	0.381**	0.003	0.405	-0.021	0.852	0.002
Skin	Attitudes	0.605**	0.001	0.511	0.299	0.116	0.132
	Subj. Norms	0.540**	0.000	0.680	0.229	0.165	0.104
	PBC	0.346*	0.024	0.264	0.281	0.058	0.185
Services	Attitudes	0.009	0.955	0.000	0.267*	0.013	0.294
	Subj. Norms	0.116	0.480	0.030	0.218	0.012	0.305
	PBC	-0.161	0.203	0.093	0.404**	0.000	0.582
Space Plan	Attitudes	0.151	0.425	0.038	0.376**	0.000	0.648
	Subj. Norms	0.088	0.464	0.032	0.308**	0.000	0.536
	PBC	0.382**	0.003	0.416	0.250*	0.034	0.226
Spirit of Place	Attitudes	0.377*	0.010	0.334	0.160	0.162	0.111
	Subj. Norms	0.455**	0.001	0.495	0.288*	0.024	0.265
	PBC	0.588**	0.004	0.395	0.288*	0.015	0.301

Considering the single linear regression results, multiple regression with backwards elimination was performed to find out the models that better explain the conservation intentions in the test and the control groups. The results, presented in Table 7.11, confirm that expressed intentions on the control group tend to be normative controlled. The model of intentions in the control group, explaining until 92,5% of the variance on intentions ($R2=0.925$), suggests that the most positive intentions towards conservation are found in the students with higher perceptions of social pressure towards the conservation of the site, the skin, the services and the spirit of place. It also suggests that highly positive attitudes towards the façade do not reflect overall positive conservation intentions.

In the test group, the results of the multiple regression suggest attitudinally controlled intentions (Table 7.11). In this case, stronger conservation intentions were found in students that report positive attitudes towards the services, space, and spirit, but, again, not necessarily towards the conservation of the façade. The norms towards the structure and towards the spirit of place present a negative correlation with intention, meaning that the higher the perception of social pressure to conserve, the lower the conservation intentions. At the same time, the attitudes towards the conservation of the spirit of place contributed significantly to the model (B=0.298, p<0.001), the attitudes towards the conservation of the skin did not (B=-0.095, p=0.094).

TABLE 7.11 Multiple regression models on "conservation intentions" and "conservation behaviours"

		Control		Test	
		B Intention	B Behaviour	B Intention	B Behaviour
Constant		**0.068**	**1.895**	**0.790**	**0.181**
Attitudes	Site	-	-	-	0.485
	Skin	-0.328	-	-0.095	0.270
	Structure	-	-	-	-
	Services	-	-0.215	0.130	-0.431
	Space	-	-	0.253	0.306
	Spirit of Place	-	0.254	0.298	0.384
Subj. Norms	Site	0.161	-	0.185	-
	Skin	0.341	-	-	-
	Structure	-	-	-0.191	0.719
	Services	0.158	-	-	0.292
	Space	-	0.388	0.193	-
	Spirit of Place	0.316	-	-0.212	-0.801
PBC	Site	-	-	-	-
	Skin	-	-	0.160	-
	Structure	0.244	-	0.102	-
	Services	-	-	-	-
	Space	-	-	-0.189	-
	Spirit of Place	-	-	-	-

The results show that both intentions and behaviours are strongly led by normative and attitudinal beliefs, with perceived behavioural control having a minor influence on conservation decisions in the case study. While intentions do not significantly correlate with reported behaviours, the Pearson correlation showed relevant correlations of behaviour with attitudes and subjective norms that were further investigated through multiple linear regression to identify the main differences between expressed intentions and reported behaviours. In the analysis of behaviour, attitudes overtake norms, in the control group, with a significant contribution of the attitudes towards the services (p=0.083) and the spirit of place (p=0.031). Together with the norms towards the conservation of the space (p<0.001), the model explains around 68% of the variance on behaviour (R2=0.675) in the control group (Table 7.11).

Regarding the conservation behaviours in the control group, the perception of the norms towards the space and the attitudes towards the spirit of the place highly influence positive conservation behaviours. Negative attitudes towards the services, on the contrary, do not translate into negative conservation behaviours.

In the test group, attitudes remain the most influential psychological construct to predict conservation behaviours. Attitudes towards the conservation of the layer services have a negative correlation with behaviour (B=-0.431, p=0.004), suggesting that even if participants show a negative attitude than can end up preserving this layer due to intervening factors; the fact that norms towards this layer have a significant positive correlation (B=0.292, p=0.010) with behaviour may help to explain this difference. Compared with the model explaining conservation intentions in the test group, attitudes towards the skin change to a positive correlation (B=0.270, p=0.052), while the norms towards the spirit have a significantly more negative influence on conservation behaviours (B=-0.801, p=0.006) than in conservation intentions.

The predictive model for conservation behaviour of the test group (R2=0.937) suggests that more positive conservation behaviours happen with students that have positive attitudes towards the conservation of site, space, and spirit, despite negative attitudes towards the conservation of the services (Table 7.11). However, the higher subjective norms towards the conservation of the spirit do not translate into general positive conservation behaviours. As suggested by the descriptive statistics, this may happen because of the moderation effect of the low perceived behavioural control.

7.3.4 Correlations between behaviour and the building passport

The regression analysis of intentions and behaviours suggests differences between the test and the control groups, with the models of the test group expressing more complex decision processes, with more factors affecting the reported conservation behaviours. To analyse the causal effect of the passport and the differences found between the test and control groups (Table 7.10), single linear regression was applied for each indicator of the building passport. The indicators for which significant relationships were found are presented in Figure 7.2, including the average sustainability assessment from the test group, the directionality of the relation (positive or negative), and if there were significant differences with the control group in the Mann-Whitney test.

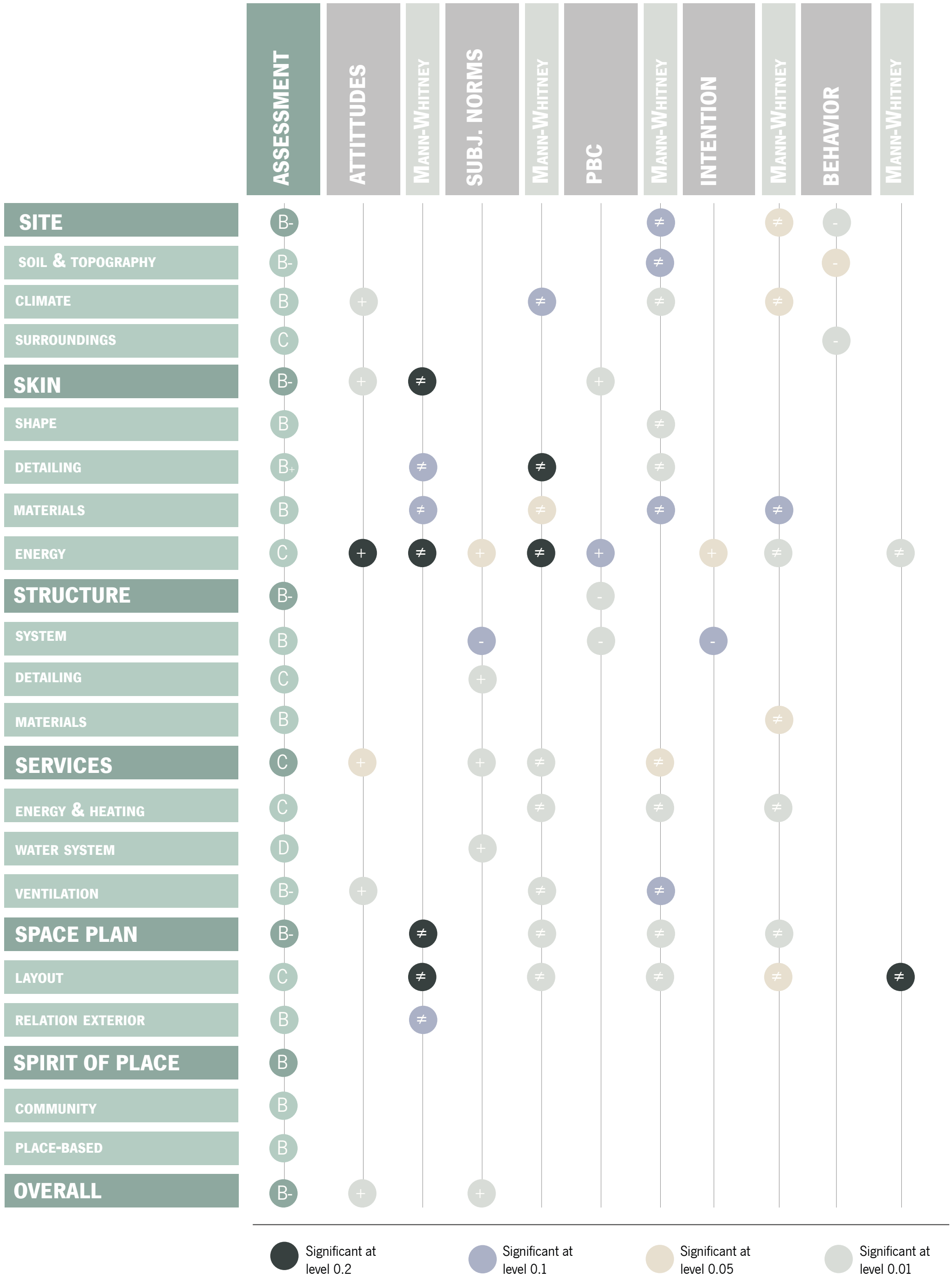

FIG. 7.2 Correlations between the building passport assessment of the test group and behaviour

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The results show significant correlations, mainly between the passport and the attitudes (22% of the indicators) and subjective norms (25%). Also, perceived behavioural control (17%), intentions and behaviours (both 14% of the indicators) seem to be affected by the building passport, but to a lesser extend. While some relations are positive – with positive assessments increasing the likelihood of positive conservation behaviours, some relations are negative, suggesting that despite negative assessments, participants can still engage in positive conservation behaviours and vice-versa.

In general, attitudes present a positive correlation with the passport. Interestingly, these correlations emerge dominantly in indicators with lower assessment ratings (C, D, or B-), such as “sufficient thermal insulation”, “windows avoid thermal losses”, or “presence of energy autonomy strategies”. This suggests that the passport has a role in reinforcing pre-existing negative beliefs about specific building attributes. Significant correlations, however, also emerge in the most positive indicators, rated with A, such as “presence of transitional spaces” or structures that are “simple to build and maintain”.

Also, the correlation with subjective norms is mostly positive, with higher sustainability assessment relating to higher perceptions of social pressure to conserve the building. However, as happened with the attitudes, this correlation emerges more clearly when assessments are low (C, D), indicating that the building passport might justify decisions not to conserve the services and the envelope attributes related to energy needs (such as openings, façade and roof).

In analysing the perceived behavioural control, an essential number of negative correlations emerge in the layer “structure”. This result suggests that despite the positive contributions for sustainability (ratings A and B), participants do not perceive behavioural control over the conservation of this layer, influencing their intention to preserve it. Together with the negative correlations found between the sustainability assessment and attitudes and subjective norms in this layer, the model explains the negative correlation between the intention to conserve the structure and the positive assessments in the building passport.

The assessment of the indicator “positive impact on biodiversity” affects attitudes, subjective norms, and intentions towards the site’s conservation. The assessment on the indicator “energy needs”, in the skin layer, and on the indicators related with water and energy and heating, in the layer services, consistently affect attitudes, norms, perception of control and intentions, shaping results significantly different from the control group, according to the Mann-Whitney test. The fact that the Mann-Whitney tests show significant differences in indicators on which no direct correlation with the passport was found suggests an indirect multi-effect of the sustainability assessment: for instance, while the assessment of the “relation of the building with climate” affects attitudes towards the conservation of this attribute, the most significant differences between the test and the control group emerge on the subjective norms and intentions. Thus, a possible interpretation is that the sustainability assessment may indirectly affect participants’ perceptions of norms and expressed intentions.

7.3.5 Reasons for the intention-behaviour gap

When asked to rank the values that may affect their intentions to conserve building attributes, the participants in the test group (that used the building passport) identify historic and aesthetic values within the same level of importance, followed by the age of the attribute. When dealing with the conservation of the building’s skin, aesthetical values have priority. Still, historic values have more relevance in decisions related to the spirit of the place and the relation with the site. The economic value is considered a priority when dealing with the conservation of the services. Ecological values appear in the middle of the ranking (4 out of 7) and never reach the top 3 criteria affecting decisions in the different building layers, as shown in Table 7.12.

TABLE 7.12 Ranking of the values affecting the conservation of the building layers

	Site	Skin	Structure	Services	Space	Spirit of Place	Overall
Aesthetic	2	1	1	3	2	4	1*
Historical	1	2	2	5	1	2	1*
Age	3	3	3	4	4	3	2
Social	4	5	6	7	3	1	3
Ecological	5	4	5	2	6	5	4
Economic	6	6	4	1	5	6	5
Scientific	7	7	7	6	7	7	6
Political	8	8	8	8	8	8	7
*ex-aequo							

The analysis of the reasons pointed out by respondents for the gap between expressed intentions and self-reported behaviours towards conservation of building elements does evidence some differences and commonalities in the respondents that previously used the building passport from the ones who did not. In both groups, the new program requirements are pointed out as the main reason impeding conservation (35% in the control group and 44% in the test group), followed by decisions related to design concepts (25% in the control group and 22% in the test group). Some respondents point out the existing elements as obsolete and restrictive to the new design and spatial quality. Sustainability issues related to energy demands, insulation and comfort, are identified by 15% of respondents of the control group as reasons not to conserve built heritage attributes. Still, only 5% of respondents in the test group specify this reason.

7.4 Discussion

7.4.1 Contributions to increase sustainable conservation

By allowing the identification of the least sustainable layers, the building passport supports users in decisions on which attributes to conserve and which attributes are less valuable from a sustainability perspective. As such, the building passport does not necessarily contribute to higher overall conservation rates but to more targeted and informed decisions. According to respondents' attitudes, the layer services, pointed out in the building passport as the least sustainable, also appear as the least valuable. After applying for the building passport, the test group reports higher perceived behavioural control over the conservation of the services, and higher intention and behaviours than the control group, but the combination of low value and low contribution to sustainability, makes this layer the least conserved. This suggests a positive contribution of the building passport in the identification of opportunities to redesign. The layer spirit was assessed in the building passport as having a positive contribution to sustainability that should be conserved. After applying for the passport, the test group shows, in general, more positive conservation intentions and higher conservation behaviours than the control group (tables 5-8). Nevertheless, confirming the results of previous studies (Joana Gonçalves et al., in press), the spirit of the place presents the lower levels of perceived behavioural control that need to be tackled to ensure the effective conservation of this attribute.

The Mann-Whitney analysis allowed to identify with further detail for which building attributes significant differences emerge due to the application of the building passport. As suggested by the descriptive statistics, significant differences emerge in the layer skin and the layer space plan and layer services and site. The test group shows more positive attitudes, higher subjective norms, and more positive intentions towards conserving the skin materials and detailing. The same indicators were highlighted as more sustainable in the Skin layer of the building passport. As already happened in previous studies (Joana Gonçalves et al., in press), the layer skin is considered one of the most important ones in building conservation. It consistently presents positive attitudes towards its conservation, translating into positive intentions and positive behaviours. However, the results show that the overall conservation intentions do not reflect extreme peaks and tend to be moderated by other factors. In essence, a respondent with consistent lower average attitudes is more likely to engage in more positive conservation behaviours than a respondent with particular extremely high attitudes towards a specific building attribute.

While in the building passport, the “relation with the exterior” in the layer space plan is clearly assessed as positive, the same does not happen with the indicator “layout”, with a lower result in the assessment. That may explain why the control group presents significantly more positive attitudes towards the conservation of the space plan and reports significantly more positive conservation behaviours of the layout, with subjective norms having a significant role in the conservation decision. These differences found in the layer space plan, in particular, of the indicator layout, point out some risks of relying exclusively on a sustainability assessment tool to inform conservation decisions. The fact of the positive correlations of subjective norms with the passport showing a predominant correlation with the most negative assessments strengthens the hypothesis that users of the building passport may feel less social pressure to preserve the less sustainable attributes and rely on this tool as a justification to destroy them, disregarding other possible values (aesthetical, historical, or others). Complementary tools that allow to analyse the state of conservation (de Brito, Pereira, Silvestre, & Flores-Colen, 2020; Joana Gonçalves, Mateus, & Silvestre, 2018; van Hees & Naldini, 2020) and assess cultural significance (Havinga et al., 2019; Pereira-Roders, 2004) must be used to ensure a holistic understanding of the building.

The results show the validity of the theoretical model, the Theory of Planned Behaviour (Icek Ajzen, 1985, 1991, 2002; Icek Ajzen & Fisbbein, 1974; Sheeran, 2002; Sheeran & Webb, 2016), to “gain insight into the important considerations that guide people’s decisions and actions“ (Icek Ajzen & Fishbein, 2010) in the context of built heritage conservation. Strong correlations emerge between attitudes, subjective norms, perceived behavioural control and intentions in both the test and control groups. Attitudes also appear as strongly correlated with behaviours, as already suggested by Gonçalves et al. (Joana Gonçalves et al., in press): attitudes matter for heritage conservation. While intentions in the test group are dominantly motivated by attitudes, in the control group, they are normatively controlled, influenced by perceptions of social pressure by tutors and peers. This suggests that the building passport can contribute to identifying opportunities for the redesign. Previous studies in the field of psychology (Sheeran, 2002) determined that attitudinally intentions have a greater likelihood of performance than normatively controlled intentions since they are self-chosen and not externally imposed. In the present research, the results suggest a positive contribution of the building passport to reinforce attitudes and personal motivations, raising confidence towards the conservation of building attributes and strengthening the intention-behaviour relationship.

As already identified in previous studies addressing designers' decision behaviours (Lee et al., 2013; Li et al., 2015), subjective norms have a limited role as a predictor of behaviour, highlighting the importance of internal motivations over external pressure. However, while the results of Lee et al.(Lee et al., 2013) and Li et al. (Li et al., 2015) with practitioners identify PBC as the stronger predictor of behaviour, the current results demonstrate that with design students PBC has a negligible role. On one hand, this confirms the premise of this study — in an educational context students have less constraints and more autonomy in design decisions; on the other hand, it evidences the importance of applying this methodology with design practitioners, to verify the influence of other factors such as cooperation with stakeholders, costs, time, or opportunity (Joana Gonçalves, Mateus, & Silvestre, 2019a) , in the final design decisions.

This research targeted a primary belief found among students (Joana Gonçalves et al., in press)and practitioners (Ashley et al., 2014; Joana Gonçalves et al., 2019b; Perovic et al., 2016; Roy & Kalidindi, 2017) that heritage buildings cannot be thoroughly conserved because they are not sustainable. The results show that by being exposed to new information and by being actively engaged in the persuasion process, through the sustainability assessment, participants show different attitudes, intentions and behaviours towards certain building attributes compared to the respondents in the control group. However, the changes seem to be insufficient to produce a significant change in the total belief indices and, above all, in the self-reported behaviours. While in earlier research, a correlation was found between intention and behaviour (Joana Gonçalves et al., in press), in the current study, the lack of statistically significant correlations makes direct comparisons unviable to determine the influence of the building passport in the increase of implementation of intentions. Three reasons may contribute to explain these results: the quality and stability of intentions, as defined by Sheeran; the primary beliefs targeted, according to Fishbein & Sheeran (Icek Ajzen & Fishbein, 2010); and the stage of behavioural change, according to Prochascka et al.(Prochaska & DiClemente, 1983).

According to Sheeran & Webb (Sheeran & Webb, 2016), directionality and intensity are not enough to measure behavioural intentions since they also differ in their quality. Among the factors affecting intentions implementation, Sheeran (Sheeran, 2002; Sheeran & Webb, 2016) identifies temporal stability, certainty, and accessibility. These aspects are related to how confident the respondents are in the expressed intention and how likely is it to change over time, either because it was forgotten or because new information changed the original decision. The fact that some participants in the study point out “changes of mind” (section 4.4) as a primary reason to not have behaved as intended suggests that the expressed intentions were not stable enough to ensure correlations with the self-reported behaviours, also motivated by a particularly unstable context, during the Covid19 pandemic. Considering the properties of intentions defined by Sheeran & Webb (Sheeran & Webb, 2016), the building passport might also be used as a monitoring tool, ensuring that users develop their design process without losing track of their previous sustainability assessment and expressed intentions.

According to Fishbein & Ajzen (Icek Ajzen & Fishbein, 2010), for an intervention to be successful in changing intentions, it must target primary beliefs: “the beliefs that provide the foundation for the behaviour of interest”. While building sustainability is often pointed out as one reason not to conserve certain building attributes, this is not the only belief hindering heritage conservation and might not be the most important one. Aesthetic reasons, related to the limitations to creativity and innovation imposed by the necessity of dealing with preexisting attributes and the adaptation to program requirements, are more often pointed out by participants, both in the test and in the control group. This may explain why, despite some differences between the test and the control group regarding attitudes, subjective norms, and intentions, no significant changes were found in the overall self-reported behaviours. Using the TPB, other mechanisms can be tested targeting different beliefs of designers involved in heritage conservation processes.

The transtheoretical model of change of Prochaska et al. (Prochaska & DiClemente, 1983) suggests that behavioural change involves a sequence of five different stages, from no intention to perform a behaviour to a consistent behavioural performance. This model demonstrates that “behaviour change is not an all-or-none phenomenon” (Icek Ajzen & Fishbein, 2010) since it involves a series of stages and different strategies to move people from one stage to another. Thus, while the building passport seems to be an effective tool to introduce new beliefs regarding built heritage sustainability, contributing to more positive intentions, further steps must be taken to support designers to act on their intentions.

7.4.2 Limitations and future research

This paper presents the results of a pilot study applying the theory of planned behaviour to heritage conservation and, in specific, to analyse design decision behaviours. This is a recent innovative field, not previously explored (Joana Gonçalves et al., 2020). Because of its novelty, this study is not exempt from limitations that should be further explored in future research. Firstly, a small sample was used due to the Covid19 limitations, with only 20 participants in both the control and the test groups. This aspect may limit the accuracy of the results and, as they showed, restrict the possibilities of finding statistically significant results. Future research shall validate these results by extending the sample population and exploring the relations between the variables affecting conservation behaviours with more accuracy. Secondly, the sample population is limited to architecture master students and does not fully represent the reality of professional practice. While this was a deliberate decision in the study design to isolate internal factors affecting decision-making (Joana Gonçalves et al., in press), it is essential to explore further how actual behavioural control, affected by real conditions, legislation, and interaction with other stakeholders, affects the correlation between intentions and behaviours towards sustainable conservation. With this purpose, the distribution and application of the questionnaire among professional organisations in the heritage conservation field may elicit how the behaviour of different stakeholders is related to intentions, and affected by perceived behavioural control, subjective norms, and attitudes.

7.5 Conclusions

This paper aimed to investigate the effect of a building passport for sustainable conservation in designers' intentions and behaviours towards built heritage conservation. The TPB use allowed to verify the efficacy of an intervention targeting the belief of designers that "compatibility with sustainability" is a barrier to built heritage conservation. The use of the BPSC influences beliefs towards certain building attributes, but current results do not substantiate significant changes in the overall conservation behaviours. By evidencing which building attributes have a lower contribution to sustainability, the BPSC allows establishing intervention priorities. Thus conservation behaviours are not necessarily more positive, even if more informed and targeted. Nevertheless, evidence suggests that this tool positively contributes to reinforcing existing attitudinal beliefs and confirms that attitudes matter for sustainable heritage conservation. This paper also allowed identifying aspects that may be improved in future research since behavioural change towards sustainable conservation happens one step at a time.

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8 Conclusions

8.1 Introduction

This research provided insights into the behaviours of designers towards the conservation of built heritage and proved that attitudes play an essential role in decision-making. Using a human-centred approach (IDEO.org, 2015), focused on practitioners, the results demonstrate that design decisions result from conscious and unconscious mechanisms, some of them socially driven and others motivated by individual choices (Ajzen & Fishbein, 2010).

By applying methods typically used in psychology to gather both qualitative and quantitative data from designers involved in built heritage conservation processes, it was possible to elicit common beliefs of practitioners regarding the conservation of built heritage and identify challenges and opportunities in the processes (Gonçalves, Mateus, & Silvestre, 2019). The questionnaire allowed collecting data regarding the role of attitudes, perceived behavioural control, subjective norms, and intentions on actual conservation behaviours (Gonçalves, Mateus, Silvestre, Roders, & Bragança, in press).

The following paragraphs provide the answers to the key questions of this research. After, there is a reflection on the implications of this work and its societal and scientific relevance. Finally, the limitations of this research are discussed, and recommendations for future research are presented.

8.2 Answers to the research questions

- How did the concepts of heritage and sustainability evolve over time?
- What is built heritage?
- What is sustainable conservation?

The first challenge of this research was to define the main concepts: heritage and sustainability, both commonly used with a very broad spectrum (Gonçalves, Mateus, Silvestre, & Pereira Roders, 2021). The analysis of the evolution of the concept of “Heritage” since the Athens Charter (CATHM, 1931) evidences a gradual extension of its limits from single architectural monuments to an integrative urban ecosystem(UNESCO, 2011). In the scope of this research, heritage is defined as:

“The resources inherited from the past that communities wish to pass on to future generations. It is an ecosystem that includes tangible and intangible dimensions resulting from the interaction between nature, fabric, and people through time.”(Gonçalves, Mateus, Silvestre, et al., 2021)

The concept of sustainability also evolved over time, from a focus on the ecological dimension of the environment, to include “all the resources providing for a better quality of life” (Brundtland, Khalid, Agnelli, Al-Athel, & Chidzero, 1987). In this research, the concept of sustainability is based on the well-known definition from the Brundtland Report (Brundtland et al., 1987), in combination with the standardised definition of the ISO 15392 (ISO, 2008):

“state of equilibrium in which the components of the ecosystem - comprised by nature, humans and built environment, and its functions are maintained for present and future generations.” (Gonçalves, Mateus, Silvestre, et al., 2021)

Considering the evolution of the concepts of “Heritage conservation” and “Sustainable environment” over time, this research demonstrated these concepts share a common scope – the ecosystem inherited from the past -, and a common goal – the safeguarding of those resources for future generations. Sustainable conservation was thus defined as:

“the processes of management of change of the ecosystem inherited from the past, so its resources can benefit present generations while retaining its value for future generations.” (Gonçalves, Mateus, Silvestre, et al., 2021)

Recognising the growing importance of heritage for sustainable development, this definition emphasises the increasing importance of value assessment to recognise the values of the resources inherited from the past and their contribution to a more sustainable future.

- How can the techniques of behavioural sciences support the identification of the main factors hindering the implementation of sustainable conservation practices in built heritage?
- How has the theory of planned behaviour (TPB) been used to promote behavioural change amongst practitioners in the field of sustainable conservation?

Behavioural approaches in the heritage field are still a recent topic. A systematic literature review crossing the essential concepts behaviour, heritage, and sustainability, screened more than 500 publications and allowed to understand that "behaviour" is commonly used to refer to the buildings' performance (either structural or energetic behaviour) or spatial behaviours of users (mapping movement of tourists in museums or heritage cities, for instance) (Gonçalves, Mateus, Silvestre, & Roders, 2020).

