

## Article

# The Role of Education in the Sustainable Regeneration of Built Heritage: A Case Study of Malta

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**Abstract:** Vernacular architecture has great historical, cultural and architectonic value, but also much potential for reducing energy demand. However, the eco-refurbishment of heritage buildings within Mediterranean countries poses particular challenges. The research presented in this paper is part of a wider study aiming to develop an effective framework for the sustainable regeneration of heritage buildings in Malta, using the 17th-century Presidential Palace of San Anton, Attard, as a case study. This paper focuses on the role of education in this field. Through qualitative research, including workshops with stakeholders, a stakeholders focus group and a public questionnaire, the awareness levels, educational background and attitudes of key stakeholders were analysed and assessed, as was the policy framework within which they operate. Interventions were found to be required at all levels. Increased awareness and education, a supportive policy framework, and a shift in the perceptions and attitudes of several key stakeholders were identified as crucial in ensuring that interventions on heritage buildings do not negatively affect their environmental performance, and/or impact their architectural and cultural value. This paper features recommendations outlining a supportive strategy for improving the knowledge base of stakeholders, including students, professionals, the public, policy-makers and operators.

**Keywords:** education; sustainable regeneration; built heritage; training; awareness; policy

## 1. Introduction

### 1.1. Broader Context and Research Background

Buildings contribute considerably to global greenhouse gas emissions [1], and are accountable for a significant percentage of energy consumption [2]. They account for 30% of carbon emissions and 40% of energy use worldwide [3]. In this light, the construction industry faces pertinent sustainability challenges in achieving energy savings and minimising environmental impact [4]. Addressing the complex and multifaceted challenges of sustainable development will require a robust framework, supported by various entities [5].

Centuries before energy efficiency and carbon dioxide emissions were a concern, the architects and engineers of what we now term heritage buildings, were faced with the responsibility of merging the concepts of aesthetics, comfort and functionality. Today, this has been compounded by the need to meet rapidly developing modern demands and technological requirements. It is further complicated by the fact that heritage value must be protected. According to Romani et al. [6], the potential for reducing energy demand and pollutant emissions is notably significant within the Mediterranean building sector. This is especially true in the case of heritage buildings [7–9]. Heritage buildings

feature passive environmental design strategies (PEDS), such as the internal courtyard for natural light and ventilation or thick walls for high thermal mass, which effectively improve comfort for occupants [10,11]. In this context, the importance of sustainably regenerating our built heritage is clear.

However, this typology presents a challenging case since numerous factors must be considered in the development of sensitive and effective eco-refurbishment solutions [12]. The professional's ability to harmoniously and effectively address these often-contrasting issues is highly dependent on developing knowledge and capability during the educational process, and evolving a skill set through practice and continuing professional development (CPD) thereafter. Educating building professionals in the nuances of heritage architecture, therefore, plays an integral role in achieving sustainability, not only in contemporary architecture, but also through interventions on heritage buildings.

It should also be acknowledged that professionals in the field of the built environment are not the only players in improving energy demand. Occupant behaviour plays a pivotal role in reducing building energy use [13], and has been defined as one of the most important aspects of energy efficiency in buildings [14]. Since a building's environmental performance may be influenced by its occupant, it is also important that building users are aware of the non-technical aspects of sustainable architecture. In this case, knowledge sharing can occur through dissemination of information and awareness campaigns.

Given the importance of energy efficiency in heritage architecture [15], the wider context of this work focuses on the sustainable regeneration of built heritage (SRBH) and the role of PEDS, inherent to historic Mediterranean buildings, in maximising occupant comfort. It seeks to derive a strategy enabling best practice decision-making, a necessity outlined by Lidelow et al. [16], through an effective policy framework and a robust educational system.

The Maltese Islands are characterised by a rich architectural history, with several heritage buildings typical of the Mediterranean context. However, the country has not yet maximised the potential energy-saving benefits of sustainable regeneration. Sustainable initiatives on historic buildings have been minimal and sporadic, as described in Section 1.2.3., and have mainly been undertaken through the impetus of European directives. The Energy Efficiency Directive (2012/27/EU) places eco-refurbishment obligations on Malta, including establishing and implementing retrofitting measures for public buildings, many of which are heritage buildings. One example is the Presidential Palace of San Anton in Malta, which was selected and assessed as a case study for this research.

The palace is a 17th-century building, with characteristics typical of heritage buildings in the region. It is representative of a typology designed to address the contextual, climatic and cultural profile of Mediterranean countries. Having undergone several changes, it is now an important multi-use centre, and is the main residence and primary office base of the President of the Republic of Malta. As a building of immense national value, it has the potential to act as a role model in the shift towards energy-efficient retrofitting, thus motivating the market [17]. The lessons learnt through this case study building are applicable to a much wider context.

The aim of this paper was to develop a comprehensive understanding of the knowledge base, awareness levels, attitudes and perceptions of key stakeholders in the SRBH, using qualitative methods, including workshops, a focus group and a questionnaire to assess education and awareness levels in Malta. In line with the overarching objective of this research, the authors make recommendations to outline an effective strategy that supports stakeholders in sensitively maximising the benefits of PEDS in heritage buildings.