As a psychological construct, concerning heritage and sustainability, behaviour is more often approached in the tourism and hospitality field. For example, studies have been used to understand better the perceptions, motivations, and intentions of tourists to visit or revisit heritage destinations, engage in pro-environmental and pro-heritage behaviours, and analyse communities' engagement in heritage conservation. However, no studies were found investigating the behaviours of practitioners. Still, the literature addressing other stakeholders involved in heritage management processes—such as tourists and residents—proves the potential of this approach for a better understanding of behaviours of the different stakeholders and to find solutions for sustainable transitions. In particular, the theory of planned behaviour (Ajzen, 1991; Ajzen & Fisbbein, 1974; Ajzen & Fishbein, 2010), continuously developed and updated since the late 70s, has been used to understand the relations between intentions and behaviours and to test the effectiveness of mechanisms to achieve behavioural change.

According to the Theory of Planned Behaviour (Ajzen & Fishbein, 2010) intentions are influenced by three considerations: 1) beliefs about consequences of an action, determining favourable or unfavourable personal evaluations (attitude); 2) beliefs about normative expectations, resulting from external social pressures (subjective norm); and 3) beliefs about factors that may hinder performance, or the perceived behavioural control (PBC). Although these aspects may impact the actual performance of intentions, attitudes and subjective norms, they tend to be moderated by perceived behavioural control since, as stated by Sheeran (Sheeran, 2002)“participants do not generally intend to perform behaviours they perceive to be outside their control. Knowledge, ability, resources, availability, opportunity, and cooperation are the main factors affecting actual and perceived control (Sheeran, 2002).

Considering this theoretical framework, the first goal of this research was to further understand the reasons for the gap between intentions and implementation in the sustainable conservation of built heritage, from practitioners’ perspective.

- What are the main problems that practitioners experience in built heritage conservation processes?
- What are the main opportunities they recognize in the processes?

The first step towards the defined goal was to identify modal accessible beliefs — the most common beliefs held by the target population. A participatory methodology was used, with surveys and a focus group with practitioners (architects, engineers, craftsmanship) involved in built heritage conservation (Gonçalves et al., 2019). The results show a positive attitude towards heritage conservation: practitioners feel positive about giving continuity to an inherited heritage and recognise the potential to reduce environmental impacts, by avoiding waste of resources. However, they also perceive low control over final decisions. The main challenges identified by practitioners in conservation processes are related to the availability of information, economic constraints, interaction with other stakeholders, limited time, and limited qualification.

This first step of the research allowed to demonstrate the validity of the chosen theoretical framework, since the main challenges identified by practitioners match the factors affecting the perception of behavioural control as described by Sheeran (Sheeran, 2002), with knowledge, skill, resources, availability, and cooperation on the top of the list. Factors affecting the perception of control may be internal or external. The survey results and the focus group show a tendency to an external locus of control, meaning that the responsibility of failure in the implementation is often attributed to other stakeholders in the process (the client, the engineer, the constructor, the policies, etc.).

- Which psychological constructs are hindering the implementation of sustainable conservation approaches in practice?
- Is there a gap between intention and implementation in a controlled environment with high perceived behavioural control?

Considering these results and that theoretical background, this research narrowed down the population of analysis to architecture students. The hypothesis was that in a context with more creative freedom, less obligation of complying with regulations and standards, and reduced interaction with multiple stakeholders, the gap between intentions and behaviour in heritage conservation should tend to zero. If not, such a study would provide information about the influence of internal factors (such as attitudes, knowledge, and skill) on implementing sustainable conservation intentions.

With this purpose, an intention-behaviour survey was applied with the students working with the American Embassy and Huys te Warmond projects (Gonçalves, Mateus, Silvestre, Roders, & Braganca, in press). A total of 40 students participated in the study, answering questions about the conservation of building attributes defined according to the seven layers of Kuipers & de Jonge (De Jonge & Kuipers, 2017). The questionnaire included four groups of questions: attitudes (I consider it to be valuable or not), subjective norms (it is expected of me), perception of control (it is easy for me) and intention (I intend to). Later on, students self-assessed their conservation action in their design projects (I decided to).

Contrary to practitioners' perceptions in the survey and focus group, the results with the students show very high levels of perceived behavioural control that do not correlate with self-reported behaviours (Gonçalves, Mateus, Silvestre, Roders, & Braganca, in press). Despite that, there is still no perfect fit between intention and behaviour, with a correlation coefficient around 0.3 instead of 1. Results also show that attitudes matter for built heritage conservation. Attitudes have a stronger correlation to behaviour than intentions, suggesting that expressed intentions are mediated by a social desirability bias (what is expected of me). Still, actual actions are motivated by personal beliefs rather than external pressures. In practice, this suggests that policies, norms, and buildings codes for conservation, even if necessary, may not be sufficient to ensure the implementation of sustainable conservation practices. Whereas the results with practitioners tend to evidence an external locus of control (Gonçalves et al., 2019), students point more often to self-chosen and autonomous decisions derived from personal beliefs such as the design concept. Innovation and sustainability are frequently used as opposite and incompatible concepts to heritage conservation and identified by respondents as reasons behind the non-implementation of intentions.

The results of this step of the research that in built heritage conservation behaviours are deeply rooted in the personal set of values of the designer, and that behavioural change needs to target attitudes, strengthening existing positive beliefs and creating new beliefs about the contribution of heritage to sustainability, through education and persuasive communication. Thus, the second goal of this research was to develop a tool that contributes to increasing knowledge and raises awareness of the value of built heritage to sustainability.

- What are the common indicators in different sustainability assessment methods?
- What indicators to assess sustainability apply to existing heritage buildings?
- What are the indicators essential to cover the core aspects of sustainable development?

Numerous tools and methodologies were developed in recent years to support decision-making in sustainable conservation of built heritage. At the same time, BSA rating schemes also evolved to cover more topics related to the rehabilitation of existing buildings. However, a literature review shows that the existing BSA methods and rating schemes are insufficient for a baseline assessment of the contributions of a heritage building to sustainability: the key concept is the baseline since the aim is to assess the building as it is before the conservation intervention takes place and not to evaluate the sustainability of the intervention itself (Gonçalves, Mateus, Dinis Silvestre, Pereira Roders, & Vasconcelos, 2021). To develop this tool, two aspects were considered: a holistic coverage of indicators for sustainability assessment and the challenges pointed by practitioners to existing tools and methodologies.

The analysis of the literature and, in detail, of two different sustainability assessment methods shows that despite the differences in structure scope and aims, existing tools share common principles towards sustainable development: site, energy, water, building systems, materials, durability, indoor environment, and community, are common priorities, and share common indicators. Therefore, a set of core indicators was selected focusing on existing features of single buildings, identifiable at the building scale, and covering all the central aspects of sustainability according to the international standards. This was the steppingstone to operationalise a tool to assess the sustainability value of heritage buildings and support decision-making in the design stage.

- How can a core set of indicators for sustainability be integrated into a building passport to identify priorities and limits of acceptable change on built heritage conservation?
- How can the building passport target the challenges pointed out by practitioners in built heritage conservation processes?

The selected set of core indicators was then organised, based on the seven building layers (Brand, 1995; De Jonge & Kuipers, 2017), in a building passport that allows surveyors to assess the sustainability performance of each building attribute through a 5-point Likert scale. The overall assessment presents a transparent identification of the building attributes with higher and lower scores, allowing to identify opportunities and priorities for the intervention.

This tool seeks to tackle some of the challenges pointed out by practitioners that consider existing methodologies too complex, difficult to access, and very time-consuming. It was developed as an online and mobile devices friendly questionnaire, with a concise set of indicators, reducing the time and cost of the assessment process. The application to different case studies of modern heritage demonstrated that the core set of indicators used is adequate for heritage buildings, allowing to recognise contributions to sustainability beyond materiality and environmental performance. The building passport for sustainable conservation effectively contributes to support non-experts to achieve consensual sustainability assessments of heritage buildings. To verify its contribution for behavioural change towards a more sustainable conservation of built heritage, the third goal of this research was to measure how this tool affects the implementation rate of intentions in the design process.

– What is the effect of the building passport on designers' intentions and behaviours towards built heritage conservation?

The same method used to measure the intention-behaviour gap in the first phase was applied with the Priorij Emmaus design studio students (Gonçalves, Mateus, Silvestre, Pereira Roders, & Bragança, in press). However, students were divided into two groups: the test group implemented the building passport before answering the intention questionnaire, while the control group only answered the intention questionnaire. Mann-Whitney tests were used to compare the differences between the two groups. By being exposed to new information and actively engaging in the persuasion process, participants who used the building passport show different attitudes and intentions towards specific building attributes, such as skin, services, or space plan. The test group shows more positive attitudes and intentions towards conserving the materials and detailing in the layer skin, the two indicators considered more sustainable in this layer, in the sustainability assessment. On the other hand, the layer services, considered the least sustainable, is also the least conserved in both groups.

The changes found between the control and the test groups seem not to be sufficient to produce a significant difference in the overall self-reported conservation behaviour; the lack of statistically significant correlations between intention and behaviour makes considerations about the contribution of this tool to reduce the gap between intention and behaviour unviable. One of the reasons that explain this fact is the unstable context during the COVID 19 pandemic (Alderweireld et al., 2020) that profoundly changed the environment and circumstances between the first (Gonçalves, Mateus, Silvestre, Roders, & Braganca, in press) and the second wave of this study (Gonçalves, Mateus, Silvestre, Pereira Roders, et al., in press).

Nevertheless, after implementing the building passport, the test group reports higher perceived behavioural control over the preservation of this building layer, suggesting that despite not necessarily contributing to higher rates of overall conservation of the building, this tool allows for more targeted and informed decisions.

8.3 Answer to the main question

This research focused on understanding the reasons behind the gap between theory and practice, looking for answers to the question: How to achieve behavioural change towards a more sustainable conservation of built heritage?

During the research process, three sequential goals were defined:

1. First, to understand the reasons for the gap between intentions and implementation in the sustainable conservation of built heritage, from practitioners' perspective.
2. To develop a tool that contributes to increasing knowledge and raises awareness of the value of built heritage to sustainability
3. To verify the contribution of such a tool for behavioural change towards a more sustainable conservation of built heritage.

Perceived behavioural control factors (such as skill, cooperation, resources and knowledge) are pointed by practitioners as the main challenges in conservation processes. The lack of implementation of design intentions is often attributed to other stakeholders in the process, expressing an external locus of causality. However, the research with design students demonstrates deeper roots behind the gap between intentions and behaviours: attitudes matter for built heritage conservation. While regulations, standards policies, and social pressure play a role in fostering sustainable conservation practices of built heritage, internal motivators, such as attitudes, have a stronger correlation with actual behaviours. At the same time, not all attitudes are worth the same: consistent moderately positive attitudes towards the conservation of different building attributes correlate with the higher implementation of behavioural intentions than very high attitudes towards particular attributes such as the façade. This suggests that targeting other building attributes (such as materials, detailing, space plan), raising awareness of its value seems to be more effective to attain behavioural change towards more positive conservation behaviours.

The developed building passport guides the user through complex issues using simple qualitative parameters that reflect the visible reality, minimising the dependence on expert technical skills and, thus, the time and cost of the process. Furthermore, it allowed users to achieve a consensual sustainability assessment of the building, establishing priorities for intervention and limits of acceptable change. In the future, this tool may be used to monitor the consistency between the analysis and the design intervention, allowing that future (and past) interventions may be carried out in comparative terms.

The theoretical framework used in this research, the Theory of Planned Behaviour, allows for a transparent evaluation of the contribution of the developed tool for behavioural change towards more sustainable conservation. Even if the unexpected circumstances of the study do not allow for a definitive answer to the question "does this tool reduces the gap between intention and behaviour" the analysis of the results suggests a positive effect of the application of the building passport in participants' perception of control, attitudes, and intentions. The results also provide essential insights on how behaviour works and how it affects designers' decisions on built heritage conservation.

The results suggest that the achieved behavioural change is not enough to mitigate the gap between design intentions and its implementation. As indicated by the transtheoretical model of change (Grimley, Prochaska, Velicer, Blais, & DiClemente, 1994; Prochaska, Redding, & Evers, 2015), behavioural change is a series of stages, and further steps must be taken to support designers to act on their intentions.

The main research question starts with the word "How". And the main contribution of this research is thus methodological. It shows the potential of applying the theoretical model to built heritage to understand practitioners' decision-making processes better. It allows identifying the latent psychological factors affecting decision processes and may inform future policies and design tools since it will enable to measure their actual effect to attain behavioural changes for sustainable conservation.

8.4 Implications

Over the past decades, a substantial part of the heritage discourse developed in an ongoing dialogue between conservation and sustainable development. However, both concepts are still far from being consensual, making it difficult to consider them in well-founded decisions objectively. This research aimed at revealing how the relationship between these two concepts evolved over time to deepen our understanding about the contribution of heritage conservation for more sustainable development. This was done by systematizing a common terminology for sustainable conservation. The developed building passport can be used to set out an intervention framework by establishing opportunities for redesign and limits of acceptable change, based on a clearer understanding of the building contributions to sustainability. Such a tool contributes to increasing consensus towards the most relevant attributes and indicates priorities for intervention that can be clearly shared and communicated between the various stakeholders. It can, thus, contribute to overcoming some limitations faced by practitioners in implementing sustainable principles in conservation interventions.

This work is a first attempt in the built heritage field to analyse design decisions considering the underneath psychological factors. This first attempt took place using the theory of planned behaviour (TPB) to measure the dissonance between intentions and actual conservation behaviours. This research shows that using new techniques to explore the decision-making processes opens different perspectives and contributes to knowing the factors behind good intentions towards sustainable conservation. This research uses a human-centred design approach, drawing inspiration from practitioners' challenges and experiences to ideate and prototype a tool to inform decision-making that tackles their conscious needs and the psychological factors behind their conservation behaviours. This dissertation contributes to scientific knowledge by demonstrating that:

- the TPB can be used to analyse and understand psychological factors affecting design decisions;
- low perceived behavioural control affects practitioners' performance of sustainable conservation intentions;
- personal attitudes have an essential role in built heritage conservation;
- the TPB can be used to measure the contribution of different tools for behavioural change towards sustainable conservation.

Thus, this research has practical implications in supporting the redesign of heritage buildings, developing policies on sustainable conservation, and the research focusing the behavioural change for sustainability in the heritage field. The methodology applied in this thesis can be used to monitor behavioural change and accurately measure how effective are new tools, standards, and policies to achieve their behavioural aims. By acknowledging the role of personal attitudes on the actual implementation of conservation behaviours, policy-makers and educators may redirect their programs by switching from normative approaches centred in social pressure and reward towards approaches that target internal motivations of designers, through persuasive communication and exposure to experiences that change the accessibility of information (Petty & Brinol, 1997).

8.5 Limitations and Future Research

This thesis presents the results of a pilot study applying the theory of planned behaviour to the field of built heritage conservation and, in specific, to analyse practitioners' behaviours. The research focus is a recent innovative field not previously explored (Gonçalves et al., 2020). Because of its novelty, this study is not exempt from limitations that should be further explored in future research. Firstly, a small sample was used, with 63 participants in the first wave of the study (September 2019-February 2020) and 40 participants in the second wave of the study (May 2020-July 2020). This aspect may limit the accuracy of the results and limit the possibilities of finding statistically significant results. Future research shall validate these results by extending the sample population to explore further the relations between the variables affecting conservation behaviours. Secondly, the sample population is limited to architecture master students and does not fully represent the reality of professional practice. While this was a deliberate decision in the study design, to isolate internal factors (psychological aspects related with the designer) affecting decision-making (Gonçalves, Mateus, Silvestre, Roders, & Bragança, in press), it is essential to explore further how actual behavioural control, affected by real conditions, legislation, and interaction with other stakeholders, affects the correlation between intentions and behaviours towards sustainable conservation. With this purpose, the distribution and application of the questionnaire among professional organisations in the heritage conservation field may elicit how the behaviour of different stakeholders is related to intentions, and affected by perceived behavioural control, subjective norms, and attitudes. Thirdly, the research took place during the COVID 19 pandemic that profoundly changed the environment and circumstances between the first study (Gonçalves, Mateus, Silvestre, Roders, & Bragança, in press) and the second study. With the transition to online education, students' actual control was limited due to reduced access to the building and less contact with tutors and peers. This situation affected the comparability of the results of the post-test with the results obtained in the pre-test. The repetition of the study under normal conditions may uncover how the unique circumstances of a pandemic affect students' design decisions, allowing for a longitudinal comparison of the intention-behaviour relationship over different periods of time.

Despite the limitations, the results show the potential of applying the theoretical model to built heritage, to understand decision-making processes better, and shed light on an important question that persists in the field: why are best practices not more widely implemented (Appleton, 2003; Vandesande, 2017; Veldpaus et al., 2016)? Using the TPB allows identifying latent psychological factors affecting decision processes and may inform future policies and design tools. It also allows to measure the actual effect of newly developed strategies and verify their effectiveness to attain behavioural changes for sustainable conservation. Even when results show that an intervention was not effective, this methodology allows identifying the reasons for the failure and enhancing future improvements (Ajzen & Fishbein, 2010). The building passport proposed in this research is only one of many possibilities: inspection and diagnosis tools (de Brito, Pereira, Silvestre, & Flores-Colen, 2020; Gonçalves, Mateus, & Silvestre, 2018; van Hees & Naldini, 2020), value assessment (Ginzarly, Roders, & Teller, 2019; Silva, Ferreira, & Pinto, 2018; Spoormans & Roders, 2020), public participation (Bai, Azadi, Nourian, & Pereira Roders, 2020; Li, Krishnamurthy, Roders, & van Wesemael, 2020; Rosetti, Jacobs, & Roders, 2020), normative and policies (Janssen, Luiten, Renes, & Rouwendal, 2014; Janssen, Luiten, Renes, & Stegmeijer, 2017), can be addressed in future research using the TPB to identify which strategies work best, for whom, and in what circumstances (Gregory-Smith, Wells, Manika, & McElroy, 2017).

Current literature shows that, in other fields and with different stakeholders — such as tourists in heritage destinations (Kastenholz, Eusébio, & Carneiro, 2018; McKercher, Weber, & Du Cros, 2008) or occupants in buildings energy efficiency (Ben & Steemers, 2018; Ortiz & Bluyssen, 2018), clustering and targeting have been used to adjust interventions to different segments of the populations. While segmentation can be based on demographic characteristics, Ajzen & Fishbein (Ajzen & Fishbein, 2010) suggest that it may also be based on personality traits, values, and beliefs. This strategy allows to "make sure that the content is relevant for each segment of the population" (Ajzen & Fishbein, 2010), adjusting interventions for maximum effect. In built heritage conservation, this means that, in the future, the building passport can be adapted as an interactive framework that takes into consideration the beliefs more determinant for each user — sustainability, heritage values, condition and state of conservation, program requirements - to achieve a more effective behavioural change towards sustainable conservation.

Heritage is an interdisciplinary subject, involving multiple stakeholders with different values, needs, ambitions, and priorities. Understanding the social, affective, and cognitive mechanisms influencing value choices, with a multi-disciplinary approach, will allow to better understand real-world decision behaviours and thus help society achieve a more sustainable management of the inherited built environment, making the most out of existing resources, avoiding waste, and ensuring its continuity for future generations. In what refers to the main ambition of this research – going beyond good intentions for the sustainable conservation of built heritage – this thesis is a beginning.

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Appendices

Appendix A

Survey to architects: questionnaire (PT)

Reabilitação do Património Construído: Experiências, Desafios, Oportunidades

Mapear Experiências, Desafios e Oportunidades: reflexões colectivas acerca dos processos de intervenção no Património Construído

*Required

Âmbito do Estudo

Este inquérito é desenvolvido no contexto de um projecto de investigação a decorrer no Centro do Território, Ambiente e Construção (CTAC), da Universidade do Minho, no âmbito do Programa Doutoral EcoCoRe – Eco-construção e Reabilitação. Pretende-se mapear experiências e estimular a reflexão colectiva, acerca das motivações, desafios e interacções enfrentados pelos arquitectos na prática profissional ao longo dos processos de intervenção no Património Construído e, em particular, no património habitacional.
Assim, será possível estudar a relação dos arquitectos com as diferentes fases do processo, nas suas interacções com clientes, construtores, engenheiros e entidades reguladoras e compreender a diversidade de aproximações metodológicas ao património habitacional, frequentemente considerado de menor importância.
O resultado final permitirá uma visão mais clara dos problemas e obstáculos à aplicação das teorias de conservação e valorização do património encontrados na prática profissional.
A sua participação é fundamental. É voluntária e por isso pode desistir de preencher o questionário e dar a sua opinião assim que o desejar. É garantido o anonimato das respostas. No entanto, se pretender continuar a contribuir nas fases seguintes do processo de investigação, acerca das metodologias de projecto, compatibilização com a legislação e procedimentos em obra, por favor, indique o seu email de contacto.

Muito obrigada pela sua colaboração.

1. Sim, aceito ser contactado para o seguinte e-mail:

____

Dados demográficos

2. Qual a sua área profissional? *

Mark only one oval.

- ◯ Arquitectura
- ◯ Engenharia
- ◯ Construção Civil
- ◯ Arqueologia
- ◯ Other: _______________________

3. Quantos anos tem de experiência profissional? *

Mark only one o val.

- 1-5 anos
- 5-10 anos
- 10-20 anos
- mais de 20 anos

4. Quantas pessoas trabalham no gabinete?

Mark only one o val.

- 1-2 pessoas
- 3-10 pessoas
- mais de 10 pessoas

5. Qual o seu distrito de permanência? *

Mark only one o val.

- Não aplicável: resido no estrangeiro
- Aveiro
- Beja
- Braga
- Bragança
- Castelo Branco
- Coimbra
- Évora
- Faro
- Guarda
- Leiria
- Lisboa
- Portalegre
- Porto
- Santarém
- Setúbal
- Viana do Castelo
- Viseu
- Madeira
- Açores

6. Exerce actividade:

Tick all that apply.

- [ ] a nível local
- [ ] a nível nacional
- [ ] a nível internacional

7. Ao longo da sua experiência esteve ou está envolvido em projectos de reabilitação? *

Mark only one o val.

- Sim
- Não   Skip to question 27

8. Se respondeu "Não" à pergunta anterior, indique a razão:

Tick all that apply.

- [ ] Não estou interessado
- [ ] Não surgem oportunidades
- [ ] Não tenho formação específica nessa área
- [ ] Os projectos de reabilitação oferecem pouca rentabilidade
- [ ] O mercado de reabilitação está sobrelotado

Other: [ ] ____________________

Skip to question 27

Reabilitação na Prática Profissional

Nesta secção, refira a sua experiência na prática profissional direccionada para a intervenção no Património Construído.

9. Há quantos anos trabalha em projectos de Reabilitação? *

Mark only one o val.

- 1-5 anos
- 5-10 anos
- 10-20 anos
- Mais de 20 anos

10. Quais as tipologias com que tem trabalhado? (seleccione apenas uma resposta) *

Mark only one oval.

- ( ) Monumentos (arquitectura religiosa, militar ou civil de carácter público)
  Skip to question 27
- ( ) Habitação (urbana ou rural)
- ( ) Equipamento ou Serviços (arquitectura erudita ou industrial)
  Skip to question 27
- ( ) Espaço Público   Skip to question 27
- ( ) Habitação e outra(s)
- ( ) Várias das anteriores, mas não habitação   Skip to question 27
- ( ) Other: ______________________

11. Indique os 5 principais problemas que encontra na prática profissional: *

Tick all that apply.

- [ ] Incompatibilidade da legislação entre si
- [ ] A legislação existente impede a conservação das técnicas tradicionais
- [ ] Escassez de informação técnica acerca de soluções construtivas tradicionais
- [ ] Informação existente dispersa e pouco acessível
- [ ] Levantamento exaustivo consome demasiados recursos
- [ ] Não existem modelos 2D/3D/BIM que tornem os processos de representação mais rápidos
- [ ] Construtores desconhecem os procedimentos de intervenção
- [ ] Promotores apenas estão interessados no factor económico e desconsideram o valor patrimonial
- [ ] A formação dos técnicos é insuficiente para aplicar as técnicas tradicionais
- [ ] Conservar é demasiado caro comparativamente às soluções industrializadas
- [ ] Os imprevistos em obra tornam preferível a demolição e reconstrução
- [ ] As técnicas tradicionais geram problemas e desconforto

Other: [ ] ______________________

12. De 1 a 10, indique como se sente quando envolvido em processos de reabilitação de Património Habitacional:

Mark only one oval.

	1	2	3	4	5	6	7	8	9	10	
Frustração	⬭	⬭	⬭	⬭	⬭	⬭	⬭	⬭	⬭	⬭	Entusiasmo

Levantamento

Considere agora apenas a sua experiência em projectos de reabilitação de edifícios antigos de habitação.

13. Que métodos utiliza no levantamento do edifício? *

Tick all that apply.

- [ ] Levantamento Topográfico
- [ ] Fotogrametria
- [ ] Laser Scanner
- [ ] Levantamento Métrico Directo (fita métrica)
- [ ] Desenho à mão livre
- [ ] Levantamento Fotográfico

Other: [ ] ______________________

14. Que aspectos considera usualmente na caracterização histórica do edifício

Tick all that apply.

- [ ] Estilo arquitectónico (p.ex. "Barroco" ou "Neo-clássico")
- [ ] Tipo-morfologia (p.ex. "Casa-pátio" ou "Casa Burguesa")
- [ ] Período de construção (p.ex. "1850" ou "século XVI")
- [ ] Cronologia de Intervenções
- [ ] Bibliografia ou Fontes Documentais Relevantes
- [ ] Caracterização Construtiva
- [ ] Acontecimentos Históricos
- [ ] Todas as anteriores
- [ ] Não faço caracterização histórica de edifícios de habitação

Other: [ ] ______________________

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15. Costuma realizar a inspecção do estado de conservação do edifício? *

Mark only one o val.

- Sim
- Não Skip to question 27
- Ocasionalmente

16. Se respondeu "Não" ou "Ocasionalmente" à pergunta anterior, indique as razões:

Tick all that apply.

- Não considero necessário em edifícios de habitação
- Prazos muito condicionados
- Disponibilidade financeira limitada
- Desconhecimento técnico dos procedimentos de inspecção
- Os procedimentos são demasiado complexos
- Não é necessário para intervenções contemporâneas, com novas soluções técnicas

Other:

Inspecção e Diagnóstico

Considere agora a sua experiência na Inspecção do Estado de Conservação dos Edifícios Antigos de Habitação.

17. Quem realiza habitualmente a inspecção do Estado de Conservação do edifício?

Tick all that apply.

- Arquitecto
- Engenheiro
- Arqueólogo
- Todos os intervenientes

Other:

18. A inspecção é, usualmente: *

Tick all that apply.

- [ ] Visual
- [ ] Registada fotográficamente
- [ ] Registada em formulários próprios
- [ ] Utilizando métodos não destrutivos (resistógrafo, pylodin, ultra-sons...)
- [ ] Utilizando métodos destrutivos (carotagens, ensaios laboratoriais...)

Other: [ ] ____________________

19. Aproximadamente, quanto tempo dedica em média ao processo de inspecção? *

Mark only one oval.

- ( ) 1 dia
- ( ) 3 dias
- ( ) 1 semana
- ( ) Mais do que 1 semana

20. Quantas pessoas estão envolvidas neste trabalho?

Mark only one oval.

- ( ) 1 pessoa
- ( ) 2-3 pessoas
- ( ) Mais do que 3 pessoas

21. Indique, no máximo, 3 problemas que encontra mais frequentemente neste processo: *

Tick all that apply.

- [ ] Os procedimentos consomem demasiado tempo
- [ ] Os procedimentos são demasiado caros
- [ ] Conhecimentos limitados para a interpretação dos resultados
- [ ] Escassa informação técnica de apoio à análise dos resultados
- [ ] Informação técnica de apoio à análise dos resultados dispersa e de consulta complexa
- [ ] Os resultados do diagnóstico não têm consequência directa no projecto

Other: [ ] ______________________

22. Indique os métodos de Inspecção do Estado de Conservação de Edifícios de Habitação desenvolvidos pelo LNEC que já utilizou:

Tick all that apply.

- [ ] Metodologia de Certificação das Condições de Habitabilidade
- [ ] Método de Avaliação do Estado de Conservação dos Imóveis
- [ ] Método de Avaliação das Necessidades de Reabilitação dos Edifícios
- [ ] Conheço, mas nunca utilizei
- [ ] Não conheço estes métodos

23. Que recursos de análise utiliza para a interpretação do diagnóstico de anomalias do edifício? *

Tick all that apply.

- [ ] Reabilitação de Edifícios Antigos - Patologias e Tecnologias de Intervenção, João Appleton (2003)
- [ ] Inspecções e Ensaios na Reabilitação de Edifícios, Vítor Cóias (2009)
- [ ] Reabilitação Estrutural de Edifícios Antigos, Vítor Cóias (2007)
- [ ] Trabalhos académicos (dissertações, teses, relatórios,..) disponíveis em repositórios online
- [ ] Materiais De Construção. Patologia, Reabilitação E Prevenção, Luca Bertolini (2004)
- [ ] Glossário ilustrado das formas de deterioração da pedra, ICOMOS (2008)
- [ ] Não conheço estas referências

Other: [ ] ______________________

24. Indique, no máximo, 5 mais-valias que encontra nos recursos que utiliza: *

Tick all that apply.

- [ ] Efectividade: consigo encontrar o que preciso
- [ ] Eficiência: encontro rapidamente o que procuro
- [ ] Satisfação: o processo de consulta é apelativo e agradável
- [ ] Sistematização: reúne toda a informação necessária num único lugar
- [ ] Clareza: informação explícita e com linguagem acessível para o reconhecimento dos problemas
- [ ] Completude: informação completa acerca de possíveis causas, assim como procedimentos de reparação e intervenção
- [ ] Consistência: Recomendação dos procedimentos adequados e de acordo com as boas práticas
- [ ] Flexibilidade: conteúdos adequados a diferentes contextos geográficos, socioeconómicos e culturais
- [ ] Disponibilidade: a informação é facilmente acessível em qualquer circunstância

Other: [ ] ______________________

25. Indique, no máximo, 5 limitações que encontra nos recursos que utiliza habitualmente: *

Tick all that apply.

- [ ] Efectividade: não encontro a informação de que preciso
- [ ] Eficiência: a pesquisa é demasiado demorada
- [ ] Satisfação: o processo de consulta é complexo e custoso
- [ ] Sistematização: a informação está dispersa e preciso de consultar várias fontes
- [ ] Clareza: a informação não é clara e/ou a linguagem é demasiado técnica
- [ ] Completude: informação incompleta
- [ ] Consistência: a informação não é adequada à realidade da prática profissional
- [ ] Flexibilidade: conteúdos orientados para contextos locais muito específicos e pouco generalizáveis
- [ ] Disponibilidade: o formato não me permite aceder à informação quando e onde preciso

Other: [ ] ______________________

26. De 1 a 10, indique como se sente quando envolvido em processos de inspecção e diagnóstico de Património habitacional:

Mark only one oval.

	1	2	3	4	5	6	7	8	9	10	
Hesitante	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	Confiante

Obrigado por ter respondido a este inquérito!

Lembramos que se pretender continuar a contribuir nas fases seguintes pode indicar-nos o seu email de contacto.

27. Sim, aceito ser contactado para o seguinte e-mail:

28. Deixar opinião:

Appendix B

Survey to architects: challenges to inspection and diagnosis in historical residential buildings

First published as: Gonçalves J., Mateus R., Silvestre J. D., Vasconcelos G. (2017) Survey to architects: challenges to inspection and diagnosis in historical residential buildings, 3rd International Conference on Preservation, Maintenance and Rehabilitation of Historical Buildings and Structures (REHAB 2017), pp. 3 10, 978-989-8734-23-5.

Introduction

In the recent history of built heritage preservation, there is a constant concern for the prior understanding of the building, through historic analysis and state of conservation assessment (Viollet-le-Duc, 1873; Boito, 1893; Giovannoni, 1924; League of Nations, 1931; ICOMOS, 1964, De Nayer, Arroyo & Blanco, 2000). The evolution of thinking on this is-sue has essentially two vectors: on the one hand, the extension of the concept of heritage to entire groups of buildings and historical towns (European Council, 1975; UNESCO, 1976; ICOMOS, 1987); on the other hand, the technological progress, which introduces new tools that empower more detailed forms of survey.

The international document that most emphatically expresses the “principles for the analysis, conservation and structural restoration of architectural heritage” was presented by ICOMOS in 2003. It intends to “ensure rational methods of analysis and repair methods appropriate to the cultural context” (ICOMOS, 2003). It recommends diagnosis based on qualitative approaches – i.e. historical information, direct observation - but also quantitative, through trials and monitoring.

New technologies have followed the need to gather more information about the building, without, however, eliminating it. Recent literature includes studies about the development of computer tools to support technicians in the inspection procedure (Caccioti & Valach, 2015), the use of laser scanner and photogrammetry for detailed survey of historical buildings (Haddad, 2013; Balzani & Maietti, 2015), the non-destructive analysis of old structures through digital images and thermography (Moropoulou, Labropoulos, Delegou, Karoglou, & Bakolas, 2013), and the development of integrated methodologies for the trans-position of data collected for parameterized three-dimensional models (Li, Liu, Wang, Wu, 2015). In common, all these studies confirm the survey as an active process of selection, essential for weighted decision-making.

These studies and methodologies are, however, predominantly oriented to intervention in monuments, although several authors emphasise their importance in residential buildings, to preserve the authenticity of ancient historical urban fabrics (Appleton, 2011; Cóias, 2009; 2017). According to Vítor Cóias, president of the Heritage Guild of Portugal, “good rehabilitation practices are not sufficiently widespread, although the necessary know-how is available” (Pedro, 2017).

Caccioti, & Valach (2015), identified as the main problems at this stage of the process the fragmentation of information, often incomplete, and the incompatibility between data collected using different methodologies and from local authorities. They also point out that most inspection and survey methods, other than purely visual ones, consume too many resources and are, therefore, only applied in exceptional situations. However, there are no relevant studies that allow understanding the reasons for the low acceptance and practical application of these methodologies between the involved technicians.

In this paper, we report the results of a web-based questionnaire, disseminated to Portuguese architects, that was used to qualitatively analyse this problem and that contribute to identifying the main obstacles that affect the procedures for inspection and diagnosis in professional practice, in Portugal.

Methodology

A web questionnaire was used to collect information from Portuguese architects about perceptions and attitudes about surveying, inspection and diagnosis practices in historical residential buildings. About 500 professionals were contacted via email, using the online database of the Portuguese College of Architects (OA). In addition, the survey was also disseminated through social networks and mailing lists of professional communities (web-platform Reabi(li)tar and INTBAU - Portugal).

The questionnaire was divided into four parts, in a process of sequential filtering of the respondents. In this way, it was possible to obtain the specific sample of "architects in-volved in the rehabilitation of historical residential buildings that carry out the inspection and diagnosis of the state of conservation". The first part of the survey recorded information about the professional background of the respondents. Still, in the general observations, the second part referred to the experience of respondents in rehabilitation projects. In the specific observations, two groups of questions were considered: survey practices in residential buildings, and procedures for inspection and diagnosis of the state of conservation.

The form consisted solely of semi-structured response questions: multiple choice, closed response, or selection. Whenever possible, a free response field ("Other") was considered, allowing the respondent to add specific answers not initially contemplated. For only two cases, a 10-point Likert-type scale was used to evaluate the respondents' emotional perception. At the end of the survey, a long response field was included to allow respondents to share experiences not considered in the questions presented.

Data was collected and analysed using the Google Forms and Spreadsheets online tools. In the first phase of surveys, which took place between 20 March and 12 April 2017, 57 responses were received. This paper presents a descriptive statistical analysis, with the aim of synthesising the data and describing, graphically and numerically, the variables considered and the results obtained.

Results

General Observations

All respondents belong to professional areas of the construction sector and 94.7% were architects. The answers cover the whole national territory (Figure APP.B.1). The districts of Lisboa (35.1%), Braga (19.3%) and Porto (15.8%) have recorded greater participation. Only 8.8% said they had not been involved in rehabilitation projects throughout their professional careers. In the following analysis, only the responses of architects with experience in rehabilitation were considered (n=50).

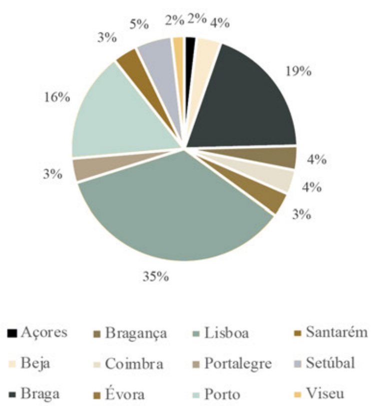

FIG. APP.B.1 Geographic distribution

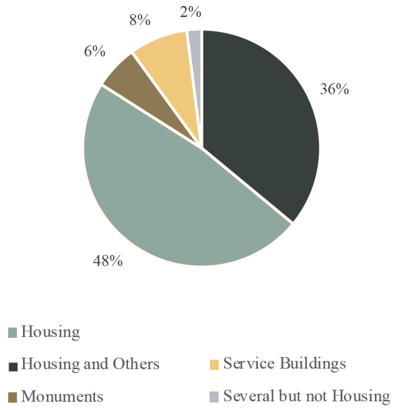

FIG. APP.B.2 Building types

It was found that 84% of the respondents had experience in the rehabilitation of residential buildings (Figure APP.B.2), either exclusively (36%) or in parallel with other typologies (48%). More than half of the respondents (56.1%) have more than 10 years of experience (Figure APP.B.3). However, this number decreases (41.9%) when referring to the specific experience in rehabilitation.

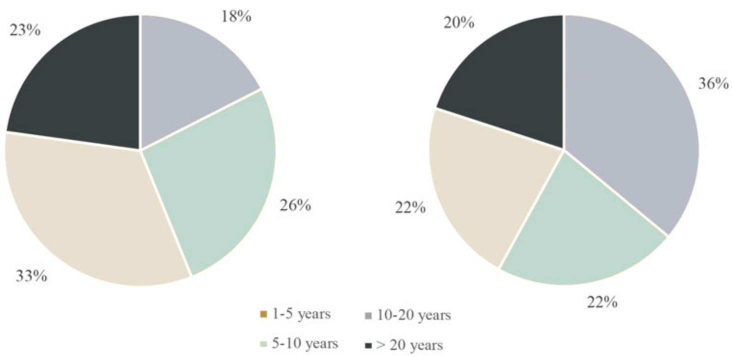

FIG. APP.B.3 Respondent's professional experience and experience in rehabilitation

The fact that the promoters/owners only, or predominantly, meet the economic criteria, disregarding the heritage value of the buildings is considered as the main problem by 72% of the respondents (Figure APP.B.4). It was also highlighted the lack of knowledge of the builders regarding the intervention procedures, with 54% of respondents identifying this problem.

FIG. APP.B.4 Major problems in rehabilitation processes identified by respondents

Respondents assumed that the training of technicians (architects and engineers) involved in rehabilitation processes is insufficient to prescribe traditional construction techniques. This option was the second most voted, with 56% of answers. This problem is predominantly pointed out by professionals with more than 10 years of experience (74.9%). Only 14% of those who consider the training of technicians a gap have less than 5 years of experience in professional practice.

In the specific observations about inspection and diagnosis procedures in historical residential buildings, only the respondents with experience in the rehabilitation of residential buildings (n=42) were considered.

Inspection and Diagnosis Procedures in Historical Residential Buildings

Regarding the most used survey techniques, the results confirm the predominance of the metric and photographic survey, both used by 85.7% of respondents. Topographic surveying, considered in 80.9% of responses, closely follows these resources. The use of more complex techniques, such as laser scanner or photogrammetry, it is only occasional, as shown in Figure APP.B.5.

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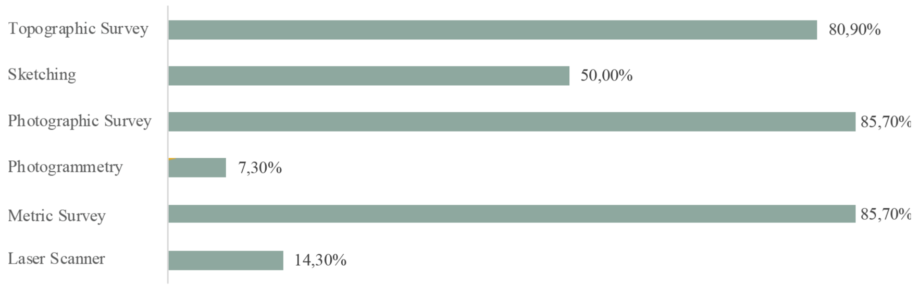

FIG. APP.B.5 Survey procedures in historic housing buildings

About a quarter of the respondents (26.2%) do not inspect the state of conservation of residential buildings or admit doing it only sporadically (Figure APP.B.6). The reasoning for this are the limited financial resources, in 54% of the cases, the technical ignorance of the inspection procedures (representing 36% of these options) and the very limited deadlines, in 27% of the cases (Figure APP.B.7).

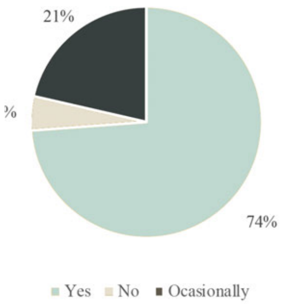

FIG. APP.B.6 Respondents that perform inspection and diagnosis of existing buildings

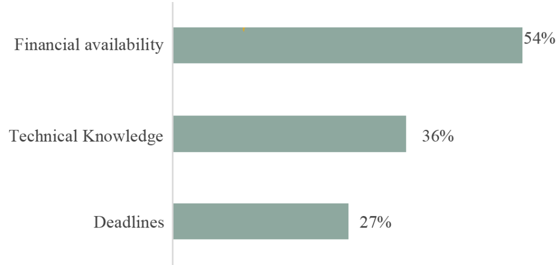

FIG. APP.B.7 Reasons to not perform inspection and diagnosis

Considering only the respondents who, regularly or occasionally, inspect the state of conservation of residential buildings (n = 40), it has been found that in 95% of the cases the inspection procedures are visual and photographic. For 37.5% of respondents, photography is the only inspection-recording format; and 45% records the information collected in appropriate data sheets (Figure APP.B.8).

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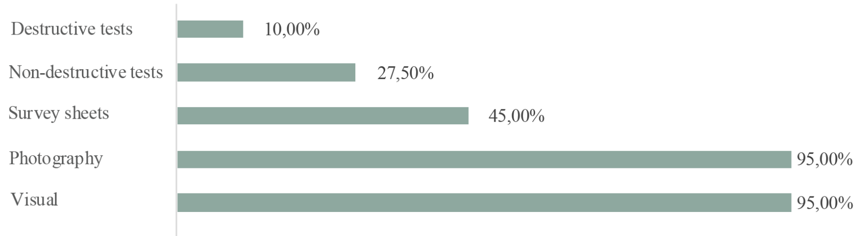

FIG. APP.B.8 Inspection techniques

More complex technical tests are not very representative: non-destructive tests – using resistographs or ultrasound, for example – are considered by 27.5% of respondents, and the destructive laboratory tests, by only 10%.

Most of the respondents (67.5%) do not know (30%) or never used (37.5%) the inspection and diagnosis models developed by LNEC (Pedro, Vilhena, Paiva& Pinho,2012). Among the three methodologies developed between 2003 and 2007, he MAEC - Method of Evaluation of Buildings' State of Conservation - is the most recognised, and was used by 22.5% of the respondents. It was possible to verify that the respondents with experi-ence in the application of these methodologies also use data sheets in their professional practice, corresponding to 55.6% of the total of individuals that identify this procedure.

The main problems identified during these processes are related to the excessive consumption of resources (Figure APP.B.9): 47.5% of the respondents think that the procedures are too expensive and time-consuming. Of the latter, 31.6% stated that they spent more than a week, on average, to inspect and diagnose the building, although the majority (42.1%) de-votes 3 days to this phase of the process; 10.5% of the architects who consider the procedures too time-consuming, dedicates only 1 day to them.

For 37.5% of the respondents, the information to support the analysis of results is scattered and complex to consult. The majority (62.5%) of the participants in this survey state that they seek support for their diagnosis in academic works (dissertations, scientific pa-pers, reports) available in online repositories. Also, more than half (57.5%) considers the work of Appleton (2011), Rehabilitation of Old Buildings - Pathologies and Intervention Technologies, an important reference at the national level, being the most consulted publication. Only 17.5% of the respondents use the Illustrated Glossary on Stone Deterioration Patterns (ICOMOS, 2008).

FIG. APP.B.9 Problems identified in building inspection proceses

Regarding the resources they use regularly, the respondents highlight the effectiveness of the research, understood as the ability to find what is sought. The main weaknesses are the lack of systematisation of information, the lack of efficiency of the research - considered too time-consuming -, and the availability of information, which is not always accessible when necessary.

Discussion

The survey collected answers from 54 architects. It was verified that 92% are involved in rehabilitation projects and that 78% have been working in the rehabilitation of residential typologies, which demonstrates the potential impact of the dissemination of good intervention practices in this type of heritage. However, the inspection and diagnostic procedures are still regularly applied by only 74% of respondents.

From the presented results, it is possible to highlight three problems, specific to residential buildings:

- Very limited deadlines, with no room for time-consuming procedures;
- Low budget for tests that require the acquisition or contracting of specialised resources and technicians;
- Lack of interest from the promoters or owners, who do not consider the heritage value of the building to intervene.

These reasons justify the preference for visual inspections, recorded only photographically since they do not imply an increase of costs. Registration in survey data sheets al-lows for the systematisation of identified anomalies and “is a tool to promote and justify decision-making” (Silva & Vicente, 2004). Although this tool also does not imply an in-creased cost, this questionnaire evidenced that its use is not generalised, probably due to the lack of knowledge of the technicians. The predominance of users of this resource in the group familiar with the inspection models developed by LNEC (Pedro, Vilhena, Paiva & Pinho, 2012) demonstrated that these have the potential to be adapted to inspect the state of conservation of residential buildings with heritage value.

The knowledge gap in professional practice is associated with the scarcity and dispersion of information, low systematised, time-consuming consultation and not accessible everywhere. However, the investment made in the academic field to research traditional techniques and define good intervention practices (Teixeira, 2012; Freitas, 2012) is relevant for professionals, who consider them as one of the main sources of information during the projects.

Conclusion

The purpose of this study was to identify, with the support of the professional community, the obstacles faced in the application of inspection and diagnosis procedures in the rehabilitation of historical residential buildings.

The query showed that these procedures are not yet widespread in professional practice. It allowed concluding that in historical residential buildings, there is low budget and time available to resort to the current detailed methods of inspection and diagnosis.

According to the technicians, the training gap is still confronted by the scarcity of technical information and, above all, by its dispersion. This paper demonstrated the need to systematise an alternative approach that responds to the limiting factors of historical residential buildings' rehabilitation processes, with its multiple actors: building owner, regulators, architects, engineers, archaeologists, builders, final inhabitants.

The sample considered in this first analysis of the results is reduced (n=57) and it would be important to understand whether the results are generalizable at the national level. The weblink with the survey remains open, with a total of 78 responses registered on 7 of May 2017. A new round of dissemination is planned, considering a larger universe, to confirm the preliminary results.

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Appendix C

Experiences from professional practice in rehabilitation: analysis of a focus group (PT)

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Introdução

A valorização do Património Habitacional
Entendendo a casa como o meio fundamental através do qual o Homem se relaciona com o mundo (Pallasma, 2016), esta investigação é orientada para o estudo do património construído especificamente destinado ao habitar, o qual será daqui em diante designado Património Habitacional.

A partir da segunda metade do século XX verifica-se uma concordância generalizada acerca da importância da habitação para a história da arquitetura e da construção. Para Conde (2011), "microcosmo da sociedade, a casa, urbana ou rural, comum ou qualificada, é profundamente reveladora daquela, dos espaços e dos tempos em que se ergueu e perdurou", pois revela as "estruturas sociais, mentalidades, recursos, técnicas e organização económica" da sociedade do seu tempo.

A evolução desta linha de pensamento permitiu um alargamento do conceito de Património, definido internacionalmente pelas cartas da UNESCO e do ICOMOS. Em 1964, na Carta de Veneza, o conceito de "monumentos e sítios" passa a integrar "não só as criações arquitetónicas isoladamente, mas também os sítios, urbanos ou rurais, nos quais sejam patentes os testemunhos de uma civilização particular, de uma fase significativa da evolução e do progresso, ou algum acontecimento histórico” (ICOMOS, 1964).

As “Recomendações sobre a Salvaguarda dos Conjuntos Históricos e da sua Função na Vida Contemporânea” (UNESCO, 1976) ou a “Convenção para a Salvaguarda do Património Arquitetónico da Europa” (Conselho da Europa, 1982), adicionam ao interesse histórico, artístico e científico, o interesse social e técnico, considerando a dimensão humana dos edifícios de habitação, pois “fazem parte da vida quotidiana dos seres humanos ( ) constituindo a presença viva do passado que os moldou” (UNESCO, 1976). Fica assim consolidada a importância da salvaguarda dos conjuntos históricos edificados e da sua “integração na vida contemporânea” (UNESCO, 1976), como “expressão insubstituível da riqueza e da diversidade do património cultural da Europa, um testemunho inestimável do nosso passado e um bem comum a todos os europeus” (Conselho da Europa, 1982).

Reabilitação Sustentável do Património

Paralelamente a um crescente interesse pelo património habitacional que constitui os centros históricos, assiste-se a uma maior consciencialização sobre os perigos da sociedade de consumo, não apenas ao nível económico, mas também no que ao ambiente diz respeito. Em 1987, o Relatório Brundtland define desenvolvimento sustentável como “o desenvolvimento que satisfaz as necessidades atuais sem comprometer a capacidade das gerações futuras para satisfazerem as suas próprias necessidades” (World Comission on Environment and Development, 1987). Tal como o conceito de Património, o conceito de Sustentabilidade remete também para o legado deixado às gerações vindouras, não só na dimensão ambiental, mas também económica e social.

Apesar desta relação entre os dois conceitos, apenas em 2011 a publicação dos “Princípios para a Gestão e Salvaguarda das Cidades Históricas e Áreas Urbanas” (ICOMOS, 2011) articula a questão do desenvolvimento sustentável com os princípios de salvaguarda do património histórico, em recomendações largamente aceites internacionalmente. Este documento reconhece que “o desenvolvimento sustentável ganhou tal importância que várias diretivas acerca de planeamento arquitetónico são agora baseadas em políticas desenhadas para limitar a expansão urbana e preservar o património urbano” (ICOMOS, 2011). Nesse sentido, defende que as intervenções na cidade histórica são oportunidades para melhorar a qualidade de vida urbana, baseada no respeito pelo equilíbrio ambiental. Nas Propostas e Estratégias a adotar, incentiva a reutilização e reciclagem de recursos não renováveis e a implementação de estratégias para a melhoria da eficiência energética: “todas as intervenções nos centros históricos e áreas urbanas, ainda que respeitando as características históricas, devem ser orientadas para a melhoria da eficiência energética e redução dos poluentes” (ICOMOS, 2011).

Em 2013, também o relatório da UNESCO “Colocar a Cultura no Centro das Políticas para o Desenvolvimento Sustentável” afirma a necessidade de se considerar a cultura como um pilar essencial do desenvolvimento sustentável, “como um sistema de valores, um recurso e um enquadramento para construir desenvolvimento verdadeiramente sustentável, aprendendo das experiências das gerações passadas” (UNESCO, 2013). Reconhece também que a salvaguarda das áreas históricas, juntamente com os saberes e práticas tradicionais, “reduz a pegada ambiental das sociedades, promove padrões de consumo e de produção mais ecológicos e soluções urbanas e arquitetónicas mais sustentáveis” (UNESCO, 2013).

Boas Práticas para a Reabilitação

A valorização do Património histórico de carácter habitacional e a crescente preocupação com a sua sustentabilidade (económica, ambiental e social) tem gerado nas últimas décadas abundante literatura acerca de normativas de intervenção, recomendações de boas práticas e princípios de intervenção (Appleton, 2011; Teixeira, 2012; Cóias, 2009). No entanto, como refere o relatório do Conselho da Europa “a formulação de princípios não é, em si, suficiente; é necessário aplicá-los” (Conselho da Europa, 1975).

Em 2017, o então presidente da direção do Grémio do Património em Portugal, Vitór Cóias, constatou que “as boas práticas de reabilitação não estão suficientemente difundidas, apesar de o conhecimento necessário estar disponível” (Pedro, 2017). Esta afirmação corrobora o problema já identificado por Appleton (2011): os resultados dos estudos e investigações realizados no meio académico não chegam, frequentemente, “ao público utilizador, em particular projetistas e construtores”.

A presente investigação tem como objetivo compreender as razões da lacuna na transmissão do conhecimento para a prática profissional no sector da reabilitação, para que o desenvolvimento de soluções alternativas possa partir do reconhecimento das necessidades reais dos diferentes intervenientes. Como refere Fawcett (1991), pretende-se “determinar objetivos e métodos de investigação, desenhar e disseminar intervenções, comunicar resultados de investigação e defender mudanças na comunidade”.

Metodologia

De acordo com o objetivo definido, recorreu-se a uma metodologia de análise qualitativa, com recurso a técnicas participativas, como o inquérito e o grupo de foco, para investigar motivações, necessidades e opções do coletivo constituído pelos profissionais envolvidos na prática de reabilitação de património habitacional, para obter informações sobre o contexto específico da prática profissional e levantar questões para futuras investigações.

Inquérito aos Profissionais

O inquérito acerca da reabilitação de património habitacional foi realizado online a equipas de projetistas em Portugal, através da ferramenta Google Forms. Foram contactados por email cerca de 500 profissionais, recorrendo à base de dados da Ordem dos Arquitetos e à disseminação através das redes sociais e listas de contactos de comunidades profissionais (plataforma online Reabi(li)tar e INTBAU — Portugal).

Os resultados da primeira fase, que decorreu entre 20 de março e 12 de abril de 2017, incluíram a análise de 57 respostas, 94,7% das quais de arquitetos, e permitiram reconhecer os procedimentos de inspeção do estado de conservação utilizados na prática profissional (Gonçalves et al., 2017).

Neste artigo são analisados dados qualitativos não considerados nessa primeira análise, incluindo os provenientes dos campos de resposta aberta e subjetiva, que permitiram aos respondentes partilhar experiências não abrangidas pelas perguntas de resposta fechada. Nesta análise são consideradas as 82 respostas obtidas no período entre 20 de março e 14 de setembro de 2017.

Todos os respondentes ao inquérito (n=82) pertencem a áreas profissionais relacionadas com o sector da construção: 78% são arquitetos, 16% engenheiros e os restantes 6% representam áreas diversas como arqueologia, empresas de construção ou técnicos de conservação e restauro. Obtiveram-se respostas representativas de todo o território nacional, ainda que com uma maior concentração nos distritos de Lisboa (40,2%), Porto (17,1%) e Braga (14,6%).