For the purpose of this study, stakeholders are defined as organisations or groups that play an integral role, or have an interest in, the SRBH. These include students and graduates in building studies, professionals (including architects and civil/structural engineers), the general public and heritage building owners and/or occupants, policy-makers and regulators and non-governmental organisations.

The remainder of this section will review existing literature on the subjects discussed above. Section 2 will describe the research methodology adopted for the purpose of this study. The results will be presented in Section 3 and discussed, in the context of the literature framework, in Section 4. Section 4

will also highlight the knowledge gaps identified through this work, as well as the recommendations designed to address these.

## 1.2. Review of Previous Research

This section includes a discussion of the existing literature on the subject of impact of occupant behaviour on building performance. It also outlines the importance of the drive for the SRBH, narrowing to the Maltese context. The topic of sustainability in architectural education is reviewed, as is the educational system in Malta in the context of sustainability and heritage.

### 1.2.1. Impact of Occupant Behaviour on Environmental Performance of Buildings

Users' actions to improve internal comfort conditions account for a significant percentage of energy used in buildings [3]. Occupant behaviour plays a pivotal role in reducing building-energy use [13], and has been defined as one of the most important aspects of energy efficiency in buildings [14]. Situating behavioural analysis within the wider context of eco-refurbishment has been shown to improve the results of the process [18]. Therefore, low energy consumption in buildings cannot be guaranteed through technology alone: it should be supported by the appropriate interaction of occupants with the building [19].

Education provides a tool for influencing occupants to interact with a building in a more energy-conscious manner, thereby reducing energy consumption [20]. In fact, the promotion of energy-saving measures has been shown to have a significant benefit of up to 10% reduction in household electricity consumption as a result of improving user behaviour [14]. This outcome, termed "green behaviour", produces energy savings following positive behavioural changes [13]. According to Quist & Vergragt [21], behavioural change incentivised by green training programmes is also required to meet the energy reduction requirements.

### 1.2.2. Sustainable Regeneration of Heritage Buildings

Internationally, interest in the energy performance of heritage buildings has increased substantially, both in practice and through research [16]. Studies have shown that significant energy savings can be achieved without impinging on a building's heritage value [8,22]. Notwithstanding this, proposals designed to improve the energy performance of heritage buildings must face the challenge of harmoniously merging several different aspects [12]. These include respecting the protection status of historic features, satisfying modern requirements generated by new uses, retaining balanced environmental conditions for artefacts and achieving comfort requirements for occupants [23]. The optimum retrofit should result in a rational balance of these components.

In designing contemporary energy-efficient buildings, architects consider the passive environmental design strategies (PEDS) developed over centuries of experience [24]. These include natural ventilation, solar orientation, thermal mass and shading. PEDS are inherent to heritage buildings, implemented through the use of traditional features with the purpose of providing a comfortable internal environment for building occupants [11]. Maximizing the performance benefits of PEDS is core to the SRBH.

The relationship between conservation and sustainability is internationally recognized [25]. Although the goal of merging energy and heritage conservation through sustainable regeneration has been acknowledged through previous research [15], no study has collated and assessed the various types of PEDS. However, several distinct studies have analysed the impact of specific PEDS [11,26–29]. For example, Cardinale et al. [11] concluded that the vernacular Southern Italian buildings which they studied performed well environmentally as a result of the high thermal mass of the building structure.

### 1.2.3. Heritage Buildings in Malta

The updated minimum energy performance requirements for buildings in Malta came into force on 1 January 2016, as specified by the National Energy Efficiency Action Plan [30]. This document, which must be submitted to the European Commission by each member state every three years,

outlines energy-efficiency measures and savings. Although the latest submission makes no specific reference to initiatives on built heritage, it does mention the retrofitting of a large-scale public-owned heritage building through energy-efficient measures, namely, the St. Vincent de Paul Rehabilitation Centre and Old People's Home. Although this is highlighted as the public sector leading by example, the Government's obligation to reduce carbon emissions from existing stock requires an infrastructure policy that encourages stakeholders to make the transition towards green retrofits [31].

Given Malta's abundance of heritage buildings, huge potential exists to exploit the benefits of energy-efficient retrofits and sustainable interventions. However, whereas the regeneration and reuse of older properties is encouraged [32], the role of eco-refurbishment remains generally unacknowledged. Nonetheless, the Energy Efficiency Directive (2012/27/EU) obliges Malta to adopt national building renovation strategies (Article 4), including the eco-refurbishment of public buildings (Article 5), many of which have heritage value. The next section will discuss the importance of the role of education in achieving a balance between heritage and energy conservation.

#### 1.2.4. Sustainability in Architectural Education

The period between 2005 and 2014 was declared by the United Nations as the Decade of Education for Sustainable Development [33], with the United Nations Educational, Scientific and Cultural Organisation stating that "Education for Sustainable Development is not an option but a priority" [34]. In 2012, Member States renewed their commitment to the initiative [35], and further reinforced this commitment through the post-2015 Sustainable Development Goals [36]. According to Khataybeh et al. [33], embedding the principles of sustainable development in education will motivate students to consider and collaborate towards a sustainable future. Given the clear links between the sustainability agenda and the building industry, there is justification for basing construction degree curricula in higher education on sustainability principles [37].