Grupo de Foco

De forma a validar os resultados do inquérito junto de um conjunto mais alargado de intervenientes no processo de reabilitação e incitar respostas divergentes e mais detalhadas, realizou-se um grupo de foco no âmbito do 5º Encontro de Arquitetura Tradicional e Sustentabilidade, organizado pela Associação Palombar.

O grupo de foco foi constituído por 26 participantes internacionais, interessados e ativamente envolvidos na reabilitação de arquitetura tradicional: 34,6% dos participantes eram arquitetos, 11,5% técnicos de construção e restauro e artesãos e 30,7% representando pequenos promotores privados. Portugal foi o país mais representado (46%), seguido por Espanha (19%) e por França (11,5%). Estiveram também representados a Guiné-Bissau, Itália, México, Tunísia e Alemanha.

A discussão foi estruturada em torno de um mapa, representando de forma diagramática os processos de reabilitação e os pontos de interação entre os múltiplos intervenientes (figura 1), entendido como “um meio para a reflexão, a socialização de saberes e de práticas, o impulso à participação coletiva” (Risler & Ares, 2014). O resultado desta ação foi um mapa da experiência do utilizador, construído coletivamente, com o potencial de “distinguir prioridades e recursos quando chega o momento de se projetarem práticas transformadoras” (Risler & Ares, 2014).

Cada participante recebeu inicialmente um post-it de cor verde e um post-it cor-de-laranja, estando o primeiro associado a aspetos positivos do processo de reabilitação e o segundo a aspetos negativos. A ausência de questões estruturadas permitiu não condicionar a reflexão individual, evitando o enviesamento dos resultados. Foi atribuído um tempo de reflexão individual de cerca de 10 minutos, para que os participantes pudessem refletir e anotar as suas experiências pessoais. Seguidamente, os post-its foram trocados entre os participantes, no sentido de reduzir a pressão ou o desconforto de assumir a própria opinião e garantindo o anonimato das contribuições.

As anotações foram depois lidas e discutidas pelo grupo, referenciando-se a sua posição no mapa, identificando interações, clarificando-se o sentido das afirmações e partilhando experiências da prática profissional. No decorrer da discussão foram adicionados post-its amarelos com recursos e soluções que surgiram ao longo do debate. A sessão durou aproximadamente 180 minutos, não tendo sido possível dar a palavra a todos os 26 participantes, pelo que foi dada preferência às participações voluntárias. Os restantes post-its foram adicionados pelos próprios participantes, no mapa que ficou disponível até ao final do encontro.

Análise Qualitativa

A informação apresentada no capítulo seguinte resulta do cruzamento dos dois procedimentos descritos: o inquérito e a análise das reflexões do grupo de foco. Procedeu-se a uma análise temática e de conteúdo dos dados recolhidos através das duas ações.

Para a organização da informação recorreu-se à metodologia proposta por Turner (1981), classificando a informação em grupos temáticos e relacionando-os entre si, estabelecendo conexões entre os conceitos emergentes e as teorias existentes. Para análise e hierarquização da informação consideraram-se as categorias de análise propostas por Krueger (1994), recorrendo apenas à análise de palavras-chave, frequência dos conteúdos, intensidade das emoções expressas e ideias principais.

Na análise dos resultados do grupo de foco, consideraram-se apenas os resultados escritos adicionados ao mapa pelos participantes. Foi eliminada informação ambígua ou pouco percetível, com um limite de 2% do total de participações.

Os resultados do inquérito foram sobrepostos aos do grupo de foco, no sentido de construir um mapeamento do processo de reabilitação mais completo e detalhado, sintetizando dados e descrevendo de forma gráfica as variáveis consideradas e os resultados obtidos.

Resultados

Observações Gerais
A análise dos dados permitiu distinguir diferentes classes temáticas, que agrupam os assuntos que emergem transversalmente a partir das opiniões dos participantes. Os temas tendem a constituir os critérios considerados nas fases de projeto para a tomada de decisão pelos diferentes intervenientes. Foi possível distinguir 8 classes temáticas capazes de agrupar todos os fragmentos de informação qualitativa recolhida, apresentadas na tabela APP.C.1.

TABLE APP.C.1 Classes Temáticas (ordenadas por frequência e intensidade)

Tema	Descrição
Informação	Informação existente para apoiar o dia-a-dia da prática profissional
Economia	Questões económicas, como o custo e o valor de investimento
Social	Aspetos culturais da comunidade que condicionam a tomada de decisão
Qualificação	Problemas estruturantes na formação da comunidade técnica
Tempo	Preocupações acerca dos prazos e duração das tarefas
Utilização	Utilização e papel dos habitantes na fase pós-ocupação
Património	Preservação do valor patrimonial dos edifícios
Ambiente	Impacte na sustentabilidade ambiental do meio edificado

Tanto do inquérito como do grupo de foco destacam-se como temas mais problemáticos a Informação, o Critério Económico, o Critério Social e a Qualificação. Estes quatro critérios surgem no topo das prioridades, quando se considera a frequência com que os assuntos são abordados pelos participantes.

Considerando a intensidade das emoções expressas, verifica-se que os aspetos considerados globalmente mais negativos são, novamente, a informação e o critério económico, destacados em relação à questão social e de qualificação dos técnicos. É também a informação o tema que suscita mais sugestões e necessidades urgentes nos participantes. Os temas considerados mais positivos são o critério patrimonial e o critério ambiental. A tabela APP.C.2 sistematiza os principais indicadores recolhidos para cada classe temática.

Analisando a distribuição por objeto a que se referem (recursos, intenções, interações), verifica-se que o tipo considerado mais crítico pelos participantes corresponde aos recursos existentes, aos quais são apontados mais aspetos negativos, mas também mais propostas alternativas. As interações entre os múltiplos intervenientes no processo são também consideradas um momento crítico, revelando problemas na comunicação que influenciam a tomada de decisão.

A análise de palavras-chave revela as principais preocupações dos intervenientes. Por um lado, os resultados do inquérito são mais direcionados para os problemas, destacando-se o custo, a informação e o tempo. Já o mapeamento expressa as intenções dos participantes em considerar preocupações ambientais e com o bem-estar dos habitantes.

TABLE APP.C.2 Principais indicadores por classe temáatica (ordenada por frequência e intensidade)

Tema	Indicadores
Informação	Escassa informação técnica e informação existente dispersa e pouco acessível.
	Recursos existentes insuficientes para apoiar a tomada de decisão ponderada.
	Falta de partilha de conhecimento entre as instituições de ensino/investigação e a comunidade profissional.
	Hierarquias estabelecidas criam barreiras de comunicação entre os intervenientes.
	Procedimentos e metodologias existentes demasiado complexos.
Economia	Promotores consideram apenas o critério económico na tomada de decisão.
	As boas práticas são demasiado caras e a disponibilidade financeira limitada.
	Os projetos de reabilitação oferecem pouca rentabilidade.
	Não existem ferramentas de apoio à tomada de decisão que permitam ponderar critérios para além do económico.
	O mercado é dominado pela especulação, tanto imobiliária como no comércio de materiais.

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TABLE APP.C.2 Principais indicadores por classe temáatica (ordenada por frequência e intensidade)

Tema	Indicadores
Social	Problema cultural estrutural: nem os técnicos nem os clientes estão informados.
	O preconceito ainda orienta os processos, favorecendo a demolição integral.
	Pouca tolerância ao erro perante a aplicação de técnicas tradicionais.
	Necessidade de educar promotores através de exemplos de boas práticas.
	Existe uma maior consciencialização e interesse dos responsáveis políticos e mais promoção privada.
Qualificação	Intervenção desqualificada conduz à destruição da matriz tipológica dos edifícios.
	Formação de técnicos e construtores é insuficiente.
	O ensino formal desconsidera o saber-fazer tradicional.
Tempo	As boas práticas consomem demasiado tempo.
	Os prazos para o projeto são muito condicionados.
Utilização	O recurso a técnicas tradicionais e materiais naturais tem um contributo positivo na saúde dos ocupantes.
	A legislação e o projeto desconsideram o papel dos habitantes no Património.
Património	Motivação em participar na continuidade da identidade dos lugares e da sua história.
	Critérios excessivamente conservadores impedem a inovação.
Ambiente	Reabilitação contribui para a redução do impacte ambiental por reutilizar estruturas existentes e utilizar materiais naturais.
	Os clientes ainda não reconhecem a bioconstrução como alternativa.

Observações relacionadas com a Informação

As barreiras à aplicação das boas práticas identificadas pelos participantes podem, no que diz respeito ao tema da Informação, ser distinguidas em duas questões-chave: a escassez de informação e a comunicação da informação existente.

Para 43,7% dos respondentes ao inquérito, a escassez de informação técnica relativa às soluções construtivas tradicionais é um dos principais problemas. Ainda que no grupo de foco se afirme que “as docências oficiais consideram as técnicas tradicionais obsoletas e desconsideram os saberes artesanais”, os participantes inquiridos reconhecem e utilizam publicações de referência a nível nacional (Appleton, 2011; Cóias, 2009; Freitas, 2012) e 48,3% afirmam encontrar efetivamente a informação que procuram, maioritariamente em trabalhos académicos disponíveis nos repositórios das instituições (62,1%).

No entanto, a informação existente é considerada dispersa e pouco acessível por 36,6% dos respondentes. A questão da acessibilidade surge relacionada com o fator Tempo: a pesquisa é considerada demasiado demorada (46,6%), já que é necessário consultar várias fontes bibliográficas nas quais a informação não surge sistematizada (44,8%). Além disso, a informação não está facilmente disponível quando e onde seria necessária durante a fase do projeto, nomeadamente em procedimentos in situ. Os participantes do grupo de foco destacam ainda que a informação se encontra "encerrada nas instituições académicas", considerando urgente melhorar a comunicação para que o conhecimento se torne efetivo.

A necessidade de melhorar a comunicação do conhecimento para a prática profissional foi uma das ideias mais salientada ao longo do debate, em linha com o que já tinha sido evidenciado pelos resultados do inquérito: "a bibliografia é muito válida, mas não é suficiente para tomar decisões". Esta afirmação reforça ainda o momento da tomada de decisão como um dos mais críticos do processo. Os participantes destacam a necessidade de ferramentas que apoiem a tomada de decisão ponderada, considerando, por exemplo, necessidades e custos de manutenção a longo prazo, impactes ambientais e na saúde dos habitantes.

Observações relacionadas com o Critério Económico

A necessidade expressa de ferramentas para a ponderação de critérios na tomada de decisão, está diretamente relacionada com o segundo tema considerado mais problemático pelos participantes: as barreiras à aplicação das boas práticas devidas a constrangimentos económicos.

Uma vasta maioria dos inquiridos considera como um dos problemas prioritários encontrados na prática profissional o facto de os promotores/donos de obra atenderem, apenas ou predominantemente, aos critérios económicos, desconsiderando o valor patrimonial dos edifícios. Esta opção reúne 64,8% de consenso entre os inquiridos e foi também destacada pelo grupo de foco.

Paralelamente, consideram que a reabilitação conservando as técnicas artesanais tende a ser mais cara do que a prática corrente (como indicado por 49,3% dos inquiridos). Os participantes do grupo de foco apresentam como principais razões para esta diferença o facto de a mão-de-obra qualificada ser mais cara, mas também a "competição desleal com o mercado dos materiais industrializados".

Além disso, os técnicos consideram que a aplicação das boas práticas de reabilitação, nomeadamente através do levantamento rigoroso do existente ou da avaliação do estado de conservação, é demasiado complexa, demorada e cara para a disponibilidade financeira dos pequenos projetos de reabilitação de edifícios de habitação. 23,3% dos inquiridos assume não realizar de modo regular a inspeção do estado de conservação do edifício a intervir, no caso de projetos de habitação. A principal razão apontada é a disponibilidade financeira limitada (54,5% de respostas). Mesmo os inquiridos que afirmam realizar este procedimento, consideram que se consome demasiado tempo (50%) ou que o mesmo é demasiado caro (44,8%).

Considerando a predominância do critério económico na tomada de decisão e os custos mais elevados associados às boas práticas, é possível concluir que, para os participantes, e apesar da motivação em trabalhar com edifícios com valor patrimonial, "os projetos de reabilitação oferecem pouca rentabilidade", necessária à viabilidade profissional do sector.

Observações relacionadas com questões Sociais e de Qualificação
Os dois problemas anteriores — a informação e os constrangimentos económicos, encontram-se relacionados com aspetos culturais que envolvem os diferentes intervenientes, nas várias fases dos processos, o que confirma a perceção plasmada por um dos respondentes ao inquérito no campo de resposta aberta: a reabilitação não é apenas um problema técnico, mas também um problema cultural e "sem clientes, técnicos e trabalhadores informados, e sem uma escala que permita reduzir os custos e atrair investimento, a caracterização adequada do edificado não é possível, a aprendizagem resultante é apenas casuística ( )".

A dificuldade no acesso à informação é agravada pela lacuna na formação dos técnicos — tanto construtores, como projetistas. Os resultados do inquérito apontam o desconhecimento dos construtores relativamente aos procedimentos de intervenção como um problema para 56,3% dos respondentes. Mas os inquiridos assumem que a formação dos técnicos (arquitetos e engenheiros) de reabilitação é também insuficiente para prescrever as técnicas de construção tradicionais, reunindo esta opção 57,7% de respostas. Também o grupo de foco levanta esta questão considerando que o ensino formal é insuficiente para a formação qualificada dos técnicos.

Associada à questão da qualificação, o grupo de foco destaca os perigos do fachadismo, derivado da "falta de compreensão da globalidade dos métodos, linguagens e técnicas da arquitetura tradicional", e "resultando na destruição daquilo que se pretende preservar". Este problema tem origem nas questões de qualificação mencionadas, mas também em questões culturais e no preconceito enraizado nos múltiplos intervenientes que continuam a favorecer a demolição integral do interior dos edifícios.

As principais razões apontadas para favorecer a demolição são os imprevistos em obra (para 40,8% dos inquiridos), o avançado estado de degradação das construções — assumida mesmo antes da inspeção rigorosa, considerada inconsequente para 24,1% dos inquiridos, e a crença de que as técnicas tradicionais geram problemas e desconforto (16,9%). O grupo de foco permite constatar ainda que "Existe uma menor tolerância ao erro quando são utilizadas as técnicas

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tradicionais, tanto por parte dos construtores como dos clientes", criando barreiras sociais à aplicação das boas práticas.

Discussão dos resultados

Em suma, o problema inicialmente identificado — a escassa aplicação das boas práticas de reabilitação na prática profissional — tem as suas raízes nas seguintes causas, como é sistematizado na figura APP.C.1:

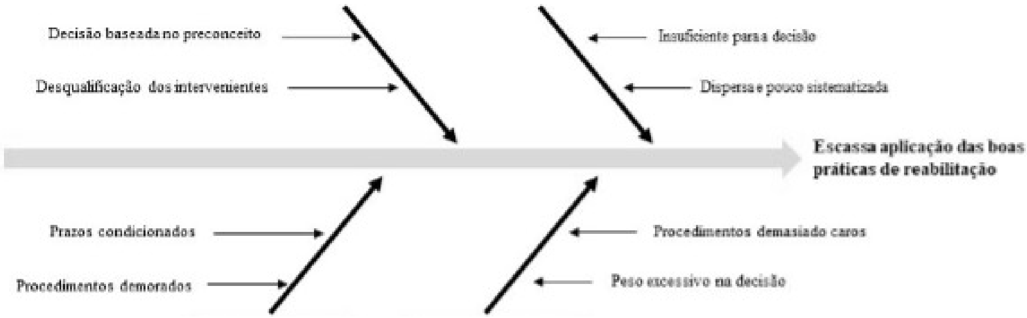

FIG. APP.C.1 Diagrama causa-efeito do problema da escassa aplicação de boas práticas na reabilitação

1. Disponibilidade da informação: dispersa, pouco sistematizada e insuficiente para a tomada de decisão;
2. Constrangimentos económicos: as boas práticas são mais caras e há uma prevalência do critério económico como único critério para a tomada de decisão;
3. Perceção social: desqualificação generalizada dos intervenientes (técnicos, construtores e promotores), conduzindo a decisões desinformadas e baseadas no preconceito;
4. Tempo limitado: os prazos muito condicionados não permitem aplicar boas práticas consideradas demoradas ou pesquisar informação para fundamentar a decisão.

Consolida-se assim a conclusão de que a tomada de decisão é um momento-chave do processo e que o peso do fator económico nas decisões é considerado excessivo pelos profissionais. Para que as alterações efetivamente aconteçam na prática profissional é essencial dispor de informação que permita "fundamentar a decisão numa base dotada de consistência" (Bertuglia et al., 1974), no sentido de "trazer objetividade ( ) e transparência ao processo de alocar recursos escassos aos trabalhos de construção" (Bana e Costa & Oliveira, 2002).

A concentração dos resultados em torno dos recursos existentes confirma a afirmação de Appleton: "o progresso registado nos últimos anos continua a não ser suficiente para garantir a disponibilização de ferramentas de projeto" (Appleton, 2011). O desenvolvimento de sistemas de informação que explorem "a capacidade crescente dos meios informáticos" (Appleton, 2011), é hoje essencial para tornar a comunicação da informação mais eficiente para a prática profissional, constituindo "um precioso banco de dados que possibilite obter, com a esperada rapidez, dados importantes conducentes à tomada de decisões acertadas" (Flores & Brito, 2001).

A experiência prática dos profissionais confirma a perceção da investigação de Ferraz et al. (2016), que concluiu que os procedimentos existentes para a inspeção e diagnóstico do estado de conservação dos edifícios são demasiado complexos. O desenvolvimento de ferramentas informáticas para apoiar os técnicos durante os procedimentos de inspeção e diagnóstico in situ, como proposto por estes autores, mas também por Pedro et al. (2012), pode contribuir para tornar os procedimentos mais rápidos e menos dispendiosos, ao encontro das preocupações manifestadas pelos participantes. Sobretudo, "ao aplicar automaticamente o método de síntese de resultados" (Pedro et al., 2012), será possível que os procedimentos de inspeção do estado de conservação passem a ser encarados pelos técnicos como consequentes nos resultados de projeto.

Os resultados evidenciam principalmente a preocupação generalizada com o peso do fator económico na tomada de decisão. De facto, "os custos iniciais e a rentabilidade do investimento a curto prazo não podem ser, para o Promotor/Dono da Obra, a única preocupação" (Flores & Brito, 2001), confirmando a necessidade de demonstrar as mais-valias da prática regular de manutenção para a rentabilização dos edifícios, "assegurando o valor comercial do bem e a sustentabilidade da sua utilização durante a vida útil expectável" (Flores & Brito, 2001).

Conclusões

As barreiras sociais reforçam os dois principais problemas identificados: a informação e o peso do fator económico. A lacuna de informação e formação dos diversos intervenientes conduz a decisões baseadas unicamente no investimento inicial, desconsiderando outros critérios relevantes para os participantes: a saúde dos ocupantes, os custos de manutenção, o impacte ambiental da intervenção, o respeito pelo saber-fazer tradicional e a valorização patrimonial.

O recurso a metodologias participativas, para além de detetar e descrever problemas, permitiu estabelecer necessidades concretas e recolher sugestões para a resolução dos problemas identificados pelos profissionais do sector da reabilitação, nomeadamente de edifícios de habitação com valor patrimonial. Esta reflexão salientou a importância de comunicar a informação em sistema aberto: por um lado, transpor para a prática profissional o conhecimento produzido, mas que não foi disseminado; por outro, permitir que a comunidade oriente investigação que dê resposta às necessidades dessa prática.

Os resultados desta investigação abrem diversas linhas de investigação a aprofundar, tais como:

1. Demonstrar as mais-valias económicas a longo prazo da aplicação de boas práticas de reabilitação (retorno de investimento, durabilidade e custos de manutenção);
2. Avaliar o impacte da exposição às boas práticas qualificação dos promotores;
3. Quantificar os benefícios da reabilitação e das técnicas tradicionais para a redução dos impactes ambientais associados à construção;
4. Demonstrar o contributo das técnicas artesanais com recurso a materiais naturais para o conforto e saúde dos ocupantes;
5. Desenvolver ferramentas multicritério para apoio à tomada de decisão, considerando não só o fator económico, técnico e o valor patrimonial, mas também o impacte ambiental, a saúde dos habitantes e o tipo de utilização dos lugares a preservar.

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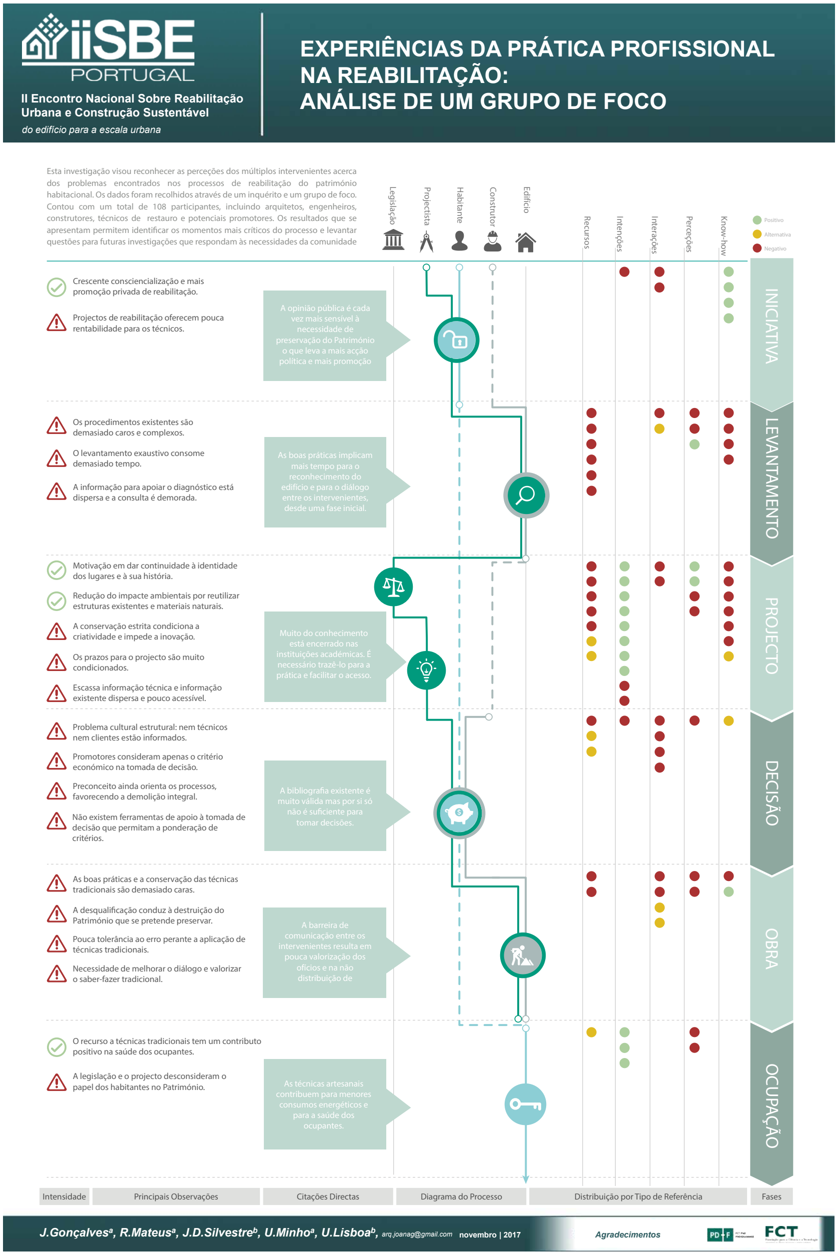
Analysis of the focus group: poster (PT)



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Appendix D

The role of the developer in the quality of urban requalification interventions (PT)

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O PAPEL DO PROMOTOR NA QUALIDADE DAS INTERVENÇÕES DE REABILITAÇÃO URBANA

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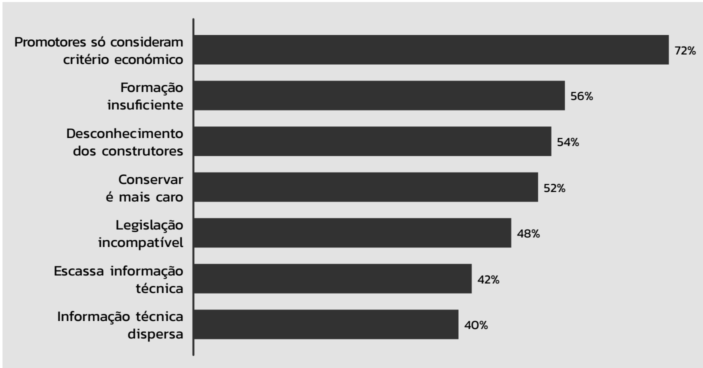
As estatísticas recentes não deixam margem para dúvidas quanto ao crescente investimento no sector da reabilitação. O desafio que agora se coloca é o de compreender em que medida esse crescimento tem sido acompanhado por um acréscimo da qualidade das intervenções, entendida num sentido holístico – o bem-estar e qualidade de vida dos habitantes, o contributo para a cidade, o impacte no meio ambiente e o respeito pelo valor patrimonial dos conjuntos históricos urbanos.

FIGURA 1
PRINCIPAIS PROBLEMAS IDENTIFICADOS PELOS INQUIRIDOS



O Barómetro da Reabilitação Urbana, de dezembro de 2017, registou um incremento de 3,6% do nível de atividade das empresas do sector da construção no mercado da reabilitação, acompanhado de um muito expressivo aumento da Carteira de Encomendas, na ordem dos 32% (AICCOPN, 2017). Também o Sindicato da Construção Civil afirma que o número de postos de trabalho associados à reabilitação mais do que duplicou entre 2016 e 2017, passando de 6 mil para cerca de 15 mil (Lusa, 2017).

O desafio é compreender o crescimento da reabilitação tem sido acompanhado por um acréscimo da qualidade das intervenções.

Apesar do evidente crescimento económico, não é certo que outros indicadores de desenvolvimento tenham acompanhado estas tendências. Ao mesmo tempo que os valores de venda dos imóveis dispararam atingindo, em alguns locais, valores acima dos 5.000 €/m² (Ci, 2017)b, tornando as cidades "inacessíveis não só à maioria dos portugueses, mas também a mercados emergentes" (LaSalle, 2017), discute-se a gentrificação, a exclusão social e a perda de urbanidade gerada pela aposta monofuncional no mercado turístico. Enquanto o montante de investimento mais do que triplicou desde 2015 (Ci, 2017)a, o Sindicato da Construção Civil aponta a falta de mão-de-obra qualificada em Portugal e afirma que "75% da atividade é trabalho precário" (Lusa, 2017). No período de 6 anos, desde 2011, o mercado valorizou em cerca de 95,3% no Centro Histórico do Porto (Ci, 2017) mas, ao mesmo tempo que as intervenções se centram na herança da cidade histórica, "as boas práticas de reabilitação não estão suficientemente difundidas" (Cóias, em Pedro, 2017).

As intervenções de reabilitação urbana envolvem a participação de múltiplos intervenientes, entre os quais o promotor que é, provavelmente, o mais influente. É ele que estipula os objetivos da intervenção, o montante de investimento e os prazos de execução. É, em última análise, o responsável final pelas decisões tomadas (dentro dos limites legais). A qualidade da reabilitação urbana depende, assim, da sua capacidade de tomar decisões fundamentadas e, sobretudo, de assegurar um nível de exigência adequado à complexidade dos trabalhos de intervenção neste Património.

Quando questionados acerca dos problemas e barreiras à aplicação de boas práticas na reabilitação, os projetistas tendem a apontar o dedo aos promotores. No inquérito realizado, entre 20 de março e 12 de abril de 2017, a arquitetos envolvidos em projetos de reabilitação de edifícios de habitação, 72% indicam como principal problema o facto de os promotores só considerarem critérios económicos na tomada de decisão (figura 1), desconsiderando os valores patrimoniais (Gonçalves *et al.*, 2017).