Academic institutions play an important role in supporting future generations of academics, architects and civil engineers, and policy-makers to develop effective strategies for overcoming existing barriers in the sustainable regeneration of heritage buildings. Educational programmes have been revolutionised in order to enable learners across several disciplines to formulate innovative, problem-driven solutions, despite the context of information deficits [5,38]. For example, the Architectural Association, a prominent school of architecture in London, adopted a dynamic approach to education by annually revising the Graduate School's Masters Programme in Environment and Energy Studies to explore different ways of assessing environmental performance and attributes [39].

Altomonte et al. [38] suggest that architectural and urban design curricula centred around sustainability should be developed with a focus on learning outcomes and content delivered. The study recommends consideration of the following factors: teaching structure, including stages of delivering specific information; the learning methods, including lectures, seminars and workshops; learning tools, including real-case projects and e-learning using advanced computer software; and the assessment criteria, including coursework, laboratory testing and site work. The developed programme should be based on a mission statement that prioritises sustainability from the beginning of a student's education.

However, Taleghani et al. [40] note that the development of sustainable architectural education is hindered by ambiguous definitions of sustainable architecture, unclarity regarding the meaning of sustainability and insufficient expertise in this field. Moreover, research examining the curricula of architecture degrees in Turkey has shown that, although the inclusion of aspects relating to sustainable architecture has improved, it remains incomplete [41]. In contrast, studies such as EDUCATE (Environmental Design in University Curricula and Architectural Training) have highlighted the successes of educational programmes that adopt more flexible and dynamic teaching techniques, and that link academic education to the professional domain [38]. The results of another study [36] on the implications of sustainable development trends concluded that universities play an integral role in the advancement of sustainability through education, research and outreach.

In order to maximise the potential of this role, researchers are encouraging alternative approaches to long-standing traditional teaching methodology. Charalambous and Christou [42] questioned whether traditional architectural education programmes sufficiently equip graduates for the challenges they will face in practice. The study outlines the benefits of an investigative approach to learning, supporting a practical application of concepts, and highlights the potential offered by the design studio to link academia with the profession. Further research [38] has shown that the use of experiential learning aids, including case studies, field trips, laboratory use and computer applications, may increase the awareness, motivation and interest of undergraduates. Ibrahim et al. [43] promote the use of collaborative teamwork through roundtable discussions, project review sessions and critiques, and brainstorming sessions, supported by advanced computer technologies. This approach challenges the student. Adopting different forms of learning methods, such as workshops, has also been shown to be beneficial [44].

Problem-based learning also challenges the student, increasing interest in the topic and rendering the knowledge and skills gained more memorable in preparation for life-long learning [38]. As part of the problem-based learning approach, Ibrahim et al. [43] encourage mentoring and reverse mentoring. Through this system, the student is supported in developing trans-disciplinary skills by interacting with a design team. The mentor may also learn from this experience by being exposed to innovative technologies, skills and ideas.

Hardin et al. [5] advocate an evolution of the case-based method, whereby students are involved in developing course content through engaged learning and the strengthening of existing cases. This initiative has registered a positive initial experience, and is being developed further through strategic, community-building efforts. Charalambous and Christou [42] also advocate practice-based learning as a means of engaging students and encouraging them to develop creative solutions to real-case projects. The effectiveness of a practical approach to education is further highlighted by Gulay Tasci [45], who proposes utilising built and natural environments, such as the school building itself, as a learning tool for students to explore sustainability principles.

Student-involvement at the development stage of a real-case sustainability-based project at Curtin University of Technology in Perth, Western Australia, was found to be advantageous, improving the quality, scope and probability of implementation [46]. In this context, the importance of designing school buildings using these sustainability principles is emphasised [45]. The University of Arizona's College of Architecture, Planning and Landscape Architecture undertook an education, research and community outreach programme, conducting energy audits and identifying efficiency opportunities for greening the campus [47].

An effective learning environment motivates and enthuses students to better engage in the task of seeking knowledge [38], whichever approach is adopted. Student engagement and interest were found to improve the efficacy of the process, and may be achieved through a learning environment that fosters enquiry, discussion and practical application, allowing the student to establish links between key concepts [38] such as heritage and energy conservation. Analytical and cross-referencing skills, as well as imaginative and independent thinking, provide a basis for interest-led deep learning, which Warburton [48] promotes as a method to maximise the benefits of sustainable architectural education. The study notes that successful programmes should allow the student to develop a flexible style of learning by developing both knowledge and understanding of a subject.

Deep learning is also encouraged by [38], as a means of embedding sustainability in the academic programme. The study emphasises the need to provide students with technical knowledge of sustainable design, as well as the skills and competence to apply it creatively. This should be supported by an understanding of the multidisciplinary nature of a project. In this context, the study also highlights the importance of cross-disciplinary teaching in sustainability.