A análise qualitativa das perceções dos participantes neste inquérito e num grupo de foco (Gonçalves et al.,2017), demonstrou que, de entre as oito classes de problemas identificadas (tabela 1), quatro podem ser relacionadas, direta ou indiretamente, com os promotores: as questões económicas, sociais, de tempo e de utilização.

A qualidade da reabilitação urbana depende da capacidade que o promotor tem de tomar decisões fundamentadas e assegurar um nível de exigência adequado à complexidade dos trabalhos de intervenção neste Património.

Ao considerar apenas o valor de investimento inicial na tomada de decisão, o promotor contribui para a implementação de uma cultura de imediatismo que favorece o mais barato e a falta de responsabilização. Ao mesmo tempo, desconsideram-se fatores essenciais à análise da sustentabilidade económica do investimento ao longo do seu ciclo de vida: os custos de utilização e de manutenção. Ignorando os custos de utilização nas tomadas de decisão poderá ainda estar na base de outras consequências como, por exemplo, comprometer a possibilidade de os utilizadores manterem o ambiente interior dos edifícios dentro dos parâmetros aceitáveis de qualidade, o que, por sua vez, poderá comprometer o seu conforto e saúde.

TABELA 1 – CLASSES TEMÁTICAS DE PROBLEMAS IDENTIFICADOS PELOS INQUIRIDOS (ORDENADAS POR FREQUÊNCIA E INTENSIDADE)

Tema	Descrição
Informação	Informação existente para apoiar o dia-a-dia da prática profissional
Economia	Questões económicas, como o custo e o valor de investimento
Social	Aspetos culturais da comunidade que condicionam a tomada de decisão
Qualificação	Problemas estruturantes na formação da comunidade técnica
Tempo	Preocupações acerca dos prazos e duração das tarefas
Utilização	Utilização e papel dos habitantes na fase pós-ocupação
Património	Preservação do valor patrimonial dos edifícios
Ambiente	Impacte na sustentabilidade ambiental do meio edificado

FIGURA 2 – PERCENTAGEM DE INQUIRIDOS QUE REALIZAM PROCEDIMENTOS DE INSPEÇÃO E DIAGNÓSTICO E RAZÕES PELAS QUAIS NÃO O FAZEM

A redução exagerada ou forçada dos valores de investimento traduz-se na redução dos valores disponíveis para honorários e leva a que os projetistas considerem que "os projetos de reabilitação oferecem pouca rentabilidade", ameaçando a viabilidade do sector de projeto.

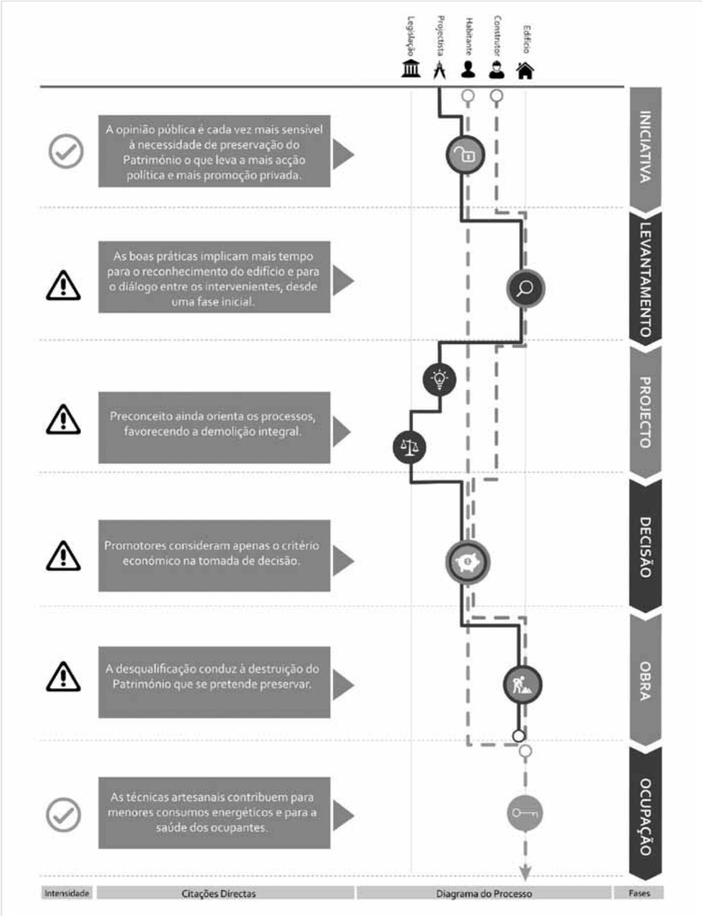
Esta opção traz implicações ao nível da qualidade técnica das intervenções. Cerca de 54% dos projetistas que admitem não realizar os necessários estudos de inspeção e diagnóstico do edifício existente apontam como principal razão a disponibilidade financeira limitada (figura 2). Mesmo quando este procedimento é realizado, é considerado demasiado caro para 45% dos inquiridos.

Na fase de obra, a conservação das técnicas artesanais acaba frequentemente por não ser considerada, uma vez que na opinião de 50% dos inquiridos é mais cara do que a prática corrente, por exigir mão-de-obra qualificada. Assume-se então, por princípio, que a prática corrente para a intervenção em edifícios com valor patrimonial é apoiada em mão-de-obra precária.

Outra das preocupações recorrentes dos técnicos prende-se com o tempo dedicado aos projetos. Os prazos, muito condicionados, não permitem aplicar boas práticas consideradas demoradas ou pesquisar informação para fundamentar a decisão. Condicionam também o trabalho de levantamento e análise do edifício existente e a procura de soluções técnicas mais adequadas à sustentabilidade do edificado. Além disso, limitam a possibilidade de diálogo entre os diferentes intervenientes, a valorização das competências profissionais e a consideração da experiência dos artesãos envolvidos nos processos.

As restrições orçamentais e de tempo levam, frequentemente, a intervenções que favorecem a demolição integral do interior dos edifícios, no sentido de reduzir o risco de imprevistos em obra (razão apontada por 41% dos inquiridos). Para os técnicos que reconhecem que o valor patrimonial dos edifícios reside "na inte-

FIGURA 3 – INFOGRAMA COM AS PERCEÇÕES DOS PARTICIPANTES EM RELAÇÃO ÀS DIFERENTES FASES DO PROCESSO DE REABILITAÇÃO



gridade de todos os seus componentes, como um produto único da tecnologia de construção específica do seu tempo e local" (ICOMOS, 2003), esta é uma opção perigosa que ameaça "destruir o que se pretende conservar", ao eliminar os elementos que tornaram este património atrativo em primeiro lugar.

Mas as consequências podem ser também mais concretas para o investimento do promotor. A ausência de levantamento prévio e o desconhecimento da condição real do edifício gera atrasos na obra devido ao aparecimento de situações imprevistas, incompatibilidades entre o projeto e a construção por erros de dimensionamento, aumento de custos devido à substituição de elementos construtivos e materiais que poderiam ser reaproveitados, e até alterações profundas ao plano de investimento, por não ser possível cumprir o programa proposto.

A longo prazo as decisões fundamentadas refletem-se em investimentos mais consistentes e objetivos.

A falta de tempo para o planeamento conduz a frequentes falhas na compatibilização entre projetos de arquitetura e de especialidades e à falta de pormenorização das soluções construtivas, implicando que situações que poderiam (ou deveriam) ser antecipadas na fase de projeto tenham que ser decididas em obra, com soluções imediatistas ou provisórias que levam a derrapagens orçamentais e que não resolvem os problemas de modo definitivo ou podem mesmo agravá-los.

Em conclusão, este estudo demonstra que, apesar do crescente investimento no sector da reabilitação, os participantes consideram que existe uma falta de qualificação generalizada dos intervenientes (técnicos, construtores e promotores), acentuada pelo problema cultural do imediato e do mais barato (figura 3). A lacuna de informação e formação dos diversos intervenientes conduz a decisões baseadas unicamente no valor do investimento inicial, desconsiderando outros critérios relevantes: os impactes no meio ambiente e na saúde dos ocupantes, o conforto e eficiência energética, os custos de manutenção e a autenticidade do património. Como consequências imediatas destes problemas, encontram-se as incompatibilidades e imprevistos em obra, atrasos e aumento dos custos. Num prazo mais dilatado do que o imediato, estas práticas ameaçam a qualidade do sector da construção, comprometem o conforto na fase de utilização e mesmo a rentabilidade do investimento do promotor, por não ser garantida suficiente flexibilidade para acompanhar as transformações do mercado.

A responsabilidade é partilhada. Implica que todas as partes assumam um papel atuante. Cabe ao promotor informar-se e exigir ser informado, com respeito pelos tempos e competências de cada interveniente. A longo prazo as decisões fundamentadas refletem-se em investimentos mais consistentes e objetivos. Ganha assim a qualidade da reabilitação urbana e a competitividade do sector. Ganham os habitantes e ganhamos todos uma cidade que alia de modo equilibrado o seu passado, presente e futuro.●

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Appendix E

Comparative analysis of inspection and diagnosis tools for ancient buildings

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Introduction

In the recent history of built heritage preservation, there is a constant concern for the prior understanding of the building, through historical analysis and state of conservation assessment (Viollet-le-Duc, 1873; Boito, 1893; Giovannoni, 1924; League of Nations, 1931; ICOMOS, 1964, 2003). The evolution of thinking on this issue has essentially two vectors: on the one hand, the extension of the concept of heritage to entire groups of buildings and historical towns (European Council, 1975; UNESCO, 1976; ICOMOS, 1987); on the other hand, the technological progress, which introduces new tools that empower more detailed forms of survey.

The international document that most emphatically expresses the “principles for the analysis, conservation and structural restoration of architectural heritage” was presented by ICOMOS in 2003. It intends to “ensure rational methods of analysis and repair methods appropriate to the cultural context” (ICOMOS, 2003). It recommends diagnosis based on qualitative approaches – i.e. historical information, direct observation - but also quantitative, through trials and monitoring.

New technologies have followed the need to gather more information about the building, without, however, eliminating it. Recent literature includes studies about the development of computer tools to support technicians in the inspection procedure

(Caccioti & Valach, 2015), the use of laser scanner and photogrammetry for detailed survey of historical build-ings (Haddad, 2013; Balzani & Maietti, 2015), the non-destructive analysis of old struc-tures through digital images and thermography (Moropoulou, Labropoulos, Delegou, Karoglou, & Bakolas, 2013), and the development of integrated methodologies for the trans-position of data collected for parameterized three-dimensional models (Li, Liu, Wang, Wu, 2015). In common, all these studies confirm the survey as an active process of selection, essential for weighted decision-making. These studies and methodologies are, however, predominantly oriented to intervention in monuments, although several authors emphasize their importance in residential buildings, to preserve the authenticity of ancient historical urban fabrics (Appleton, 2011; Cóias, 2009; 2017).

According to Vítor Cóias, president of the Heritage Guild of Portugal, “good rehabilitation practices are not sufficiently widespread, although the necessary know-how is available” (Pedro, 2017). A survey to practitioners in Portugal (Rehab 2017) concluded that in historical residential buildings, there is low budget and time available to resort to the cur-rent detailed methods of inspection and diagnosis. This problem is exacerbated by the scarcity of technical information and its dispersion, making it difficult for technicians in-volved in the process. Only 74%% of the respondents perform regular inspection of the state of conservation, with procedures that are not very objective since they are based pre-dominantly on photographic record and on previous experience of the technicians.

This research presents a comparative analysis of international methodologies to support inspection and diagnostic procedures in heritage buildings. It is aimed to systematize its characteristics and understand the potential of application in professional practice according to the needs expressed in previous studies (Rehab 2017, RUCS).

Methodology

With the defined aim, a qualitative methodology was used, focused on bibliographical sur-vey and comparative analysis of the most relevant methods used in Portugal and internationally.

In the literature review the tools were selected considering three criteria:

- Tools most used in professional practice by technicians in Portugal (Gonçalves et al., 2017)
- Tools most prominent in international scientific literature
- International tools aimed at practical conservation

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For each criterion, two tools were considered. Only methods that have identical characteristics were considered: evaluation based on visual inspection and focus on buildings with heritage value. Thus, expert-systems not oriented towards heritage rehabilitation (Brito, year) or that have already been the subject of previous studies were excluded from this analysis. (Ferraz et al., 2016).

In the comparative analysis, the medium and format of the information, the type of building, the stage of intervention, the end-users, and the deliverables resulting from the application of the tool were considered as key variables.

Tools to support building inspections and diagnosis

In this section we present the characterization of the analysed tools, contextualizing their scope and aim. As described in the Methodology, 8 tools to support inspection and diagnosis were analysed – 2 in each selection criterion, as described in Table APP.E.1.

TABLE APP.E.1 Inspection and diagnostic support tools analysed

Criteria	Tool	Country	Author	Year
Identified by Portuguese professionals	Reabilitação de Edifícios antigos	Portugal	Appleton	2003-2011
	Método de Avaliação do Estado de Conservação de Imóveis (MAEC)	Portugal	LNEC	2007
Scientific Literature	Monument Diagnosis and Conservation System (MDCS)	Netherland	?	1995-Now
	Monument Damage Ontology (Mondis)	Rep. checa	Caccioti et al.	2013-2015
International Practice	Faith in Maintenance - Maintenance Co-operatives Project (FiM/MCP)	United Kingdom	SPAB	2007-2017
	Caring for your Home	United Kingdom	IHBC	2016

Reabilitação de Edifícios Antigos (Appleton, 2011)
The book Reabilitação de Edifícios Antigos – Rehabilitation of Ancient Buildings (Appleton, 2011) is one of the publications most consulted by Heritage professionals in Portugal (Rehab 2017). It was first published in 2003 and reissued in 2011, with the main goal of "contribute to the formation of the national technical environment and to make a more efficient and widespread dissemination of information on architectural heritage" (Appleton, 2011).

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It is a technical publication that gathers and describes the main constructive defects, relating them to possible causes and intervention criteria. It is specifically oriented to intervention in ancient buildings, defined as those “built before the advent of concrete as a dominant structural material (...) thus resorting to traditional materials and technologies for the construction” (Appleton, 2011).

In addition to the technical characterization of the defects, it incorporates an example of a preliminary diagnostic report, which acts as a guideline for professional practice.

Método de Avaliação do Estado de Conservação (MAEC)
Between 2003 and 2010, the National Laboratory of Civil Engineering (LNEC) developed in Portugal different methods of evaluation of the building’ state of conservation, aiming to “support the implementation of public policies for the rehabilitation of building stock” (referência): Method of Certification of Habitability Conditions, the Method of Evaluation of the State of Conservation of Buildings (Método de Avaliação do Estado de Conservação - MAEC), and Method of Assessment of Rehabilitation Needs.

Although it was not specifically developed for use in buildings with a heritage value, the use of MAEC is highlighted by Portuguese professionals in the rehabilitation sector (Rehab 2017).

Consisting of an inspection form and a supporting glossary, this method aims at “rigor-ously, objectively and transparently determining the state of conservation and the existence of basic infrastructures in building units”. Published as a legal instrument, its application is mandatory in the Portuguese context only under the Portuguese Urban Renting Regime (reference), to determine the updating of the value of rental agreements.

Monument Diagnosis and Conservation System (MDCS)
The online platform Monument Diagnosis and Conservation System is an expert system and decision support tool, oriented to Heritage professionals, “meant to furnish a support during inspection aiming at assessing the type and severity of the damage found” (Naldini).

It is the latest version of a project started under the European program E.C. Environ-ment R & D in 1993 (Comissão europeia), including international partners of Katholieke Universiteit Leuven, Politécnico di Milano, TNO Building and Construction

Research e Technische Universität Hamburg. Then called Masonry Damage Diagnosis System (MDDS) aimed “bridging the gap between scientific information and application of it in the field of architectural conservation” (van Balen, 2001). It brought together uniform terminology for the types of damages and its origins in the “Atlas of Damage to historic brick structures” and created the possibility of identification through the computerized questionnaire in a di-agnostic system (van Balen, 1995).

Currently, the software accessible through the website http://mdcs.monumentenkennis.nl/, created by Auxilium, supports content developed by experts from TNO, TU Delft and RCE, with more information about historical structures, including brick, natural stone structures, mortars, plaster and structural damages (site).

Monument Damage Ontology (Mondis)

The Mondis System – Monument Damage Ontology, was developed by Cacciotti, Blasko and Valach between 2012 and 2015, in a project funded by the Ministry of Culture of the Czech Republic, “aimed at enhancing data sharing and access, and integration of existing digital systems” (Caccioti et al, 2013) in the field of immovable cultural heritage. It is an Information System centred on the diagnosis of damage to historical constructions, “ena-bling professionals to document, understand and consequently to intervene more appro-priately” (Caccioti et al, 2014).

The fully computerized system consists of a series of tools oriented to the introduction, edition and consultation of information by professionals. It includes a mobile application for data entry during on-site procedures and an online platform where users can consult information about the terminology used as well as possible solutions to the problems iden-tified (Caccioti et al, 2015).

Despite the advantages of this tool to ensure “user accessibility, the reliability of con-tents and possibility of integrating other information systems already existent in the do-main” (Caccioti et al, 2013), after the end of the project the online platform is no longer available (consulta de 2017).

Faith in Maintenance – Maintenance Co-operatives Project (FiM/MCP)

When in 1877 William Morris stated, “an association should be set on foot to keep a watch on old monuments, to protest against all ‘restoration’ that means more than keeping out wind and weather” (carta do Morris), exalting the need for a culture of preventive mainte-nance of monuments, launched the foundations of the Society

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for Protection of Ancient Buildings (SPAB), in United Kingdom. More than 100 years later, SPAB remains one of the most important international associations in Build Heritage safeguard (Black, 2017).

It was in this role that, in 2007, SPAB promoted the project Faith in Maintenance (FiM), aimed at safeguarding religious buildings, followed by the project Maintenance Co-operatives (MCP), with the main goal of "connect, encourage and support people who care for their local places of worship" (Toolkit introduction).

To contribute to a "more systematic informal inspections and routine maintenance of places of worship" (reference) these projects developed for the non-professional commu-nity an online toolkit with resources such as baseline survey templates, instructions for as-sessment and a glossary of historic buildings terminology.

Caring for your Home

Caring for your Home is an online platform aimed at homeowners of traditional buildings, defined as "those built using local, indigenous building materials by craftsmen" (site). It was developed in 2016 by the Institute of Historic Building Conservation (IHBC), the "professional body for building conservation practitioners and historic environment ex-perts working in the United Kingdom" (site IHBC). This tool is "intended to explain why maintenance is so worthwhile and help owners to look after their homes".

It gathers information in accessible language on the characteristics of traditional build-ings, with instructions for periodic inspections organized by building elements and materi-als, as well as recommendations for maintenance interventions.

Comparative analysis

The tools to support inspection and diagnosis described above were analyzed comparative-ly, considering: medium (form of storage by which information is communicated); format (defined structure for processing and display data); type of buildings, end-user, and stage of the intervention for which they are intended; and deliverables (results obtained with the procedure). The comparative analysis is presented in Table APP.E.2.

TABLE APP.E.2 Comparative analysis of key-parameters

Tool	Medium	Format	Type	End-user	Stage
Reabilitação de Edifícios Antigos	Book	N/A	Ancient Buildings	Architects and Engineers	Anamnesis
MAEC	Legal Document	Checklist	Rented Properties	Architects and Engineers	Value Assessment
Mondis	Mobile App	Form	Monuments	Architects and Engineers	Anamnesis
MDCS	Online Platform	Questionnaire	Monuments	Architects and Engineers	Anamnesis
FiM / MCP	Online Toolkit	Questionnaire	Places of Worship	Wardens and caretakers	Periodic Maintenance
Caring for your Home	Online Toolkit	Checklist	Traditional Buildings	Building Owners	Periodic Maintenance

Medium

Considering the medium in which information is stored, it is possible to verify the pre-dominance in the last decade of the adoption of digital technologies as a tool to support professional practice. Despite the predominance of computer support, it is possible to dis-tinguish different approaches and levels of digitalization: totally digital systems; systems based on the dissemination of information in digital media and non-computerized systems.

MDCS and Mondis are fully digital systems whose inspection procedure is based on the automation of information in databases. Appleton’s reference work is the only fully non-computerized tool. Although the Faith in Maintenance project has also resulted in the pub-lication of a handbook for caregivers, this support does not exclude additional computer-ized possibilities.

FiM and Caring for your Home are platforms that gather and make available information online, even though the procedure relies mainly on filling in paper forms (not automated). Also, the MAEC can be considered in this group since although published in legal diploma the documents of support are made available online and accessible in PDF format.

FiM and MAEC have in common the attempt to bridge the gap between non-digital sys-tems and fully digital systems, including in their approach physical information, but also tools for automated weighting (excel sheet in the case of FiM and online simulator in the case of the MAEC). These procedures are, however, more simplified than the overall pro-cedure provided for in each methodology.

Format

In the analysis of the format, it was considered how the information is structured, to sup-port the end-user during inspection procedures. It was possible to distinguish three ap-proaches: checklists, forms and questionnaires. The checklist format includes methods that are based on checking elements in a predefined list; in the forms are considered the methods that include the possibility of field selection and filling; in the questionnaires, the inspection is carried out by answering objective questions (Yes or No answers).

The book Reabiltação de Edifícios Antigos does not provide any practical tools to sup-port inspection, and therefore this field was considered not applicable.

The checklist format sets out a method for the inspection, guiding the sequence of pro-cedures to be adopted in-situ. However, the ability to identify and describe anomalies is dependent on the user's technical competencies. In computerized forms such as Mondis, this problem is minimized by limiting the user to the selection of previously standardized possibilities, depending on materials and building elements. It also has the advantage of providing specific information for each case, at the exact moment of the inspection.

The questionnaire format is what most effectively eliminates the inspector's subjectivi-ty, as evidenced in the MDCS expert-system. It determines the defect by means of objec-tive, closed-ended questions that reflect only the visible reality and not the user's technical knowledge in formulating hypotheses.

Type of Building

The majority of the analysed methods are oriented to the inspection and diagnosis of the state of conservation in buildings with heritage value. The main exception is the MAEC, "designed to be applied to buildings of any construction period" (Pedro et al, 2012). For the adaptation of the method to historical buildings, Pedro et al. (2012) suggest that the in-spection parameters should also consider "the heritage value of each functional element af-fected", however, the way of doing so is not clearly defined.

The Mondis and MDCS tools, while including in their designation the expression "Mon-ument", present a broad view of the concept reflecting an increasing "interest in monitoring and follow-up of the state of conservation of historic structures and more ordinary build-ings in historic towns" (Van Balen, 2001).

End-user

In relation to the end-users of the analysed tools, it was possible to distinguish two differ-ent approaches: tools aimed at the technical community - with the designation expert sys-tem - and tools directed to the non-technical community – to guide caretakers and home-owners.

In the second group are the toolkits developed by professional associations of heritage protection, aimed at contributing “enhance the skills expertise and personal development of volunteers” in Heritage preservation (FiM, 2007).

In the remaining tools, there is a concern to make inspection procedures accessible in everyday professional practice, as expressed by van Balen (2001): “technicians, architects, engineers should be helped in executing correct analysis of the major part of (simpler) damage cases, leaving the more difficult and special cases to the smaller group of leading professionals”.

Stage of Intervention

It is possible to distinguish the tools analysed in two groups in relation to the stage of the intervention for which they were developed: anamnesis and periodic maintenance. Anam-nesis designates the stage of investigation and diagnosis that must precede any intervention in Built Heritage. It consists, as defined by ICOMOS (2003) in the collection of infor-mation “on the structure in its original and earlier states, on the techniques that were used in the construction, on the alterations and their effects, on the phenomena that have oc-curred, and, finally, on its present state”.

The tools developed to support periodic maintenance are distinguished from the former by aiming above al “a set of simple but effective tasks” (SPAB toolkit), that “carried out on a regular basis can safeguard the condition of a building, while failure to identify problems early enough can lead to major faults developing” (IHBC).

The main exception to these two classifications is the MAEC, which was developed with the purpose of determining the real estate value of housing units. This classification does not, however, invalidate that the same tools can be used in different phases of rehabilita-tion processes, namely to “verify the need to carry out maintenance / repair interventions, to support the definition of the value of the property in real estate transactions, to evaluate property damage due to unforeseen actions and to inform the preparation of preventive maintenance programs” (Pedro et al., 2012), among other situations that may be necessary to support decision-making on interventions in the building.

Deliverables

The application of the procedures of the methodologies analysed results in different types of information for the user: defect diagnosis, summary of condition, priority weighting and possible remedies, as shown in Table APP.E.3.

TABLE APP.E.3 Outputs of each tool

Tools	REA	MAEC	Mondis	MDCS	FiM/MCP	CYH
Support defect diagnosis	X	X	X		X	X
Automated Defect Diagnosis				X		
Summary of Condition		X			X	
Priority Weighting			X		X	X
Possible Remedies	X		X			

The diagnosis of the identified damages can be supported by complementary literature, through glossaries, such as the Appleton technical book or the MAEC support glossary. In the case of Mondis and Caring for your Home, the identification of defects is supported by pre-defined lists associated with the different building elements.

With a different approach than the previous, the MDCS expert-system automatically de-termines the defect identified - not depending on the technician's subjective judgment ca-pacity, which is directly related to the questionnaire format described earlier.

The MAEC and FiM / MCP tools allow obtaining a summary of condition of each build-ing element's conservation status. In MAEC it is also possible to associate each element with a weighting factor for the determination of the overall conservation status of the build-ing.

Also using the weighting factors, the Mondis, FiM / MCP and Caring for your Home tools make it possible to prioritize conservation interventions after inspection. The priority can be determined qualitatively by the user, classifying it as "high" or "low", as in the case of the checklist Caring for your Home; related to a timescale for the intervention ("attention within 12 months" or "18 to 24 months", for instance) according to the predetermined weight of the damage identified, as in the FiM's baseline survey; or related to a numerical scale depending on the damage and the affected element, as in the case of Mondis.

Less frequently the diagnostic tools analysed advance with possible interventions to solve the identified problems, through complementary literature such as the book Reabili-tação de Edifícios Antigos, or through the computerized knowledge matrix that relates causes and remedial actions, in the Mondis tool.

Discussion

The analysis of the selected methodologies allowed to deepen the knowledge about the available tools to support the professionals in the inspection and diagnosis of the state of conservation in ancient buildings with heritage value. These tools show that “while in building rehabilitation, each case is a unique case, the majority of occurrences of defects in non-structural elements can be solved in a systemic way” (Ferraz et al., 2016).

Unlike the Building Inspection Systems previously analysed by Ferraz et al. (2016), that “have a similar organization but none are entirely devoted to on-site intervention”, the sys-tems analysed in this research have in common the aim of developing practical tools capa-ble of communicating scientific knowledge to daily professional practice. The methodolo-gies developed by the English conservation associations (SPAB and IHBC) are the most il-lustrative of this concern because they are created for the common domestic user. Due to its simplified structure and accessible language - to guarantee the possibility of use by owners and caretakers – they are “an effective support system in order to provide readily and freely accessible information across the range of media to assist volunteers in the care of the fabric of places of worship and their contents” (SPAB). They demonstrate that it is possible to systematize tools that are sufficiently expeditious for daily practice, performing the inspection of the conservation status to inform decisions, even with few economic re-sources and little availability of time – the two main reasons pointed out by professionals in Portugal not to perform this procedure (rehab 2017). The conclusions of the Mainte-nance Co-operatives Project point to “an increased community awareness of the importance of maintaining historic places” (SPAB 2), showing that “increase the number of persons to execute general monitoring of historic buildings” may led to “a shift toward maintenance type interventions on historic buildings instead of more “heavy” restoration interventions” (van Balen, 2001), as aimed by the team working on the MDCS expert system.