Several disciplines have a shared interest in the principles of sustainability [45]. Spanning these disciplines to facilitate sustainability education has been shown to produce positive results [48]. In this light, Ibrahim et al. [43] recommend that trans-disciplinary learning is incorporated in the architectural



curriculum. They define the trans-disciplinary teaching framework as targeting a particular issue, such as sustainability, and incorporating perspectives from and beyond the boundaries of the discipline. This is implemented through an approach that facilitates collaboration of the educational team members and the collective contribution of beneficial knowledge and skills [43]. In architectural education, trans-disciplinary teaching aims to develop an understanding of the multi-faceted built environment, which is impacted by several fields. It also aims to prepare the graduate for professional team scenarios in practice.

Although studies [38,43,45] highlight the importance of broadening teaching for undergraduates to encompass subjects that are not traditionally associated with sustainability, to the authors' knowledge none of the literature makes direct reference to the correlation with heritage conservation in undergraduate education. This highlights a gap in the existing research whereby teaching models integrating the concepts of heritage and energy conservation, as part of the sustainable regeneration of built heritage, have not been assessed.

Studies on insulating heritage buildings, carried out by Historic Environment Scotland, identified the need for education and training targeting specific stakeholders, namely building owners, professionals and contractors [49]. It was concluded that training delivery should be customised to the different groups, as described below:

- building owners: presentations to increase awareness, and e-learning modules on energy efficiency
- professionals: dissemination of detailed evidence-based data
- contractors: hands-on demonstrations of techniques.

According to Jenkins [49], a combination of custom-designed programmes, developed from a strong knowledge base established through technical research, will ensure that stakeholders receive adequate understanding and skills to collectively improve the energy performances of traditional buildings. The study also emphasises the importance of establishing a comprehensive strategy to raise awareness on the eco-refurbishment of heritage buildings through education and training.

A similar initiative was undertaken by the Townscape Heritage Initiative in Cornwall. Training days were provided for contractors and architects, focusing on retrofitting traditional buildings [50]. The programme was complemented by work experience for local college students who learnt practical techniques for repairing, rather than replacing, heritage buildings elements.

Literature [5,38] has demonstrated that connecting education to practice in sustainability is as integral in academia as CPD is in the private, non-profit and public sectors. Altomonte et al. [38] highlight the importance of linking advances in academic education to similar initiatives in the professional domain, such as linking CPD for educators and professionals to changes in legislation, and the use of best practice cases to strengthen design methodologies. The study notes life-long learning as a priority, and proposes measures to facilitate this, such as CPD initiatives and part-time further education, as well as academic and design research, with the provision of advanced analysis tools to support the latter in the design of innovative solutions.

#### 1.2.5. Formal Education and CPD on SRBH in Malta

The Faculty for the Built Environment at the University of Malta offers the only means of reading for an architectural and structural/civil engineering degree in Malta. A recent restructuring of the course has resulted in the phasing-out of the five-year degree, and the introduction of a tiered structure, as described below [51]:

- a Diploma in Design Foundation Studies (one year) provides an overview of history, art and design;
- the Bachelor of Science degree in Built Environment Studies (three years) provides development in architectural, structural/civil engineering and planning subjects;
- the professional Master's degree (two years) allows for the study of specific competencies in the three outlined fields, two of which (architecture and structural/civil engineering) qualify the graduate to prepare for the local state-awarded warrant in either practice; and

- further specialisation is offered through research-based post-graduate degrees.

The programme of study comprises lectures, assignments, design projects and a dissertation and thesis, featuring a combination of mandatory and elective units [52,53]. Amongst other subjects related to the built environment, the bachelor's [52] and master's [53] degree curricula feature a range of credits addressing the concepts of building science and physics, sustainable development, energy-efficient design, vernacular design, conservation and Maltese built heritage. Therefore, in theory, students are educated in the field of SRBH in Malta.

Having successfully completed the academic programme, the graduate is eligible to undertake a professional traineeship, spanning a minimum period of one year, and leading to the examination required to be admitted to the Warrant of Perit [54]. The term perit, or periti in plural, is the official umbrella title given to a warranted architect and civil or structural engineer in Malta [55].

Periti are not required by law to undertake CPD courses throughout their professional careers [56].

## 2. Materials and Methods

As advocated by several researchers [57–60], a mixed methodology was used to gather data. This is outlined in Table 1, which specifies the actions taken and research tools utilised in this study. The overall approach consisted of the delivery of two workshops, a structured questionnaire and a semi-structured focus group, each targeting specific participants.

**Table 1.** Synopsis of Data Gathering Methods.

Action	Research Tool	Participants
Event A Stakeholders Workshop 19 September 2016	Workshops (x3)	Participants (N = 66) included policy-makers, regulators and operators; professionals; academia; non-governmental organisations.
Event B Public Seminar 4 April 2018	Questionnaire	Participants (N = 51) comprised a self-selecting sample of the public representative of different demographic groups.
Event C Planning Authority Workshop 5 June 2018	Workshops (x2)	Participants (N = 12) were selected by senior management and represented various departments within the Planning Authority.
Event D Stakeholders Focus Group 30 July 2018	Focus Group	Participants (N = 3) represented the Faculty for the Built Environment; Chamber of Architects and Civil Engineers; Building Regulations Office.