The tool MDCS was at the beginning of the project considered “very innovative”, for being intended “to develop through scientific research a useful tool directed to possible end-users” (van Balen, 2001). This tool differs from other Building Inspection Systems, such as the Construdoctor (Ribeiro and Cóias 2003) and

Building Medical Records (Chang and Tsai 2013) analysed by Ferraz et al. (2016), which, despite providing a diagnosis online, depend on the analysis of "experts in building pathology and rehabilitation" with-out an "an actual visit from an engineer to the building" (Ferraz et al.2016). Although they support the pre-diagnosis of the building's conservation status, these tools are not really information systems or expert systems, understood as the transposition of "expertise into a computer system" (van Balen, 2001).

Despite the growing interest in computerization of systems, this is not yet a reality: it is often based on the provision of static online information or complementary tools, but not the entire method. As already described by Ferraz et al. "various pathology catalogues are accessible through a website, from where the pathology files may be downloaded or print-ed", and contribute to a greater dissemination of information, but are not enough "to pro-vide users with an expedited solution to their needs" (Ferraz et al, 2016). In other cases, such as with Mondis, despite the initial investment in the development of the systems, they still do not reach the professionals because of insufficient disclosure or lack of commer-cialization.

Most of the methods are based on the structuring of data in glossaries that support the filling of forms or checklists. Compared to the previous analysis by Ferraz et al. (2016), it is verified in the analysed tools a greater predominance of the checklist format, to ease the acquisition of data in-situ. Despite the different typology and focus in the maintenance stage, the Maintainability website (2010), highlighted by these authors, structures the con-tents in a similar way to the MDCS tool, including a "defect database classified according to various materials", where "users are encouraged to find a diagnosis based on images" (Ferraz et al.,2016).

According to these authors, the absence of statistical correlation "between defects and maintenance, diagnosis, and repair techniques", makes the diagnosis "clearly dependent on the inspector's experience" (Ferraz et al., 2016). The subjectivity of the decisions based on the individual knowledge of the technicians is one of the most evident concerns in the tools analysed in this research. Although none of the analysed methods use the statistical correlation proposed by Ferraz, it was verified that the questionnaire format contributes most to the objectivity of the results, since it depends only on the direct, concrete and measurable observation. On the other hand, the forms with automated filling of standard fields have the advantage of making data more easily accessible in on-site operations, adapted to the circumstances and immediate needs of technicians.

The tools most used by Portuguese professionals - Appleton and MAEC - are still pre-dominantly non-computerized, explaining the difficult access to information signalled by the technicians and the poor efficiency identified in the research, identified by the techni-cians (Rehab 2017). Nevertheless, considering that the typology depends on temporal and geographic context, these tools, such as Reabilitação de Edifícios Antigos (Appleton, 20 ...; Freitas, 201.., Teixeira, 2014), remain the only ones adapted to the constructive reality of ancient buildings in Portugal, and that is why the professionals interviewed are positive about finding the information they seek in these databases (Rehab 2017). Crossing the in-formation gathered in these databases with technologically more advanced models such as those identified in the literature (references), would make research more effective and re-duce the problem of scattered information and the gap in technical knowledge (Rehab 2017). It would be possible to increase the accuracy of inspections without significantly increasing the complexity of the procedures: maintaining the predominance of photo-assisted visual inspection, without intrusive techniques or costly equipment and proce-dures.

One of the most critical points for professionals involved in the inspection and diagno-sis of the state of conservation of buildings is that this procedure is considered without consequence in the project results (Rehab 2017). By including the possibility of weighing the priority of the intervention as well as information on the possible conservation actions to be taken for each damage, some of the tools analysed are more than information bases, constituting systems to support decision making. Deliverables that are useful in the deci-sions respond to the needs expressed by the technicians and make the inspection process imperative to the project.

Conclusion

The purpose of this study was to analyze comparatively different methodologies of inspec-tion and diagnosis for Built Heritage. The literature review identified different approaches to the subject: databases, legal documents, computerized expert-systems and toolkits for the non-technical community. In common, these tools rely on visual, expeditious and cost-effective inspections.

Databases and glossaries gather scattered technical information but are not sufficient to support in-situ procedures. Checklists, forms, and questionnaires can be used during the fieldwork to guide the technicians and reduce the subjectivity of the inspection.

Implement the technical expertise in computerized systems favors the dissemination of information accessibility in real time and allows for more rigorous evaluations, less de-pendent on the user's individual experience. Linking these systems with information about intervention priorities and remedial solutions makes them more than information catalogs, becoming decision support tools.

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This paper demonstrated that the main problems pointed out by technicians in previous studies - expensive, time-consuming, inconsequential procedures and dispersed infor-mation - find a solution in structuring information in computer systems. However, these only remain valid if adapted to the different geographic and temporal contexts.

Future research may contribute to the development of a methodology that brings together the added value identified in the different models, consolidating a tool that allows in a sim-ple but objective way to diagnose the state of conservation of buildings with heritage value and to support the decision making regarding the intervention.

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Appendix F

Sustainability in the valorisation of built heritage (PT)

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Sustentabilidade na valorização do património construído

É tempo de lançar um novo olhar sobre o edificado histórico, salvaguardando o saber acumulado ao longo de séculos na interação e adaptação ao meio ambiente, como um valor patrimonial a preservar.

O PAPEL DO PATRIMÓNIO PARA O DESENVOLVIMENTO SUSTENTÁVEL

O início do século XXI veio acompanhado de uma maior consciencialização sobre os perigos da sociedade de consumo, não apenas ao nível económico, com as constantes oscilações dos preços dos produtos e dos mercados financeiros internacionais, mas também no que ao ambiente diz respeito. A indústria da construção é uma das mais representativas na economia mundial, mas também a que está associada a maiores impactes ambientais, com mais emissões de carbono e consumo de matérias-primas. Para além disso, na Europa, as áreas urbanas concentram cerca de 80 % da população e consomem entre 60 % a 80 % da energia produzida.

Em 1987, o Relatório Brundtland define desenvolvimento sustentável como "o desenvolvimento que satisfaz as necessidades atuais sem comprometer a capacidade das gerações futuras para satisfazerem as suas próprias necessidades". A partir desta definição, a relação entre Sustentabilidade e Património torna-se mais evidente: Património, no seu sentido literal, remete também para o legado deixado às gerações vindouras, no sentido de herança construída. Desta forma, o conceito de património apresenta um vínculo com o futuro tão ou ainda mais forte do que com o passado, já que importa preservar a sua continuidade, assegurando a sua transmissão às gerações futuras.

Apesar desta relação entre os dois conceitos, apenas em 2011, a publicação dos "Princípios para a Gestão e Salvaguarda das Cidades Históricas e Áreas Urbanas", pelo ICOMOS, articula a questão do desenvolvimento sustentável com os princípios de salvaguarda do património histórico, em recomendações largamente aceites internacionalmente. Este documento reconhece que a necessidade de limitar a expansão urbana tem contribuído para uma maior atenção devotada aos centros históricos urbanos.

Mais recentemente, os objetivos para o desenvolvimento sustentável adotados pelas Nações Unidas na Agenda 2030 salientam a importância do património para meios urbanos mais inclusivos, seguros, resilientes e sustentáveis. Na sequência da adoção internacional destes objetivos, a UNESCO tem vindo a promover a integração da perspetiva da sustentabilidade nos processos da convenção para o património mundial, afirmando a importância de reconhecer ao património um catalisador e não uma vítima do desenvolvimento sustentável.

Reconhecendo que o património cultural está integralmente conectado às alterações climáticas, questões energéticas e bem-estar social, o ICOMOS procurou, em 2016, estabelecer princípios concretos de atuação para a integração destas preocupações na valorização e salvaguarda do património. O conceito de património é redefinido, destacando o papel do conhecimento adquirido pela experiência na interação com o território ao longo de séculos. É nesta experiência que reconhece o potencial para retirar ensinamentos para lidar com as alterações climáticas e aumentar a resiliência das comunidades.

Apesar desse reconhecimento, o contributo do património para a sustentabilidade tem sido mais frequentemente analisado na perspetiva do desenvolvimento equitativo, ou seja, no cruzamento das dimensões social e económica, pelos benefícios para a coesão social, criatividade, interesse e atratividade económica e promoção do entendimento entre as comunidades. Ainda que o ICOMOS assuma que a reutilização e reabilitação do património contribui para promover processos circulares importantes para a transição para a descarbonização das economias locais, existe ainda uma lacuna de indicadores concretos que permitam compreender o contributo do património para a dimensão ambiental da sustentabilidade.

Tornam-se, assim, essenciais as ferramentas de avaliação de impacte para o património cultural que demonstrem os benefícios a longo prazo do investimento no património e que possam ser utilizadas na tomada de decisão nas ações de planeamento e gestão.

INDICADORES NA DETERMINAÇÃO DO VALOR PATRIMONIAL

No sector do património, os indicadores têm sido utilizados para a classificação de valores culturais a preservar, tais como a identidade do lugar, autenticidade ou integridade. O alargamento do conceito de património tem sido um resultado

O conceito de património é redefinido, destacando o papel do conhecimento adquirido pela experiência na interação com o território ao longo de séculos. É nesta experiência que reconhece o potencial para retirar ensinamentos para lidar com as alterações climáticas e aumentar a resiliência das comunidades.

direto da extensão de valores considerados pela sociedade ao longo do tempo, até à recente sistematização do conceito de património intangível, pela UNESCO em 2003.
No início do século XX, Alois Riegl (1903) esteve entre os primeiros a utilizar uma abordagem baseada na avaliação de valores aplicada ao património, distinguindo valores rememorativos (antiguidade, histórico e comemorativo) e de contemporaneidade (artístico, de uso e de novidade). Na classificação de património mundial, a expressão "outstanding universal value" (valor universal excecional) considera frequentemente critérios históricos, artísticos, científicos, estéticos ou antropológicos, mas, desde a criação das primeiras diretrizes operacionais em 1977, estes critérios de avaliação têm sido substancialmente expandidos e modificados.

Recentemente, as redefinições do conceito de património fazem com que este tenha deixado de ser entendido como um objeto estático, mas, sim, como um processo social de seleção. Como expressão das crenças e preocupações da sociedade, os valores podem evoluir e mudar ao longo do tempo, sendo específicas dos contextos temporais e espaciais. Segundo vários autores, a característica mais importante dos valores patrimoniais é que estes são sempre atribuídos e nunca inerentes ao objeto patrimonial. As características objetivas (cor, material, antiguidade, etc.) não têm significado cultural em si mesmas, resultando antes da projeção dos processos culturais de aprendizagem e consciencialização. Assim, todas as decisões de conservação resultam da ponderação de valores multidimensionais, expressando um processo de escolha

A falta de indicadores explícitos e objetivos faz com que as decisões de conservação sejam difíceis de compreender e comunicar. Torna-se, assim, fundamental estabelecer modelos que permitam que os dados acerca de valor e significado patrimonial se concretizem em informação concreta e efetiva para apoiar a tomada de decisão.

que não é neutro, ao implicar a aceitação que apenas alguns aspetos serão preservados, em detrimento de outros, em função da narrativa a transmitir às gerações futuras.

A necessidade de reconhecer a diversidade cultural como um aspeto fundamental do património representa uma dificuldade acrescida nas metodologias de avaliação de valores culturais, que têm sido criticadas por condicionar a flexibilidade na abordagem à especificidade de cada caso. No entanto, a avaliação de significado, mesmo que informal, é essencial para a distinção de património. A falta de indicadores explícitos e objetivos faz com que as decisões de conservação sejam difíceis de compreender e comunicar. Torna-se, assim, fundamental estabelecer modelos que permitam que os dados acerca de valor e significado patrimonial se concretizem em informação concreta e efetiva para apoiar a tomada de decisão.

EFICIÊNCIA ENERGÉTICA NOS EDIFÍCIOS HISTÓRICOS

Na última década, o tema da reabilitação sustentável tem sido muito estudado, sobretudo nas tipologias de habitação. No entanto, os estudos mais recentes centram-se essencialmente na questão da eficiência energética, procurando a otimização do edificado existente, maioritariamente construído entre as décadas de 70 e 90 do século XX, para garantir maior conforto com um mínimo custo. Nestes trabalhos, o termo reabilitação assume o carácter de reforma e melhoria técnica das habitações, mas não a vertente de valorização da identidade e memória do edificado, na sua relação com a comunidade.

Noutros casos, a a análise custo-benefício na introdução de medidas de sustentabilidade na construção incide na reabilitação de edifícios antigos, com base na análise de diferentes cenários de reabilitação da perspetiva energética e da sustentabilidade. As conclusões apontam para que os edifícios antigos não se adequam às exigências contemporâneas, nomeadamente no que respeita ao conforto térmico. Do ponto de vista patrimonial, no entanto, não são analisadas as implicações dos cenários de reabilitação mais interventivos no edifício.

Apesar de a reabilitação de edifícios patrimoniais poder contribuir para benefícios económicos, ambientais e sociais, na prática profissional, tende a identificar-se um conflito de interesses entre o valor patrimonial e a aplicação prática dos princípios para a sustentabilidade. Considera-se, por princípio, que a reutilização adaptativa deveria implicar o mínimo no significado patrimonial do edifício, adicionando-lhe valor de contemporaneidade, no entanto, os edifícios tradicionais estão frequentemente sob pressão regulamentar para cumprir com os padrões contemporâneos de sustentabilidade, frequentemente centrados na conservação de energia.

A melhoria do desempenho energético dos edifícios é uma parte importante do EU Energy 2020, no entanto a legislação corrente centra-se no combustível e energia, sem que sejam protegidos os tecidos urbanos, cuja substituição é encorajada quando o desempenho térmico é melhorado. A eficiência energética em edifícios históricos é um campo recente de investigação, mas, considerando a reduzida percentagem que

estes edifícios representam no parque edificado global, esta poderá não ser uma prioridade para fins de desenvolvimento sustentável. Considerando o balanço energético regional, a adoção de medidas de reabilitação energética da pequena percentagem constituída pelos edifícios históricos pode não ser suficiente para justificar alterações inaceitáveis do ponto de vista patrimonial.
No entanto, apesar do aparente conflito de interesses, prolongar a vida de um edifício existente através da sua reutilização pode reduzir o consumo de materiais, transportes e energia, representando um importante contributo para a sustentabilidade. Além da mais imediata avaliação do desempenho energético dos edifícios, as intervenções sobre o edificado histórico devem ter em consideração os custos de energia ao longo do ciclo de vida, incluindo a energia incorporada e a sustentabilidade, não só do ponto de vista energético, mas também do impacte ambiental incorporado do edifício, uso do solo, água, materiais e saúde dos ocupantes. Isso implica que qualquer intervenção proposta ao edifício deve partir sempre da compreensão dos seus princípios construtivos e funcionamento global.

PATRIMÓNIO SUSTENTÁVEL

A integração de valorização do património nos objetivos para o desenvolvimento sustentável de Agenda 2030 das Nações Unidas veio reforçar a necessidade de ferramentas de avaliação que permitam apoiar a tomada de decisão.
Ainda que as metodologias baseadas na avaliação de valores patrimoniais, desenvolvidas a partir do início do século XX, sejam hoje alvo de críticas devido à sua inflexibilidade, os indicadores são necessários para determinar os limites aceitáveis de mudança nos edifícios históricos. Além disso, permitem identificar e atuar sobre os aspetos negativos e fundamentar a tomada de decisão através de uma linguagem comum aos diferentes intervenientes nos processos de gestão patrimonial.
No que respeita à ligação entre património e sustentabilidade, conclui-se que esta ainda não foi estudada de forma suficientemente abrangente, resultando num aparente conflito de interesse entre a preservação dos valores patrimoniais e os padrões contemporâneos para o desenvolvimento sustentável.
Frequentemente, os edifícios históricos têm sido encarados como fragilidades que devem ser corrigidas para cumprir com os contemporâneos padrões de desempenho e requisitos de sustentabilidade, ou, em alternativa, como relíquias a proteger a todo o custo face às ameaças das alterações climáticas. Perde-se, assim, a oportunidade de reconhecer que o património construído contém valiosas lições para aproximações integradas ao desenvolvimento sustentável.
Assumindo que a atribuição de valor patrimonial é um processo que reflete as preocupações da sociedade do seu tempo e reconhecendo que, cada vez mais, o desenvolvimento sustentável é uma prioridade a nível mundial, é tempo de lançar um novo olhar sobre o edificado histórico, salvaguardando o saber acumulado ao longo de séculos na interação e adaptação ao meio ambiente, como um valor patrimonial a preservar.

Appendix G1

TPB Questionnaire: attitudes, subjective norms, perceived behavioural control, intentions

BETWEEN ASSESSMENT AND DESIGN

Introduction

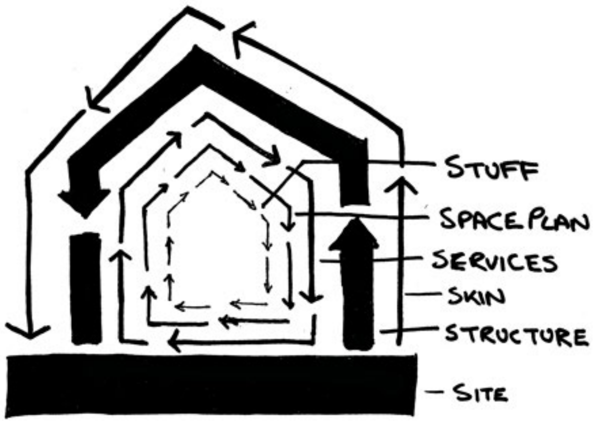
Dear student,

This is an invitation to reflect on your learnings and intentions towards the conservation of certain building attirbutes in the next stage of your design project. That will help you to better understand your own decision process.

Consider your experience and answer ALL questions in specific context of this Studio.

All the data collected in this questionnaire is confidential.

STRUCTURE OF THE QUESTIONNAIRE



This questionnaire is organised according to the seven building layers suggested by Keupers & de Jonge (2017) in **Designing from Heritage**, based on the six shearing layers of Brand (1994). This structure is recommended in the analysis process, since it allows for a gradual approach to the building, from site to spirit of place.

Keep in mind the following concepts:

- **SITE:** relation of the building with the surrounding urban landscape SKIN: the building envelope and interface with the exterior
- **STRUCTURE**: the support construction systems
- **SERVICES**: the infrastructures, such as plumbing, electrical systems, heating and ventilation
- **SPACE PLAN:** the interior layout and distribution of spaces
- **STUFF:** furnishings and furniture
- **SPIRIT OF PLACE:** intangible aspects related to building's meanings over time

What building are you working with?

Demographics

What is your nationality?

[ ]

What is your age?

[ ]

What is your gender?

- Female
- Male
- I prefer not to answer

Are you a student, designer, or other stakeholder?

- Student
- Designer
- Stakeholder (please specify)

Can you indicate in the context of what course you are receiving this questionnaire?

- Minor
- MSc1
- MSc3
- MSc3/4: graduation project
- Other (please specify)

Attitudes

GROUP 1. INTERNAL MOTIVATIONS

In this first group of questions identify the elements of the building that you believe are valuable, based on your analysis in the last few weeks.

In relation to the SITE, **I consider the conservation of the:**

	extremely valuable			worthless
Relation with soil and topography	O	O	O	O
Relation with climate (orientation, sun, wind, rain..)	O	O	O	O
Surroundings and context	O	O	O	O

In relation to the STRUCTURE, **I consider the conservation of the:**

	extremely valuable				worthless
Structural system	O	O	O	O	O
Structural materials	O	O	O	O	O
Structural techniques and detail	O	O	O	O	O

In relation to the SKIN, **I consider the conservation of the:**

	extremely valuable				worthless
Facade	O	O	O	O	O
Roof	O	O	O	O	O
Openings	O	O	O	O	O
Building Shape	O	O	O	O	O
Building Materials	O	O	O	O	O
Building Techniques and detail	O	O	O	O	O

In relation to the SERVICES, **I consider the conservation of the:**

	extremely valuable				worthless
Energy and Heating system	O	O	O	O	O
Ventilation System	O	O	O	O	O
Water System	O	O	O	O	O

In relation to the SPACE PLAN, **I consider the conservation of the:**

	extremely valuable				worthless
Layout and distribution	O	O	O	O	O
Relation with the exterior	O	O	O	O	O
Proportion and scale	O	O	O	O	O

In relation to the SPIRIT OF PLACE, **I consider the conservation of the:**

	extremely valuable				worthless
Relation with historic events	O	O	O	O	O
Relation with local culture and traditions	O	O	O	O	O
Relation with ecological features of the place	O	O	O	O	O
Relation with community	O	O	O	O	O

In relation to the SITE, **I consider the conservation of the:**

	pleasant			unpleasant
Relation with soil and topography	O	O	O	O

	pleasant			unpleasant
Relation with climate (orientation, sun, wind, rain..)	○	○	○	○
Surroundings and context	○	○	○	○

In relation to the STRUCTURE, **I consider the conservation of the:**

	pleasant				unpleasant
Structural system	○	○	○	○	○
Structural materials	○	○	○	○	○
Structural techniques and detail	○	○	○	○	○

In relation to the SKIN, **I consider the conservation of the:**

	pleasant				unpleasant
Facade	○	○	○	○	○
Roof	○	○	○	○	○
Openings	○	○	○	○	○
Building Shape	○	○	○	○	○
Building Materials	○	○	○	○	○
Building Techniques and detail	○	○	○	○	○

In relation to the SERVICES, **I consider the conservation of the:**

	pleasant				unpleasant
Energy and Heating system	○	○	○	○	○
Ventilation System	○	○	○	○	○
Water System	○	○	○	○	○

In relation to the SPACE PLAN, **I consider the conservation of the:**

	pleasant				unpleasant
Layout and distribution	○	○	○	○	○
Relation with the exterior	○	○	○	○	○
Proportion and scale	○	○	○	○	○

In relation to the SPIRIT OF PLACE, **I consider the conservation of the:**

	pleasant				unpleasant
Relation with historic events	○	○	○	○	○
Relation with local culture and traditions	○	○	○	○	○
Relation with ecological features of the place	○	○	○	○	○
Relation with community	○	○	○	○	○

Subjective Norm

GROUP 2. EXTERNAL FACTORS

In this group of questions, reflect on what you feel others (colleagues, clients, tutors) expect of you to do when designing your redesign, in the coming weeks.

In relation to the SITE, **it is expected of me that I conserve:**

	extremely likely				extremely unlikely
Relation with soil and topography	○	○	○	○	○
Relation with climate (orientation, sun, wind, rain..)	○	○	○	○	○
Surroundings and context	○	○	○	○	○

In relation to the STRUCTURE, **it is expected of me that I conserve:**

	extremely likely				extremely unlikely
Structural system	○	○	○	○	○
Structural materials	○	○	○	○	○
Structural techniques and detail	○	○	○	○	○

In relation to the SKIN, **it is expected of me that I conserve:**

	extremely likely				extremely unlikely
Facade	○	○	○	○	○
Roof	○	○	○	○	○
Openings	○	○	○	○	○
Building Shape	○	○	○	○	○
Building Materials	○	○	○	○	○
Building Techniques and detail	○	○	○	○	○

In relation to the SERVICES, **it is expected of me that I conserve:**

	extremely likely				extremely unlikely
Energy and Heating System	○	○	○	○	○
Ventilation System	○	○	○	○	○
Water System	○	○	○	○	○

In relation to the SPACE PLAN, **it is expected of me that I conserve:**

	extremely likely				extremely unlikely
Layout and distribution	○	○	○	○	○
Relation with the exterior	○	○	○	○	○
Click to write Statement 3	○	○	○	○	○

TOC

In relation to the SPIRIT OF PLACE, **it is expected of me that I conserve:**

	extremely likely				extremely unlikely
Relation with historic events	O	O	O	O	O
Relation with local culture and traditions	O	O	O	O	O
Relation with ecological features of the place	O	O	O	O	O
Relation with community	O	O	O	O	O

In relation to the SITE, **if I decide to conserve the following elements, the tutor will most likely:**

	approve				disapprove
Relation with soil and topography	O	O	O	O	O
Relation with climate (orientation, sun, wind, rain..)	O	O	O	O	O
Surroundings and context	O	O	O	O	O

In relation to the STRUCTURE, **if I decide to conserve the following elements, the tutor will most likely:**

	approve				disapprove
Structural system	O	O	O	O	O
Structural materials	O	O	O	O	O
Structural techniques and detail	O	O	O	O	O

In relation to the SKIN, if I decide to conserve the following elements, **the tutor will most likely:**

	approve				disapprove
Facade	O	O	O	O	O
Roof	O	O	O	O	O
Openings	O	O	O	O	O
Building Shape	O	O	O	O	O
Building Materials	O	O	O	O	O
Building Techniques and detail	O	O	O	O	O

In relation to the SERVICES, **if I decide to conserve the following elements, the tutor will most likely:**

	approve				disapprove
Energy and Heating System	O	O	O	O	O
Ventilation System	O	O	O	O	O
Water System	O	O	O	O	O

In relation to the SPACE PLAN, **if I decide to conserve the following elements, the tutor will most likely:**

	approve				disapprove
Layout and distribution	O	O	O	O	O
Relation with the exterior	O	O	O	O	O

	approve				disapprove
Click to write Statement 3	O	O	O	O	O

In relation to the SPIRIT OF PLACE, **if I decide to conserve the following elements, the tutor will most likely:**

	approve				disapprove
Relation with historic events	O	O	O	O	O
Relation with local culture and traditions	O	O	O	O	O
Relation with ecological features of the place	O	O	O	O	O
Relation with community	O	O	O	O	O

Control

GROUP 3. ABILITY

In this group of question reflect on your own design skills and technical knowledge on heritage conservation, that you will apply in the coming weeks, in your redesign.