In order to develop an effective strategy for the SRBH in Malta in line with the overarching aim of this research, contributions from a wide network of local stakeholders were required. Workshops are a robust instrument for attaining the intimate involvement of stakeholders [61] across a range of disciplines. Quist & Vergragt [21] have demonstrated the success of workshops as a participatory method that enables the opinions, attitudes, perceptions and values of diverse groups to be registered, and allows for ideas to be developed harmoniously.

Another research tool utilised was a questionnaire, since it offers the opportunity to collect a large amount of data from the targeted respondents quickly. Questionnaires administered in this way allow participants to answer questions at their own pace, but within the allocated time. Moreover, the generated data is free of interviewer variability and interviewer effects which, as suggested by Tourangeau and Smith [62], may yield biased responses.

The focus group technique is a method of interviewing a small group of respondents simultaneously. In this case, it was considered more appropriate than a group interview, since it was designed to address a specific topic, and more advantageous than individual interviews, since it allowed for a discussion that might challenge the respondents, strengthening the quality of data generated. Although Bryman [63] notes that multiple sessions are typically held, the single session held as part of this

research targeted a specific group of respondents whose views were particularly valuable to the study. It was, therefore, sufficient to hold one focus group. Morgan [64] recommends smaller groups in instances when participants are well versed in the topic, as was the case for the respondents interviewed in this study.

### 2.1. Implementation of Research Methods

Table 2 outlines the research tools used to address each objective of this study.

**Table 2.** Synopsis of Data Gathering Methods.

Objective	Event A Stakeholders Workshop	Event B Public Seminar	Event C Planning Authority Workshop	Event D Stakeholders Focus Group
Objective 1: To assess the existing knowledge base of policy-makers and operators, professionals and academics, on the SRBH and PEDS	X		X	X
Objective 2: To assess the awareness of policy-makers and operators, the public and professionals, on PEDS and their potential to influence energy performance		X	X	X
Objective 3A: To assess the public's attitude towards SRBH		X		
Objective 3B: To assess perceptions of policy-makers and operators, professionals and academics towards SRBH	X		X	X
Objective 4: To assess the Planning Authority's approach to SRBH	X		X	X

#### 2.1.1. Workshops: Events A and C

Two semi-structured workshops were held in sequence (Events A and C), with the former informing the latter. The first was addressed to a range of stakeholders, listed below. Of these, the Planning Authority was identified as necessitating further in-depth investigation. Therefore, the second workshop specifically targeted Planning Authority representatives.

In both cases, the workshop sessions were preceded by presentations and a walking tour of the case study building, contextualising the study. The stakeholder workshop featured a panel discussion on the wider concepts of sustainability and heritage buildings, which presented the perspectives of different entities, including the Planning Authority, NGOs, academia and the profession. The Planning Authority workshop featured an informal discussion designed to establish the knowledge base and perceptions of the Authority on the concepts of heritage and energy conservation.

The aim of the Stakeholders Workshop (Event A) was to establish the knowledge base and awareness levels of key players in the eco-refurbishment of heritage buildings, and to explore the issues faced in designing, proposing and implementing interventions. Three workshop sessions, run simultaneously, focused on the

- eco-refurbishment of heritage buildings;
- sensitive interior design of heritage buildings; and
- effect of PEDS on the environmental performance of heritage buildings.

The Stakeholders Workshop involved a varied group of local participants comprising various key stakeholders. The participants (N = 66) included representatives of the following organisations/groups:

- Ministry for Sustainable Development, the Environment and Climate Change
- Building Industry Consultative Council
- Faculty for the Built Environment and Faculty of Engineering, University of Malta



- Institute for Climate Change and Sustainable Development, University of Malta
- Planning Authority and Building Regulations Office
- the profession (periti, as defined in Section 1.2.5)
- product suppliers

The objective of the Planning Authority Workshop (Event C) was to develop an understanding of the procedures and best practice guidelines adopted by the Planning Authority, as well as the obstacles faced in relation to interventions on heritage buildings. Two workshops were run simultaneously. The participants of each session were selected on the basis of their role within the Authority. The groups, which were divided into senior management and on-the-ground operators, addressed similar topics from different perspectives. The aspects discussed centred around the existing knowledge base and awareness levels, and included the:

- availability and adequacy of existing policy, guidance documents and best practice standards;
- direction adopted by the Planning Authority on heritage buildings and environmental design;
- attitudes of the public and periti towards heritage buildings, as perceived by the Planning Authority;
- obstacles faced by the Planning Authority; and
- recommendations to facilitate the Planning Authority's assessment of heritage building applications.

#### 2.1.2. Public Questionnaire: Event B

The public seminar targeted the general public, a key stakeholder in the SRBH. The participants comprised of a self-selecting sample with an interest in the President's Foundation for the Well-Being of Society, the entity which issued invitations to the event through their mailing list.

The primary scope of the session was to derive an understanding of the respondents' awareness of PEDS and participants' attitudes in the context of the field of research. The event was also designed as a means of disseminating information. To this end, after completing the questionnaire, respondents attended an information seminar and a tour of the case study building designed to inform participants of the benefits of PEDS inherent to heritage buildings.

Participants were asked to hand in the completed questionnaire before leaving the session. Of the 51 participants ( $N = 51$ ), 47 completed and submitted the questionnaire ( $n = 47$ ). The sample of participants was representative of all age groups. Of the respondents ( $n = 47$ ), 40% of whom were male and 60% female, the majority (81%) had a tertiary level of education, whilst the remainder had a secondary level of education. Just under half of all participants (48%) had direct experience (residence or workplace) with heritage buildings, which implies that the results should illustrate both experiences and perceptions.

#### 2.1.3. Stakeholders Focus Group: Event D

This focus group involved key stakeholders in the sustainable regeneration of Malta's built heritage. A single session was held, during which one representative from each of the below-listed organisations participated collectively in a semi-structured discussion. The interview schedule included general questions designed to guide the session, as recommended by Bryman [63].

The aim of the focus group was to discuss specific themes and issues arising from both workshops and the public questionnaire in a setting where participants' interactions could be observed. The session was particularly informed by the Planning Authority Workshop, which identified the following stakeholders as having a key role in the SRBH:

- Faculty for the Built Environment, University of Malta: As the sole provider of the educational training and degree necessary to graduate as an architect and civil engineer in Malta, the Faculty for the Built Environment (University of Malta) plays an integral role in defining the existing knowledge-base of students and graduates. During the stakeholders focus group, this entity was represented by a senior member of the Faculty.

- Malta Chamber of Architects and Civil Engineers: The Chamber of Architects and Civil Engineers supports members of the profession in their practice in the interest of the community [65]. The Chamber advocates for the protection of Malta's architectural heritage and for the formulation of a local Building Regulations framework [66]. During the stakeholders focus group, the Chamber was represented by a council member.
- Building Regulation Board, Malta: Amongst other responsibilities, the Building Regulation Board (BRB) is entrusted with the preparation of technical guidance documents [67]. This may include a national framework for environmental performance requirements in buildings. The BRB was represented at the stakeholders focus group by a board member.

## 2.2. Data Analysis Methods

### 2.2.1. Qualitative Data Analysis

Content Analysis was used to assess the rich descriptive data generated through the workshops, a public questionnaire and a focus group. This approach involves the systematic, and replicable, distribution of information into defined categories [63]. It is considered to be a transparent and reliable method, allowing for rigorous data analysis and the ascertainment of a practical conclusion [68]. It is also considered to be a highly flexible approach that may be applied to a wide selection of documents [63].

Three approaches to content analysis have been identified, namely: conventional, directed and summative [68,69]. Of these, directed content analysis was adopted as the primary means of data analysis for the purpose of this research, and applied to the results of Events A, C and D. Conventional content analysis was adopted within a mixed-method approach, to assess the results of Event B.

### 2.2.2. Quantitative Data Analysis

Due to the relatively small sample size ( $n = 47$ ), quantitative data analysis was used to assess the responses of the questionnaire (Event B). However, numerical comparisons were performed, both manually and using SPSS, in order to understand respondents' perceptions and knowledge bases, as well as to ascertain whether the dissemination of information triggered a change in this regard.

The quantitative analysis of the questionnaire results was carried out in three stages, as described below:

- Stage 1, General Analysis: The results generated by each question were analysed individually, then collectively, to produce an overall assessment of the data.
- Stage 2, Demographic Context Analysis: The results generated by each question were analysed in the context of the participant demographics (age, level of education, experience of heritage buildings) in order to determine whether these affected the data from this group of respondents.
- Stage 3, Comparative Analysis: The responses to questions in Section B were compared to those generated by the same questions in Section A, to ascertain whether the information disseminated triggered a change in responses.

The primarily quantitative method of analysing the data generated through the questionnaire was paired with an element of qualitative content analysis. The responses to open-ended questions were coded in order to enable the interpretation of a general meaning.

## 3. Results

### 3.1. Existing Knowledge Base, Awareness and Education

These results successfully addressed research objectives 1 and 2, as outlined in Table 2.

### 3.1.1. Awareness and Access to Information

The results of the Planning Authority Workshop highlighted the Authority's perception of a general lack of knowledge and awareness on heritage value and PEDS, calling for education of various stakeholder groups, such as periti (defined in Section 1.2.5), energy performance assessors, developers and the general public, including children. This perception was supported by the results of the public questionnaire, which highlighted the participants' general lack of awareness of the environmental performance potential of heritage buildings. Of the total respondents ( $n = 47$ ), 40% believed energy demand to be greater in heritage buildings than in contemporary buildings. The significance of this result is highlighted by the fact that it is heavily based on the participants' personal experiences. Almost half of respondents (49%) lived or worked in a heritage building, and 64% have been involved, directly or indirectly, in a heritage building project. A majority of respondents stated that, in their experience, there was not enough information to guide a heritage building project (67%) and, in their view, there was not enough information to guide eco-refurbishment interventions in a heritage building (86%).

The Focus Group also highlighted a lack of awareness and insufficient information on the subject of SRBH in Malta. According to the BRB representative, few periti are aware of their obligation to certify compliance with minimum energy performance requirements, as outlined in Technical Guidance Document F [70]. Participants of the focus group agreed that not all periti have the knowledge base and technical abilities to fulfil this responsibility, and that this is mainly a consequence of a lack of evidence-based data. It was felt that, in this context, periti are not able to apply the principles of Technical Guidance Document F to heritage buildings, particularly since the document itself makes limited and vague reference to this typology.