In relation to the SITE, **I am confident that, if I want, I can conserve:**

	definitely true				definitely false
Relation with soil and topography	O	O	O	O	O
Relation with climate (orientation, sun, wind, rain..)	O	O	O	O	O
Surroundings and context	O	O	O	O	O

In relation to the STRUCTURE, **I am confident that, if I want, I can conserve:**

	definitely true				definitely false
Structural system	O	O	O	O	O
Structural materials	O	O	O	O	O
Structural techniques and detail	O	O	O	O	O

In relation to the SKIN, **I am confident that, if I want, I can conserve:**

	definitely true				definitely false
Facade	O	O	O	O	O
Roof	O	O	O	O	O
Openings	O	O	O	O	O
Building Shape	O	O	O	O	O
Building Materials	O	O	O	O	O
Building Techniques and detail	O	O	O	O	O

In relation to the SERVICES, **I am confident that, if I want, I can conserve:**

	definitely true				definitely false
Energy and Heating System	O	O	O	O	O
Ventilation System	O	O	O	O	O
Water System	O	O	O	O	O

In relation to the SPACE PLAN, **I am confident that, if I want, I can conserve:**

	definitely true				definitely false
Layout and distribution	O	O	O	O	O
Relation with the exterior	O	O	O	O	O
Click to write Statement 3	O	O	O	O	O

In relation to the SPIRIT OF PLACE, **I am confident that, if I want, I can conserve:**

	definitely true				definitely false
Relation with historic events	O	O	O	O	O
Relation with local culture and traditions	O	O	O	O	O
Relation with ecological features of the place	O	O	O	O	O
Relation with community	O	O	O	O	O

In relation to the SITE, **it is entirely up to me to conserve:**

	totally agree				totally disagree
Relation with soil and topography	O	O	O	O	O
Relation with climate (orientation, sun, wind, rain..)	O	O	O	O	O
Surroundings and context	O	O	O	O	O

In relation to the STRUCTURE, **it is entirely up to me to conserve:**

	totally agree				totally disagree
Structural system	O	O	O	O	O
Structural materials	O	O	O	O	O
Structural techniques and detail	O	O	O	O	O

In relation to the SKIN, **it is entirely up to me to conserve:**

	totally agree				totally disagree
Facade	O	O	O	O	O
Roof	O	O	O	O	O
Openings	O	O	O	O	O
Building Shape	O	O	O	O	O
Building Materials	O	O	O	O	O
Building Techniques and detail	O	O	O	O	O

In relation to the SERVICES,**it is entirely up to me to conserve:**

	totally agree				totally disagree
Energy and Heating System	O	O	O	O	O
Ventilation System	O	O	O	O	O
Water System	O	O	O	O	O

In relation to the SPACE PLAN, **it is entirely up to me to conserve:**

	totally agree				totally disagree
Layout and distribution	O	O	O	O	O
Relation with the exterior	O	O	O	O	O
Click to write Statement 3	O	O	O	O	O

In relation to the SPIRIT OF PLACE, **it is entirely up to me to conserve:**

	totally agree				totally disagree
Relation with historic events	O	O	O	O	O
Relation with local culture and traditions	O	O	O	O	O
Relation with ecological features of the place	O	O	O	O	O
Relation with community	O	O	O	O	O

Intention

GROUP 4. DESIGN PHASE

In this group of question reflect on your intentions for the following phase, identifying the elements of the building that you intend to conserve in your redesign, in the coming weeks.

In relation to the SITE, **in my design I intend to conserve:**

	extremely likely				extremely unlikely
Relation with soil and topography	O	O	O	O	O
Relation with climate (orientation, sun, wind, rain..)	O	O	O	O	O
Surroundings and context	O	O	O	O	O

In relation to the STRUCTURE, **in my design I intend to conserve:**

	extremely likely				extremely unlikely
Structural system	O	O	O	O	O
Structural materials	O	O	O	O	O
Structural techniques and detail	O	O	O	O	O

In relation to the SKIN, **in my design I intend to conserve:**

	extremely likely				extremely unlikely
Facade	O	O	O	O	O
Roof	O	O	O	O	O
Openings	O	O	O	O	O
Building Shape	O	O	O	O	O
Building Materials	O	O	O	O	O
Building Techniques and detail	O	O	O	O	O

In relation to the SERVICES, **in my design I intend to conserve:**

	extremely likely				extremely unlikely
Energy and Heating System	O	O	O	O	O
Ventilation System	O	O	O	O	O
Water System	O	O	O	O	O

In relation to the SPACE PLAN, **in my design I intend to conserve:**

	extremely likely				extremely unlikely
Layout and distribution	O	O	O	O	O
Relation with the exterior	O	O	O	O	O
Proportion and scale	O	O	O	O	O
Click to write Statement 4	O	O	O	O	O

In relation to the SPIRIT OF PLACE, **in my design I intend to conserve:**

	extremely likely				extremely unlikely
Relation with historic events	O	O	O	O	O
Relation with local culture and traditions	O	O	O	O	O
Relation with ecological features of the place	O	O	O	O	O
Relation with community	O	O	O	O	O

Attribution

GROUP 5.

Please try to imagine yourself in the following situation: in your design, you don't conserve the elements of the building that you intended to.

If such situation happened to you, what do you think might have caused it?

While situations like these may have many causes, we want you to choose only one - the main cause that made this situation happen to you.

What would be the main cause that led you not to conserve the intended elements?

Think about the reason you have written above.

Is the cause something:

That reflects an aspect of yourself	O	O	O	O	O	O	O	O	O	Reflects an aspect of the situation
Manageable by you	O	O	O	O	O	O	O	O	O	Not manageable by you
Permanent	O	O	O	O	O	O	O	O	O	Temporary
You can regulate	O	O	O	O	O	O	O	O	O	You cannot regulate
Over which others have control	O	O	O	O	O	O	O	O	O	Over which others have no control
Inside of you	O	O	O	O	O	O	O	O	O	Outside of you
Stable over time	O	O	O	O	O	O	O	O	O	Variable over time
Under the power of other people	O	O	O	O	O	O	O	O	O	Not under the power of other people
Something about you	O	O	O	O	O	O	O	O	O	Something about others
Over which you have power	O	O	O	O	O	O	O	O	O	Over which you have no power
Unchangeable	O	O	O	O	O	O	O	O	O	Changeable
Other people can regulate	O	O	O	O	O	O	O	O	O	Other people cannot regulate

Gonçalves, Mateus, Silvestre & Roders (2020). Going beyond good intentions: building passport for sustainable conservation. FCT PD/BD/127853/2016 ISISE/UMinho. IST /ULisboa. BK/TUDelft.

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Appendix G2

TPB Questionnaire: self-reported conservation behaviours

BETWEEN ASSESSMENT AND DESIGN

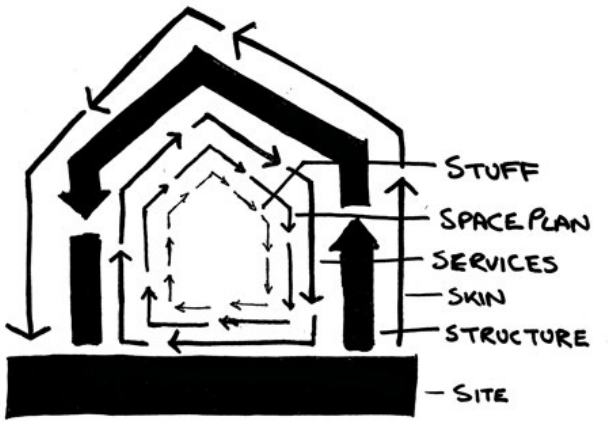
Introduction

Now that you finished the design phase of the Master H&A Studio, you are invited to reflect on your decision process during the design, in the context of the Studio. Please, self-assess your design to give accurate answers.

Consider your experience and answer ALL questions in specific context of this Studio.

All the data collected in this questionnaire is confidential.

STRUCTURE OF THE QUESTIONNAIRE



This questionnaire is organised according to the seven building layers suggested by Keupers & de Jonge (2017) in **Designing from Heritage**, based on the six shearing layers of Brand (1994). This is the same structure recommended for your previous analysis process, since it allows for a gradual approach to the building, from site to spirit of place.

Keep in mind the following concepts:

SITE: relation of the building with the surrounding urban landscape SKIN: the building envelope and interface with the exterior
STRUCTURE: the support construction systems
SERVICES: the infrastructures, such as plumbing, electrical systems, heating and ventilation
SPACE PLAN: the interior layout and distribution of spaces
STUFF: furnishings and furniture
SPIRIT OF PLACE: intangible aspects related to building's meanings over time

Building name:

Behavior

GROUP 1. DESIGN DECISIONS

In this group of questions reflect on your decisions in the design, identifying the elements that you decided to preserve in your design:

In relation to the SITE, **in my design I decided to preserve:**

	~100%		~50%		~0%
Relation with soil and topography	O	O	O	O	O
Relation with climate (orientation, sun, wind, rain..)	O	O	O	O	O
Surroundings and context	O	O	O	O	O

In relation to the STRUCTURE, **in my design I decided to preserve:**

	~100%		~50%		~0%
Structural system	O	O	O	O	O
Structural materials	O	O	O	O	O

In relation to the SKIN, **in my design I decided to preserve:**

	~100%		~50%		~0%
Facade	O	O	O	O	O
Roof	O	O	O	O	O
Openings	O	O	O	O	O
Building Shape	O	O	O	O	O
Building Materials	O	O	O	O	O
Building Techniques and detail	O	O	O	O	O

In relation to the SERVICES, **in my design I decided to preserve:**

	~100%		~50%		~0%
Energy and Heating system	O	O	O	O	O
Ventilation System	O	O	O	O	O
Water System	O	O	O	O	O

In relation to the SPACE PLAN, **in my design I decided to preserve:**

	~100%		~50%		~0%
Layout and distribution	O	O	O	O	O
Relation with the exterior	O	O	O	O	O

In relation to the SPIRIT OF PLACE, **in my design I decided to preserve:**

	~100%		~50%		~0%
Relation with historic events	O	O	O	O	O
Relation with local culture and traditions	O	O	O	O	O

	~100%		~50%		~0%
Relation with ecological features of the place	O	O	O	O	O
Relation with community	O	O	O	O	O

Attribution

GROUP 2.

Please reflect on the following situation: in your design, you don't preserve the elements of the building that you intended to.

When this situation happened to you, what do you think may have caused it?

While situations like these may have many causes, we want you to choose only one - the main cause that made this situation happen to you.

What was the main cause that led you to not preserve the elements you intended?

Think about the reason you have written above.

Is the cause something:

That reflects an aspect of yourself	O	O	O	O	O	O	O	O	O	Reflects an aspect of the situation
Manageable by you	O	O	O	O	O	O	O	O	O	Not manageable by you
Permanent	O	O	O	O	O	O	O	O	O	Temporary
You can regulate	O	O	O	O	O	O	O	O	O	You cannot regulate
Over which others have control	O	O	O	O	O	O	O	O	O	Over which others have no control
Inside of you	O	O	O	O	O	O	O	O	O	Outside of you
Stable over time	O	O	O	O	O	O	O	O	O	Variable over time
Under the power of other people	O	O	O	O	O	O	O	O	O	Not under the power of other people
Something about you	O	O	O	O	O	O	O	O	O	Something about others
Over which you have power	O	O	O	O	O	O	O	O	O	Over which you have no power
Unchangeable	O	O	O	O	O	O	O	O	O	Changeable
Other people can regulate	O	O	O	O	O	O	O	O	O	Other people cannot regulate

Gonçalves, Mateus, Silvestre & Roders (2020). Going beyond good intentions: building passport for sustainable conservation. FCT PD/BD/127853/2016 ISISE/UMinho. IST /ULisboa. BK/TUDelft.

Appendix H

Building Passport for Sustainable Conservation

BUILDING PASSPORT FOR SUSTAINABLE CONSERVATION

Welcome to the Building Passport!

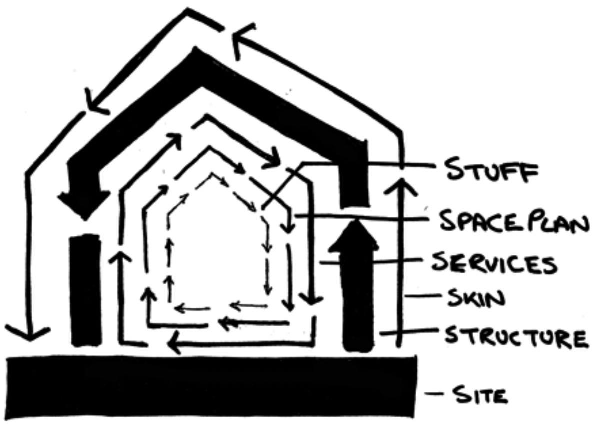
Welcome to the Building Passport, a gate between the building value assessment and the design stage.

This is a tool to assist you in the transition from the analysis and value assessment to the design. It allows you to summarize your findings and state your intentions towards valuable attributes of the building.

The aim of the Building Passport for Sustainable Conservation is to encourage the recognition of sustainability values in heritage buildings and to support the definition of priorities for its conservation. It is focused on the assessment of the baseline conditions of the building, before the intervention: how sustainable is what is already there?

The results can be used during the design process to help you monitor your progress and and support decision-making.

STRUCTURE OF THE PASSPORT



This passport is organised according to the seven building layers suggested by Keupers & de Jonge (2017) in **Designing from Heritage**, based on the six shearing layers of Brand (1994). This is the same structure recommended for your previous analysis process, since it allows for a gradual approach to the building, from the site to the spirit of place.

Keep in mind the following concepts:

SITE: relation of the building with the surrounding urban landscape
SKIN: the building envelope and interface with the exterior
STRUCTURE: the support construction systems
SERVICES: the infrastructures, such as plumbing, electrical systems, heating and ventilation
SPACE PLAN: the interior layout and distribution of spaces

STUFF: furnishings and furniture

SPIRIT OF PLACE: intangible aspects related to the building's significance over time

HOW TO USE THE PASSPORT

For each layer of the building, specific attributes with potential impact on sustainability were defined.

Ex: the layer SKIN includes building shape, building techniques, building materials and energy needs.

Each of the attributes includes yes/no questions to guide you in the assessment. The questions are answered with a qualitative scale of 5 points, as in this example:

	No	Mostly not	Partially	Mostly yes	Yes
Is this question clear?	O	O	O	O	O

The 5-point scale allows considering the singularity of each case or context.

In some situations, some clues in the building can indicate that some effort was made in the past to meet the requirements in the question, even if not effective today. In that case a **"mostly not"** is a more precise answer than **"no"**.

The same happens with **"mostly yes"**, when the building evidences solutions that are adequate but could be slightly improved.

"Partially" implies that the building has a neutral impact or that performance in the specific question is assured in 50% of the cases.

All questions must be answered to obtain a final score rating of the building's value to sustainability and opportunities for improvement.

Building ID

Building name:

Building function:

Location:

Reference Picture

Architect (original):

Year or period of construction (original):

Is the building listed as Heritage?

- Yes
- In progress
- No

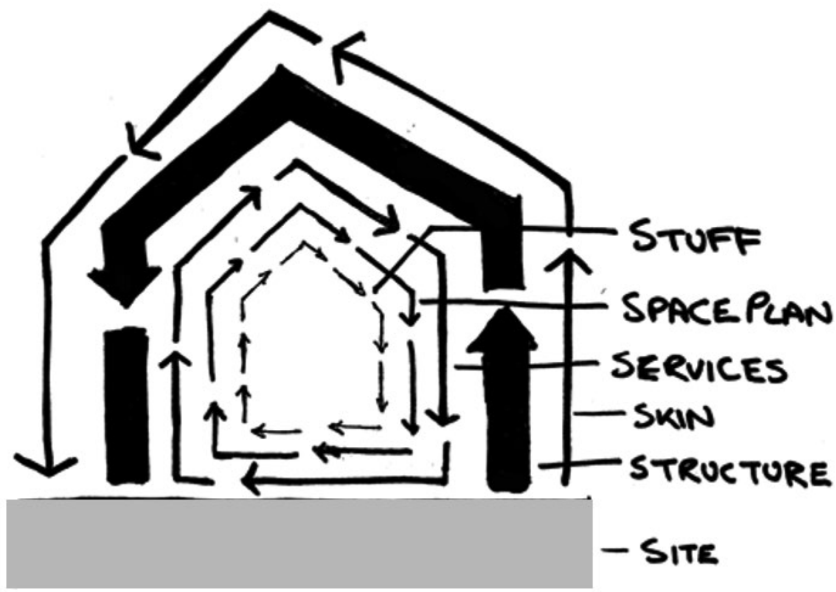
What type of Heritage classification?

- World Heritage
- National Heritage
- Local Heritage
- Other (specify)

SITE

SITE

Focus on the relation of the building with the SITE to answer the next group of questions.



TOC

In relation to SOIL AND TOPOGRAPHY, the building...

	No	Mostly not	Partially	Mostly yes	Yes
is built on previously developed land?	O	O	O	O	O
adapts to existing water lines?	O	O	O	O	O
has a positive impact on biological diversity?	O	O	O	O	O
takes advantage of soil thermal mass?	O	O	O	O	O

In relation to CLIMATE, the building...

	No	Mostly not	Partially	Mostly yes	Yes
has an adequate solar orientation?	O	O	O	O	O
is protected from prevailing winds?	O	O	O	O	O
is adequate to the local weather (rain/snow)?	O	O	O	O	O

In relation to the SURROUNDINGS, the building location...

	No	Mostly not	Partially	Mostly yes	Yes
contributes to increase urban density?	O	O	O	O	O
allows for easy access to basic services?	O	O	O	O	O

Site Assessment

PARTIAL SCORE

According to your assessment, the relation of the building with the site scored **${gr://SC_0koHmi9xIldlodT/Score}/45**.

The relation of the building with the site has valuable contributions to sustainability that should be preserved in the redesign.

The score was calculated based on the performance in the following indicators:

- **Relation with soil and topography:** ${gr://SC_bmwYZsHV8keGs3H/Score}/20
- **Relation with climate**: ${gr://SC_a8HbTgzYzOH3r1z/Score}/15
- **Relation with surroundings:** ${gr://SC_6XzELrOgBKYKCHj/Score}/10

Taking the results of your assessment into consideration, answer the next block of questions about your intervention framework for the SITE.

PARTIAL SCORE

According to your assessment, the relation of the building with the site scored **${gr://SC_0koHmi9xIldlodT/Score}/45**.

The relation of the building with the site has a positive contribution to sustainability that should be preserved, but could benefit from additional measures in the redesign.

The score was calculated based on the performance in the following indicators:

- **Relation with soil and topography:** ${gr://SC_bmwYZsHV8keGs3H/Score}/20
- **Relation with climate:** ${gr://SC_a8HbTgzYzOH3r1z/Score}/15
- **Relation with surroundings**: ${gr://SC_6XzELrOgBKYKCHj/Score}/10

Taking the results of your assessment into consideration, answer the next block of questions about your intervention framework for the SITE.

PARTIAL SCORE

According to your assessment, the relation of the building with the site scored **${gr://SC_0koHmi9xIldlodT/Score}/45**.

Despite some positive aspects, the relation of the building with the site offers wider redesign opportunities to improve its performance regarding sustainability.

The score was calculated based on the performance in the following indicators:

- **Relation with soil and topography:** ${gr://SC_bmwYZsHV8keGs3H/Score}/20
- **Relation with climate:** ${gr://SC_a8HbTgzYzOH3r1z/Score}/15
- **Relation with surroundings:** ${gr://SC_6XzELrOgBKYKCHj/Score}/10

Taking the results of your assessment into consideration, answer the next block of questions about your intervention framework for the SITE.

PARTIAL SCORE

According to your assessment, the relation of the building to the site scored **${gr://SC_0koHmi9xIldlodT/Score}/45**.

The relation of the building with the site presents some major issues that should be addressed in the redesign to improve its performance regarding sustainability.

The score was calculated based on the performance in the following indicators:

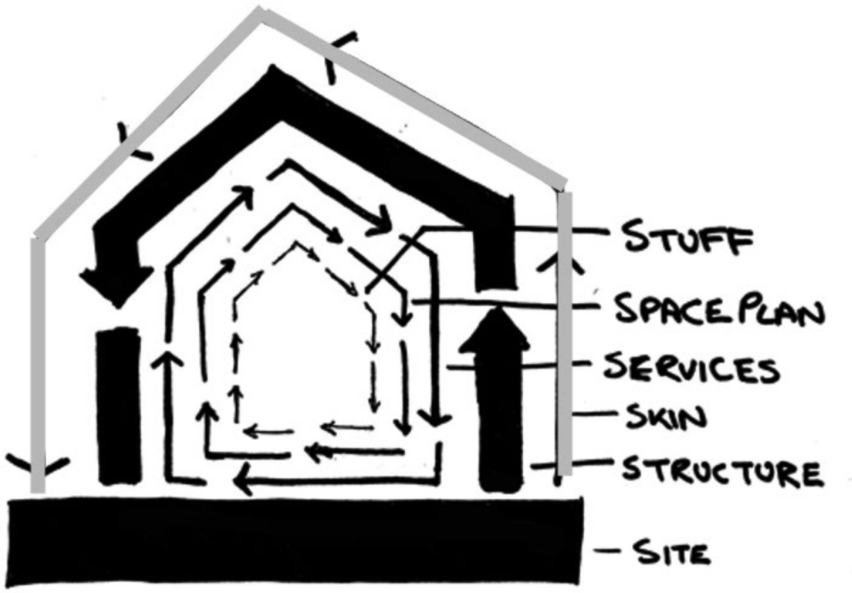
- **Relation with soil and topography:** ${gr://SC_bmwYZsHV8keGs3H/Score}/20
- **Relation with climate:** ${gr://SC_a8HbTgzYzOH3r1z/Score}/15
- **Relation with surroundings:** ${gr://SC_6XzELrOgBKYKCHj/Score}/10

Taking the results of your assessment into consideration, answer the next block of questions about your intervention framework for the SITE.

SKIN

SKIN

Focus on the building SKIN to answer the next group of questions.



In relation to BUILDING SHAPE, the building...

	No	Mostly not	Partially	Mostly yes	Yes
scale is adequate for the function?	○	○	○	○	○
scale is adequate for its maintenance and operation costs?	○	○	○	○	○
indicates extension and change over time?	○	○	○	○	○

In relation to BUILDING TECHNIQUES AND DETAIL, the building...

	No	Mostly not	Partially	Mostly yes	Yes
indicates its age and the patina of time?	○	○	○	○	○
provides information richness (variety, texture, detail and ornament)?	○	○	○	○	○

In relation to the BUILDING MATERIALS, the major finishing materials...

	No	Mostly not	Partially	Mostly yes	Yes
are produced locally?	○	○	○	○	○

	No	Mostly not	Partially	Mostly yes	Yes
are low-transformed?	○	○	○	○	○
are reused or recycled?	○	○	○	○	○
avoid the use of toxic substances (such as toxic heavy metals or volatile organic compounds)?	○	○	○	○	○

In relation to ENERGY NEEDS, the building...

	No	Mostly not	Partially	Mostly yes	Yes
has sufficient thermal insulation?	○	○	○	○	○
has walls that contribute to its thermal mass?	○	○	○	○	○
includes passive thermal regulating strategies, such as trombe walls or sunspaces?	○	○	○	○	○
windows are well dimensioned to avoid overheating and thermal losses?	○	○	○	○	○
windows include regulating strategies to minimize thermal loss? (double glazing, shutters, double windows, etc.)	○	○	○	○	○

Skin Assessment

PARTIAL SCORE

According to your assessment, the skin of the building scored **${gr://SC_9Bv7ttPtwwgc9rn/Score}/70**.

The skin of the building has valuable contributions to sustainability that should be preserved in the redesign.

The score was calculated based on the performance in the following indicators:

Building shape: ${gr://SC_eOEtahISpP7jEzj/Score}/15
Building techniques and detail: ${gr://SC_1H3CCT5p3Yk6eMZ/Score}/10
Building materials: ${gr://SC_1LWYIFWnaZKI7c1/Score}/20
Reduction of energy needs: ${gr://SC_e5t7BbxNF39CJLf/Score}/25

Taking the results of your assessment into consideration, answer the next block of questions about your intervention framework for the SKIN.

PARTIAL SCORE

According to your assessment, the skin of the building scored **${gr://SC_9Bv7ttPtwwgc9rn/Score}/70**.

The skin of the building has a positive contribution to sustainability that should be preserved, but could benefit from additional measures in the redesign.

The score was calculated based on the performance in the following indicators:

Building shape: ${gr://SC_eOEtahISpP7jEzj/Score}/15
Building techniques and detail: ${gr://SC_1H3CCT5p3Yk6eMZ/Score}/10
Building materials: ${gr://SC_1LWYIFWnaZKI7c1/Score}/20
Reduction of energy needs: ${gr://SC_e5t7BbxNF39CJLf/Score}/25

Taking the results of your assessment into consideration, answer the next block of questions about your intervention framework for the SKIN.

PARTIAL SCORE

According to your assessment, the skin of the building scored **${gr://SC_9Bv7ttPtwwgc9rn/Score}/70**.

Despite some positive aspects, the skin of the building offers wider redesign opportunities to improve its performance regarding sustainability.

The score was calculated based on the performance in the following indicators:

Building shape: ${gr://SC_eOEtahISpP7jEzj/Score}/15
Building techniques and detail: ${gr://SC_1H3CCT5p3Yk6eMZ/Score}/10
Building materials: ${gr://SC_1LWYIFWnaZKI7c1/Score}/20
Reduction of energy needs: ${gr://SC_e5t7BbxNF39CJLf/Score}/25

Taking the results of your assessment into consideration, answer the next block of questions about your intervention framework for the SKIN.

PARTIAL SCORE

According to your assessment, the skin scored **${gr://SC_9Bv7ttPtwwgc9rn/Score}/70.**

The skin presents some major issues that should be addressed in the redesign to improve its performance regarding sustainability.

The score was calculated based on the performance in the following indicators:

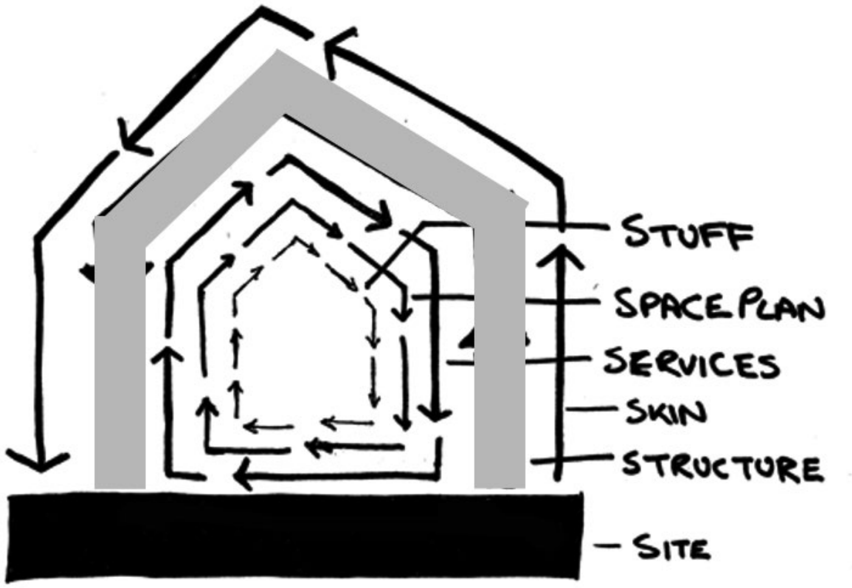
Building shape: ${gr://SC_eOEtahISpP7jEzj/Score}/15
Building techniques and detail: ${gr://SC_1H3CCT5p3Yk6eMZ/Score}/10
Building materials: ${gr://SC_1LWYIFWnaZKI7c1/Score}/20
Reduction of energy needs: ${gr://SC_e5t7BbxNF39CJLf/Score}/25

Taking the results of your assessment into consideration, answer the next block of question about your intervention framework for the SKIN.

STRUCTURE

STRUCTURE

Focus on the building STRUCTURE to answer the next group of questions.



In relation to the STRUCTURAL SYSTEM, the building...

	No	Mostly not	Partially	Mostly yes	Yes
includes resilience strategies to face natural hazards?	○	○	○	○	○
uses durable and long-lasting materials?	○	○	○	○	○
systems are simple to build and maintain?	○	○	○	○	○
ensures safety conditions?	○	○	○	○	○

In relation to BUILDING TECHNIQUES AND DETAIL, the building...

	No	Mostly not	Partially	Mostly yes	Yes
shows change and adaptation to technical innovation (integration of different techniques or materials over time)?	○	○	○	○	○
shows evolutionary processes over time?	○	○	○	○	○
shows an optimised use of materials?	○	○	○	○	○

In relation to BUILDING MATERIALS, the major structural materials...

	No	Mostly not	Partially	Mostly yes	Yes

	No	Mostly not	Partially	Mostly yes	Yes
are produced locally?	○	○	○	○	○
are low-transformed?	○	○	○	○	○
are reused or recycled?	○	○	○	○	○
avoid the use of toxic substances (such as toxic heavy metals or volatile organic compounds)?	○	○	○	○	○

Structure Assessment

According to your assessment, the structure scored **${gr://SC_0ceWqFarXyrtW4Z/Score}/55**.