### 3.1.2. Need for Developing Evidence-Based Information

The Stakeholders Workshop highlighted the need to develop a better understanding of: the impact of PEDS on performance of heritage buildings; sensitive methods of intervening on heritage buildings; and the effectiveness of eco-refurbishment solutions. It was felt that the public, especially current and potential heritage building owners, should have access to the basic principles of these subjects, and that professionals would benefit from utilising more-detailed information to guide evidence-based retrofit decisions.

Participants of both workshops agreed that practical experience currently represents the predominant method of learning for professionals in the specialised field of SRBH in Malta. The results of the focus group supported this statement. The need for specialised education for particular stakeholder groups was also highlighted during the Planning Authority Workshop. It was felt that the building industry, in general, lacked proper training and an understanding of the environmental performance benefits of vernacular PEDS.

The Faculty for the Built Environment representative stated that "With new buildings there are standards [outlined]. With old buildings, we need research data", since minimal systematic study has focused on the environmental performance of this typology. The group agreed that research to date has been sporadic in nature, with superficial follow-up, if any. As a consequence, working graduates do not have a knowledge base that enables them to guide and advise their clients in this area. The Faculty representative in the focus group supported this statement, and noted that the wider curriculum has not been successful in intersecting the concepts of passive environmental design and heritage, with students separating them at the conceptual stage. In order to address this, an increase in government scholarships was proposed to support active research in this area, with studies being undertaken in a coordinated and systematic manner. The research would include, for example, an assessment of the cost of subsidies against the long-term returns.

The need to generate scientific data was also highlighted during both workshops. This was felt to be of great importance in the context of having evidence-based data backing high-level environmental and heritage measures, such as government incentives for green technologies or restoration schemes, as suggested by the focus group. Particularly in the case of the photovoltaic solar panel grant, which

has impacted Malta's urban streetscapes and rural skylines, it was felt that other solutions should have been assessed against the national financial burden of this grant.

The importance of published, academic research was also emphasised in the context of supporting professionals. It was felt that studies are required to convert anecdotal or practical cases into evidence-based data, identifying both effective and ineffective solutions that could be fed back to colleagues and clients. Respondents called for concrete measures to be put in place to facilitate this shift.

The operators who participated in the Planning Authority Workshop also called for academic research supporting the development of improved energy-efficiency mechanisms through PEDS. The traditional timber balcony and louvered timber apertures were proposed as case studies. Participants emphasised the importance of feeding derived conclusions back to the profession, in order to support periti in making recommendations to improve the environmental performance of heritage buildings. It was felt that education of this particular stakeholder group is key to the success of initiatives to improve energy efficiency at a national level.

### 3.1.3. Knowledge Sharing

The limited ability to share knowledge between stakeholder groups was identified as a barrier to developing knowledge base. Participants of the Stakeholders Workshop felt that, since practical experience currently represents the predominant method of learning for professionals in the specialised field of SRBH in Malta, and given the hesitance to share mistakes, there is little opportunity to gain knowledge from colleagues. Knowledge sharing, particularly professional-to-professional sharing, was believed to be key to addressing the lack of education across stakeholder groups, and to the establishment of good practice guidelines, which should be prioritised.

A platform enabling professionals to share evidence-based data and anecdotal cases, including both positive and negative experiences, was suggested as a means of broadening knowledge base by disseminating information. Two existing tools were identified, which could be used for this purpose:

- a Periti Discussion Group: a closed, members-only Facebook group for periti, established by the Maltese Chamber of Architects and Civil Engineers, currently used to submit questions to colleagues and share information. This was referenced as an ideal platform for knowledge sharing between professionals; and
- an Ecobuild platform: a green building portal supported by the Building Industry Consultative Council, set-up to showcase locally available products, services and technologies, as well as case studies of good practice. A BICC representative, participating in the stakeholders workshop, noted the dependency of this tool on people coming forward with case studies.

Alternative means of disseminating information were also discussed. Short lectures for the public, and seminars or CPD courses for professionals, were proposed by the participants of both workshops. The media, including radio programmes, and social media platforms, were referenced by the Stakeholders Workshop as important tools for increasing awareness and promoting existing knowledge-sharing platforms, such as those highlighted above.

### 3.1.4. Specialised Expertise at the Planning Authority

The need for training Planning Authority officials was highlighted by senior management during the Planning Authority Workshop, and also during the Stakeholders Workshop. Stakeholders felt that heritage officers should be bolstered in their ability to support bespoke interventions, through proper training aimed at developing an understanding of the environmental performance of this building typology.

The Senior Management Workshop concluded that there is currently no feedback loop to the Planning Authority regarding national results in meeting energy-efficiency targets through, for example, government rebate schemes for double glazing. This was identified as a barrier to

developing best-practice guidelines based on which Planning Authority officials can assess proposals on heritage buildings.

### 3.2. Attitudes Towards the Sustainable Regeneration of Built Heritage

These results successfully addressed research objectives 3A and 3B, as outlined in Table 2.