The structure has valuable contributions to sustainability that should be preserved in the redesign.

The score was calculated based on the performance in the following indicators:

Structural system: ${gr://SC_a5J9pbsQn1TI0Sx/Score}/15
Structural techniques and detail: ${gr://SC_e58Z4PcIyJAE4AZ/Score}/20
Structural building materials: ${gr://SC_08PZI3fyrLAnRUp/Score}/20

Taking the results of your assessment into consideration, answer the next block of questions about your intervention framework for the STRUCTURE.

According to your assessment, the structure scored **${gr://SC_0ceWqFarXyrtW4Z/Score}/55**.

The structure has a positive contribution to sustainability that should be preserved, but could benefit from additional measures in the redesign.

The score was calculated based on the performance in the following indicators:

Structural system: ${gr://SC_a5J9pbsQn1TI0Sx/Score}/20
Structural techniques and detail: ${gr://SC_e58Z4PcIyJAE4AZ/Score}/15
Structural building materials: ${gr://SC_08PZI3fyrLAnRUp/Score}/20

Taking the results of your assessment into consideration, answer the next block of questions about your intervention framework for the STRUCTURE.

According to your assessment, the structure to the site scored **${gr://SC_0ceWqFarXyrtW4Z/Score}/55**.

Despite some positive aspects, the structure offers wider redesign opportunities to improve its performance regarding sustainability.

The score was calculated based on the performance in the following indicators:

Structural system: ${gr://SC_a5J9pbsQn1TI0Sx/Score}/20
Structural techniques and detail: ${gr://SC_e58Z4PcIyJAE4AZ/Score}/15
Structural building materials: ${gr://SC_08PZI3fyrLAnRUp/Score}/20

Taking the results of your assessment into consideration, answer the next block of questions about your intervention framework for the STRUCTURE.

According to your assessment, the structure scored **${gr://SC_0ceWqFarXyrtW4Z/Score}/55**.

The structure presents some major issues that should be addressed in the redesign to improve its performance regarding sustainability.

The score was calculated based on the performance in the following indicators:

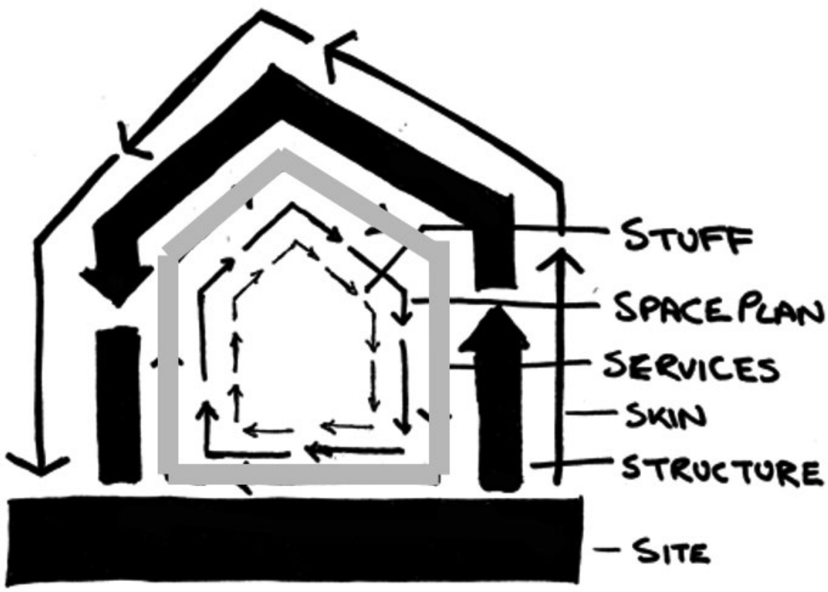
Structural system: ${gr://SC_a5J9pbsQn1TI0Sx/Score}/20
Structural techniques and detail: ${gr://SC_e58Z4PcIyJAE4AZ/Score}/15
Structural building materials: ${gr://SC_08PZI3fyrLAnRUp/Score}/20

Taking the results of your assessment into consideration, answer the next block of questions about your intervention framework for the STRUCTURE.

SERVICES

SERVICES

Focus on the building SERVICES to answer the next group of questions.



In relation to ENERGY and HEATING, the building...

	No	Mostly not	Partially	Mostly yes	Yes

TOC

	No	Mostly not	Partially	Mostly yes	Yes
provides energy autonomy strategies? (energy storage, renewable production)	○	○	○	○	○
uses non-renewable energy sources? (fireplaces are considered renewable)	○	○	○	○	○
ensures adequate levels of temperature and humidity?	○	○	○	○	○

In relation to WATER, the building…

	No	Mostly not	Partially	Mostly yes	Yes
has rain water collection systems?	○	○	○	○	○
has water storage systems?	○	○	○	○	○
has water treatment or reuse systems?	○	○	○	○	○

In relation to VENTILATION, the building...

	No	Mostly not	Partially	Mostly yes	Yes
has openable windows in frequently occupied spaces?	○	○	○	○	○
includes natural ventilation strategies, such as patios, chimneys or wind towers?	○	○	○	○	○

Services Assessment

According to your assessment, the services scored **${gr://SC_brcRSQcAqtwTLRH/Score}/40**.

The services have valuable contributions to sustainability that should be preserved in the redesign.

The score was calculated based on the performance in the following indicators:

Heating and Energy: ${gr://SC_dmqqgNitgs380Jf/Score}/15
Water: ${gr://SC_cAPE73ePbp0cdwN/Score}/15
Ventilation: ${gr://SC_0TGVCg7kGU4xlZj/Score}/10

Taking the results of your assessment into consideration, answer the next block of questions about your intervention framework for the SERVICES.

According to your assessment, the services scored **${gr://SC_brcRSQcAqtwTLRH/Score}/40**.

The services have a positive contribution to sustainability that should be preserved, but could benefit from additional measures in the redesign.

The score was calculated based on the performance in the following indicators:

Heating and Energy: ${gr://SC_dmqqgNitgs380Jf/Score}/15
Water: ${gr://SC_cAPE73ePbp0cdwN/Score}/15
Ventilation: ${gr://SC_0TGVCg7kGU4xlZj/Score}/10

Taking the results of your assessment into consideration, answer the next block of questions about your intervention framework for the SERVICES.

According to your assessment, the services scored **${gr://SC_brcRSQcAqtwTLRH/Score}/40**.

Despite some positive aspects, the services offer wider redesign opportunities to improve its performance regarding sustainability.

The score was calculated based on the performance in the following indicators:
Heating and Energy: ${gr://SC_dmqqgNitgs380Jf/Score}/15
Water: ${gr://SC_cAPE73ePbp0cdwN/Score}/15
Ventilation: ${gr://SC_0TGVCg7kGU4xlZj/Score}/10

Taking the results of your assessment into consideration, answer the next block of questions about your intervention framework for the SERVICES.

According to your assessment, the services scored **${gr://SC_brcRSQcAqtwTLRH/Score}/40**.

The services present some major issues that should be addressed in the redesign to improve its performance regarding sustainability.

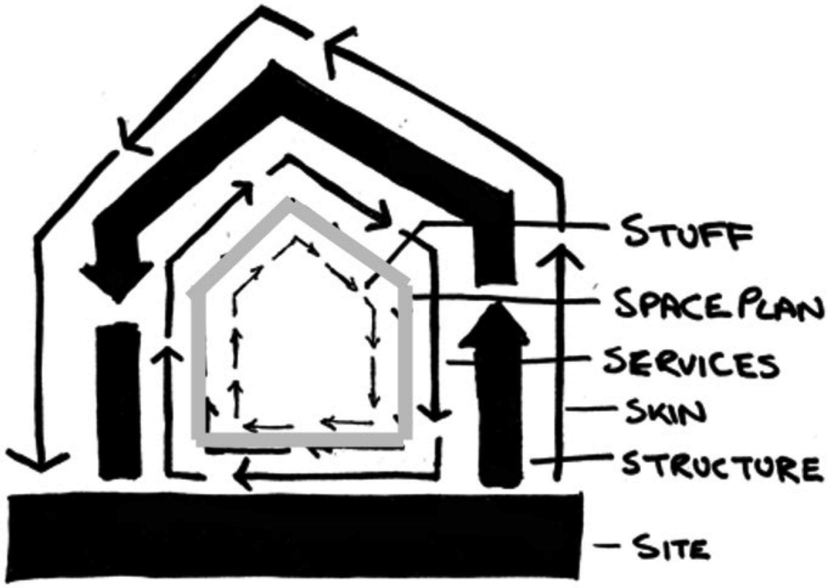
The score was calculated based on the performance in the following indicators:
Heating and Energy: ${gr://SC_dmqqgNitgs380Jf/Score}/15
Water: ${gr://SC_cAPE73ePbp0cdwN/Score}/15
Ventilation: ${gr://SC_0TGVCg7kGU4xlZj/Score}/10

Taking the results of your assessment into consideration, answer the next block of questions about your intervention framework for the SERVICES.

SPACE PLAN

SPACE PLAN

Focus on the building SPACE PLAN to answer the next group of questions.



In relation to the LAYOUT, the building...

	No	Mostly not	Partially	Mostly yes	Yes
indicates different functions over time?	○	○	○	○	○
serves multiple uses (in the same period of time)?	○	○	○	○	○
allows accessibility without barriers?	○	○	○	○	○

In relation to the EXTERIOR, the building...

	No	Mostly not	Partially	Mostly yes	Yes
provides natural light in frequently occupied spaces?	○	○	○	○	○
provides views to the outside in frequently occupied spaces?	○	○	○	○	○
has transitional spaces such as patios, balconies, porches or others?	○	○	○	○	○

Space Plan Assessment

According to your assessment, the space plan scored **${gr://SC_8bl9Z3wJgQtcQnj/Score}/30**.

The space plan has valuable contributions to sustainability that should be preserved in the redesign.

The score was calculated based on the performance in the following indicators:

Layout: ${gr://SC_3ma97IXLmJAG0HH/Score}/15

Relation with exterior: ${gr://SC_8e9ETq8ICKRVDBb/Score}/15

Taking the results of your assessment into consideration, answer the next block of questions about your intervention framework for the SPACE PLAN.

According to your assessment, the space plan scored **${gr://SC_8bI9Z3wJgQtcQnj/Score}/30**.

The space plan has a positive contribution to sustainability that should be preserved, but could benefit from additional measures in the redesign.

The score was calculated based on the performance in the following indicators:

Layout: ${gr://SC_3ma97IXLmJAG0HH/Score}/15

Relation with exterior: ${gr://SC_8e9ETq8ICKRVDBb/Score}/15

Taking the results of your assessment into consideration, answer the next block of questions about your intervention framework for the SPACE PLAN.

According to your assessment, the space plan scored **${gr://SC_8bI9Z3wJgQtcQnj/Score}/30**.

Despite some positive aspects, the space plan offers wider redesign opportunities to improve its performance regarding sustainability.

The score was calculated based on the performance in the following indicators:

Layout: ${gr://SC_3ma97IXLmJAG0HH/Score}/15

Relation with exterior: ${gr://SC_8e9ETq8ICKRVDBb/Score}/15

Taking the results of your assessment into consideration, answer the next block of questions about your intervention framework the SPACE PLAN.

According to your assessment, the space plan scored **${gr://SC_8bI9Z3wJgQtcQnj/Score}/30**.

The space plan presents some major issues that should be addressed in the redesign to improve its performance regarding sustainability.

The score was calculated based on the performance in the following indicators:

Layout: ${gr://SC_3ma97IXLmJAG0HH/Score}/15

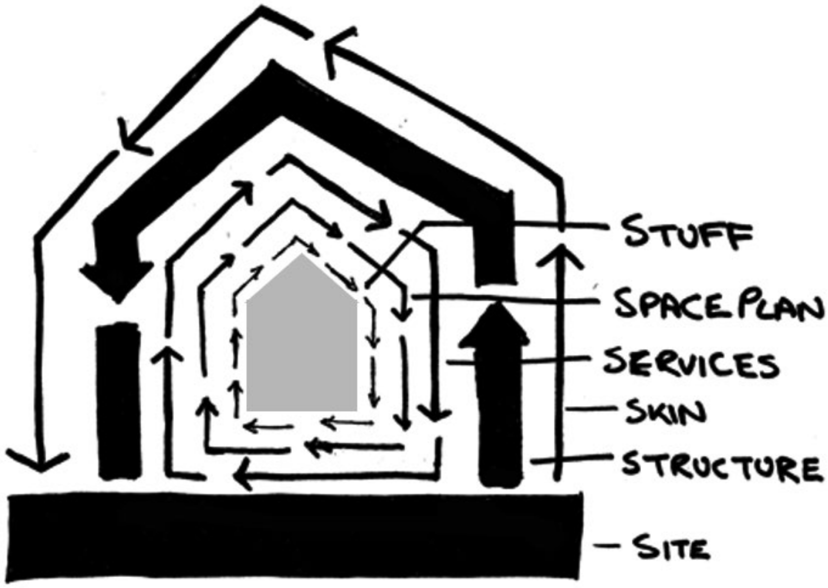
Relation with exterior: ${gr://SC_8e9ETq8ICKRVDBb/Score}/15

Taking the results of your assessment into consideration, answer the next block of questions about your intervention framework for the SPACE PLAN.

SPIRIT OF PLACE

SPIRIT OF PLACE

Focus on the SPIRIT OF PLACE to answer the next group of questions.



In relation to the COMMUNITY, the building...

	No	Mostly not	Partially	Mostly yes	Yes
offers communal spaces to gather and connect? (open spaces, break areas, gardens, parks, public spaces, commercial spaces, etc.)	○	○	○	○	○
gathering spaces are easy to access?	○	○	○	○	○
gathering spaces are attractive for the community?	○	○	○	○	○

In relation to PLACE-BASED CONNECTIONS, the building...

	No	Mostly not	Partially	Mostly yes	Yes
is connected to historic moments or events?	○	○	○	○	○
is connected to local culture and traditions? (uses, religious expressions, associations, identity)	○	○	○	○	○
is connected to geographical and ecological features of the place? (materials, colors, textures, shape)	○	○	○	○	○

TOC

Spirit of Place Assessment

According to your assessment, the spirit of place scored **${gr://SC_db7r5Klxfwez3bD/Score}/30**.

The relation of the building with the spirit of place has valuable contributions to sustainability that should be preserved in the redesign.

The score was calculated based on the performance in the following indicators:

Relation with community: ${gr://SC_86P5qpZ9iNxKKYB/Score}/15

Place-based relations: ${gr://SC_0vzmO4yC5joIaRL/Score}/15

Taking the results of your assessment into consideration, answer the next block of questions about your intervention framework for the SPIRIT OF PLACE.

According to your assessment, the spirit of place scored **${gr://SC_db7r5Klxfwez3bD/Score}/30**.

The relation of the building with the spirit of place has a positive contribution to sustainability that should be preserved, but could benefit from additional measures in the redesign.

The score was calculated based on the performance in the following indicators:

Relation with community: ${gr://SC_86P5qpZ9iNxKKYB/Score}/15

Place-based relations: ${gr://SC_0vzmO4yC5joIaRL/Score}/15

Taking the results of your assessment into consideration, answer the next block of questions about your intervention framework for the SPIRIT OF PLACE.

According to your assessment, the spirit of place scored **${gr://SC_db7r5Klxfwez3bD/Score}/30**.

Despite some positive aspects, the relation of the building with the spirit of place offers some wider redesign opportunities to improve its performance regarding sustainability.

The score was calculated based on the performance in the following indicators:

Relation with community: ${gr://SC_86P5qpZ9iNxKKYB/Score}/15

Place-based relations: ${gr://SC_0vzmO4yC5joIaRL/Score}/15

Taking the results of your assessment into consideration, answer the next block of questions about your intervention framework for the SPIRIT OF PLACE.

According to your assessment, the spirit of place scored **${gr://SC_db7r5Klxfwez3bD/Score}/30**.

The relation of the building with the spirit of place presents some major issues that should be addressed in the redesign to improve its performance regarding sustainability.

The score was calculated based on the performance in the following indicators:

Relation with community: ${gr://SC_86P5qpZ9iNxKKYB/Score}/15

Place-based relations: ${gr://SC_0vzmO4yC5joIaRL/Score}/15

Taking the results of your assessment into consideration, answer the next block of questions about your intervention framework for the SPIRIT OF PLACE.

Overall Assessment

FINAL SCORE

According to your assessment, the building scored **${gr://SC_5nAwzsnLpjvobd3/Score}/270**.

The building has valuable contributions to sustainability that should be preserved in the redesign.

The score was calculated based on the performance in the following indicators:

- **Overall site assessment:** ${gr://SC_0koHmi9xIldlodT/Score}/45
    - Relation with soil and topography: ${gr://SC_bmwYZsHV8keGs3H/Score}/20
    - Relation with climate: ${gr://SC_a8HbTgzYzOH3r1z/Score}/15
    - Relation with surroundings: ${gr://SC_6XzELrOgBKYKCHj/Score}/10
- **Overall skin assessment:** ${gr://SC_9Bv7ttPtwwgc9rn/Score}/70
    - Building Shape: ${gr://SC_eOEtahISpP7jEzj/Score}/15
    - Building techniques and detail: ${gr://SC_1H3CCT5p3Yk6eMZ/Score}/10
    - Building materials: ${gr://SC_1LWYIFWnaZKI7c1/Score}/20
    - Reduction of energy needs: ${gr://SC_e5t7BbxNF39CJLf/Score}/25
- **Overall structure assessment:** ${gr://SC_0ceWqFarXyrtW4Z/Score}/55
    - Structural system: ${gr://SC_a5J9pbsQn1TI0Sx/Score}/20
    - Structural techniques and detail: ${gr://SC_e58Z4PcIyJAE4AZ/Score}/15
    - Structural materials: ${gr://SC_08PZI3fyrLAnRUp/Score}/20
- **Overall services assessment:** ${gr://SC_brcRSQcAqtwTLRH/Score}/40
    - Energy and heating: ${gr://SC_dmqqgNitgs380Jf/Score}/15
    - Water: ${gr://SC_cAPE73ePbp0cdwN/Score}/15
    - Ventilation: ${gr://SC_0TGVCg7kGU4xlZj/Score}/10
- **Overall space plan assessment:** ${gr://SC_8bI9Z3wJgQtcQnj/Score}/30
    - Layout: ${gr://SC_3ma97IXLmJAG0HH/Score}/15
    - Relation with exterior: ${gr://SC_8e9ETq8ICKRVDBb/Score}/15
- **Overall spirit of place:** ${gr://SC_db7r5Klxfwez3bD/Score}/30
    - Community: ${gr://SC_86P5qpZ9iNxKKYB/Score}/15
    - Place-based relations: ${gr://SC_0vzmO4yC5joIaRL/Score}/15

In the last page you will find a summary of the baseline sustainability assessment of the building that you can print as a PDF to monitor and support your decision-making during the design stage.

According to your assessment, the building scored **${gr://SC_5nAwzsnLpjvobd3/Score}/270**.

The building has a positive contribution to sustainability that should be preserved, but could benefit from additional measures in the redesign.

The score was calculated based on the performance in the following indicators:

Overall site assessment: ${gr://SC_0koHmi9xIldlodT/Score}/45
Relation with soil and topography: ${gr://SC_bmwYZsHV8keGs3H/Score}/20
Relation with climate: ${gr://SC_a8HbTgzYzOH3r1z/Score}/15
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Reduction of energy needs: ${gr://SC_e5t7BbxNF39CJLf/Score}/25
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Structural materials: ${gr://SC_08PZI3fyrLAnRUp/Score}/20
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Place-based relations: ${gr://SC_0vzmO4yC5jolaRL/Score}/15

In the last page you will find a summary of the baseline sustainability assessment of the building that you can print as a PDF to monitor and support your decision-making.

According to your assessment, the building **${gr://SC_5nAwzsnLpjvobd3/Score}/270**.

Despite some positive aspects, the building offers some wider redesign opportunities to improve its performance regarding sustainability.

The score was calculated based on the performance in the following indicators:
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Building materials: ${gr://SC_1LWYIFWnaZKI7c1/Score}/20
Reduction of energy needs: ${gr://SC_e5t7BbxNF39CJLf/Score}/25
Overall structure assessment: ${gr://SC_0ceWqFarXyrtW4Z/Score}/55
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In the last page you will find a summary of the baseline sustainability assessment of the building that you can print as a PDF to monitor and support your decision-making.

According to your assessment, the building **${gr://SC_5nAwzsnLpjvobd3/Score}/270**.

The building presents some major issues that should be addressed in the redesign to improve its performance regarding sustainability.

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Overall site assessment: ${gr://SC_0koHmi9xIIdlodT/Score}/45
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 Community: ${gr://SC_86P5qpZ9iNxKKYB/Score}/15
 Place-based relations: ${gr://SC_0vzmO4yC5joIaRL/Score}/15

In the last page you will find a summary of the baseline sustainability assessment of the building that you can print as a PDF to monitor and support your decision-making.

Thank you very much for taking part in this pilot test of the Building Passport for Sustainable Conservation!

We would like to hear from you about your experience. Get in touch with any questions, comments or suggestions in the message box below.

If you are interested in the Building Passport, you want to know more about it, or you would like to keep using it as a tool in your future projects, leave your email and we will get back to you.

Email address:

Gonçalves, Mateus, Silvestre & Roders (2020). Going beyond good intentions: building passport for sustainable conservation. FCT PD/BD/127853/2016 ISISE/UMinho. IST /ULisboa. BK/TUDelft.

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List of Publications

Gonçalves J., Mateus R., Silvestre J. D., Vasconcelos G. (2017) Survey to architects: challenges to inspection and diagnosis in historical residential buildings, 3rd International Conference on Preservation, Maintenance and Rehabilitation of Historical Buildings and Structures (REHAB 2017), pp. 3-10, 978-989-8734-23-5.

Gonçalves J., Mateus R., Silvestre J. D. (2017) Experiências da prática profissional na reabilitação: análise de um grupo de foco, II Encontro Nacional Sobre Reabilitação Urbana e Construção Sustentável, pp. 147-156, 978-989-96543-9-6.

Gonçalves J., Mateus R., Silvestre J. D. (2018) Gonçalves J., Mateus R., Silvestre J. D. O Papel do Promotor na Qualidade das Intervenções de Reabilitação Urbana, Revista Confidencial Imobiliário, Issue Setembro 2018, pp. 27-30, 0874-9485

Gonçalves, J., Mateus, R., & Silvestre, J. D. (2018, October). Comparative analysis of inspection and diagnosis tools for ancient buildings. In Euro-Mediterranean Conference (pp. 289-298). Springer, Cham. DOI: 10.1007/978-3-030-01765-1_32

Gonçalves J. M., Mateus R., Silvestre J. D. (2018) Sustentabilidade na valorização do património construído, Edifícios e Energia, Vol. Novembro/Dezembro 2018, pp. 58-63, Depósito Legal nº 129681/98

Gonçalves, J., Mateus, R., & Silvestre, J. D. (2019, March). Mapping professional practice challenges in built heritage. In Professionalism in the Built Heritage Sector: Edited Contributions to the International Conference on Professionalism in the Built Heritage Sector, February 5-8, 2018, Arenberg Castle, Leuven, Belgium (p. 125). CRC Press. DOI: 10.1201/9780429397912-16

Gonçalves, J., Mateus, R., Silvestre, J. D., & Pereira Roders, A. (2020). Going beyond good intentions for the sustainable conservation of built heritage: A systematic literature review. Sustainability, 12(22), 9649. DOI: 10.3390/su12229649

Gonçalves, J. M., Mateus, R., Silvestre, J. D., & Pereira Roders, A. (2021). Contributions to a Revised Definition of Sustainable Conservation. In LDE Heritage Conference on Heritage and the Sustainable Development Goals. TU Delft Open. Delft, The Netherlands.

Gonçalves, J., Mateus, R., Silvestre, J. D., Pereira Roders, A. & Bragança, L. (2021). Attitudes matter: Measuring the intention-behaviour gap in built heritage conservation. Sustainable Cities and Society, 70, 102913. DOI: 10.1016/j.scs.2021.102913

Gonçalves, J., Mateus, R., Dinis Silvestre, J., Pereira Roders, A., & Vasconcelos, G. (2021). Selection of core indicators for the sustainable conservation of built heritage. International Journal of Architectural Heritage, 1-16. DOI: 10.1080/15583058.2020.1863518

Gonçalves, J., Mateus, R., Dinis Silvestre, J., Pereira Roders, A., & Bragança, L. (2022). Building Passport for Sustainable Conservation of Built Heritage. Journal of Cultural Heritage Management and Sustainable Development. DOI: 10.1108/JCHMSD-10-2021-0177

Gonçalves, J., Mateus, R., Silvestre, J. D., & Pereira Roders, A. (2021). Beyond Good Intentions: The Role of the Building Passport for the Sustainable Conservation of Built Heritage to Behavioural Change. Sustainability, 13(15), 8280. DOI: 10.3390/su13158280

Curriculum Vitae

Joana Gonçalves was born in Portugal in 1990. She graduated as an architect from the School of Architecture of University of Minho. In her master thesis she explored the contributions of vernacular architecture for sustainability, using both qualitative and quantitative methods to establish and analyze the relations between architecture, landscape, and ways of life, that contributed to the resilience of traditional systems over the centuries. She was awarded with the Iberian Prize on Traditional Architecture Research in 2014 for her research in this thesis.

In 2016 she started her PhD on “Beyond good intentions: building passport for sustainable conservation”, within the research program “EcoCoRe – Eco-Construction and Rehabilitation”, an International Doctoral Program on Sustainable Built Environment based in Portugal.

Between 2019 and 2021 she was a guest PhD in the Heritage & Values chair, at TU Delft, the Netherlands. In her research, which the results are presented in this dissertation, she uses a mixed-methods approach to understand practitioners’ behaviours towards heritage conservation and the reasons behind the lack of implementation of sustainable practices.

From 2020 to 2022 she was a lecturer in Heritage and Sustainability in the Heritage and Architecture section, in the Faculty of Architecture and the Built Environment, at TU Delft.

22#21

Beyond good intentions

Building passport for sustainable conservation of built heritage

Joana dos Santos Gonçalves

Sustainable Conservation are the processes of change through which the components of the inherited ecosystem from the past retain their value for present and future generations. As such, the value assessment is critical to recognise the values of heritage, not only by its aesthetical and historical values, but also by its contribution to a more sustainable future.
Despite recent policies and standards highlighting the role of heritage for sustainability and encouraging urban conservation, sustainable conservation is not yet the most common practice. The behavioural dimension is intrinsic to the decision-making process; however, studies analysing designers' decision behaviours regarding sustainability in built heritage are seldom found in recent literature.
This research aims to increase the understanding of the gap in the implementation of best practices of sustainable conservation of built heritage, and to achieve solutions for behavioural change. It applies methods from psychology to analyse designers' decisions behaviours, by eliciting common beliefs, challenges, and opportunities in the implementation of conservation intentions towards heritage buildings.
The results demonstrate that design decisions result from conscious and unconscious processes, some of them socially driven, while others result from individual attitudes. Targeting the primary belief in the study population on the (in)compatibility between sustainability and heritage conservation, a building passport for sustainable conservation was developed aiming at raising awareness in the value of built heritage to sustainability.
The results of this research can support the redesign of heritage buildings and demonstrate the importance of considering behavioural factors in the development of future sustainable conservation policies and tools.

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