#### 3.2.1. Attitudes of the Respondents of the Public Questionnaire: The Value of Heritage Buildings

The results of the public questionnaire provided an understanding of the participants' perceptions of heritage buildings. The majority of participants (62%) registered a preference for heritage buildings. The reasons for this preference were coded into three categories, namely: aesthetic/atmosphere, value and comfort. Responses highlighted notable importance attributed to atmosphere (charm and character) and aesthetics. Environmental performance was, in contrast, given much less merit. In both instances (preference for heritage buildings and preference for contemporary buildings) the results illustrated a perception of lower comfort levels associated with heritage buildings, for example: "Heritage buildings are more humid and dusty"; "Comfort is essential" (preference for contemporary); "The history, character and charm of heritage buildings outweighs lack of comfort".

#### 3.2.2. Attitudes of the Respondents of the Public Questionnaire: Regeneration of Heritage Buildings in Malta

When asked about the regeneration of heritage buildings in Malta, the majority of respondents registered a negative association. Of the 47 respondents, 41% felt that it was negative but improving, whereas 23% saw no improvement, and 8% blamed the Planning Authority for the current climate. Of the 12% that registered a positive and improving association, increased public interest was often attributed to government schemes offering refunds and tax reductions for buildings in Urban Conservation Areas.

#### 3.2.3. Attitudes of the Respondents of the Public Questionnaire: Energy Efficiency and Heritage Buildings

PEDS were noted amongst the justifications given by the 55% of respondents who identified contemporary buildings as having greater energy demand than heritage buildings. This demonstrates that the respondents are aware of the benefits of PEDS, but unaware of their presence/impact in heritage buildings. The results also highlighted the conservation of heritage features as being prioritised over maximising the benefits of PEDS in heritage buildings.

Respondents were asked to list two means of improving energy efficiency in a contemporary building and in a heritage building. Several of the listed means of increasing energy efficiency in a contemporary building were, in fact, passive design techniques, synonymous with those adopted by architects of heritage buildings in the past. Examples include: study orientation; reduce direct sun exposure; build using thicker walls; improve natural lighting and ventilation; louvered windows. PEDS were also listed as a means of improving energy efficiency in heritage buildings.

The questionnaire was used to assess the group's perceptions on whether predefined interventions related to PEDS affect the environmental performance of heritage buildings. In half of the postulated interventions, a notable group of participants (+15%) were not able to answer the question. This indicates a lack of awareness and need for education to improve the respondents' understandings of heritage buildings.

#### 3.2.4. Perceptions of the Planning Authority: Public Attitudes Towards SRBH

The participants of the Planning Authority Workshop discussed public attitude towards the SRBH at length. Participants of the Senior Management Workshop perceived a negative attitude towards the appropriate retrofitting of heritage buildings, as well as towards heritage value and energy performance of buildings in general. They felt that professionals are not sensitive to heritage value,



that developers contribute little to inciting a shift in this regard and that the cost of eco-refurbishment projects is a deterrent to the public. The financial burden was also cited as an obstacle during the Operators Workshop.

Respondents in both groups highlighted a public attitude of instant gratification, whereby active means of achieving comfort (such as air-conditioners) were immediately prioritised, with alternative measures rarely being proposed or considered. The perceived public expectation of cheap and immediate solutions for comfort was coupled with a lack of appreciation for heritage value. Participants of the Senior Management Workshop highlighted the impact of active technology suppliers, who encourage public reliance on active systems. The group expressed concerns that there are no repercussions to suppliers, even when they encourage solutions that are not in line with legislation.

The Operators Workshop emphasised the importance of addressing occupant behaviour in buildings, where the occupants are not paying the bills (e.g., office workers), highlighting an ingrained dependence on active means without first resorting to passive solutions (e.g., opening windows). This was referenced both in terms of ventilation and lighting.

Participants of both sessions agreed that a change in the mindset of the general public must be instigated in order to achieve energy savings at a national level. To this end, the following measures were recommended:

- policy-makers should invest in educating and employing conservation architects;
- the general public, including children, should be educated regarding PEDS;
- fiscal incentives should be introduced to support the eco-refurbishment of heritage buildings;
- retrofit interventions should be monitored in order to establish cost-efficiency, and the information garnered should be disseminated to the public;
- developers should invest in new technologies, such as BREAAAM software and intelligent systems; and
- product suppliers should be educated, and a register should be established by law.

### 3.2.5. Perceptions of the Stakeholders Workshop and Focus Group: Attitudes Towards SRBH

The findings of the Stakeholders Workshops highlighted a general understanding of certain PEDS: water reservoirs and thick walls, typical of this building typology, were identified as solutions to address the local climate. Participants agreed that there is a need to increase public awareness on the benefits of these features, which are rarely incorporated in contemporary design: “We have to push society to think more in sustainable terms”. There was also general consensus regarding the importance of considering context, building use, occupant behaviour and comfort. However, there was disagreement on most other aspects. For example, participants proposed different approaches to designing for thermal comfort. Some emphasised the importance of understanding how the building performs, others focused on the need to design for adaptive comfort temperatures according to a worst-case temperature week, and some favoured using weather files rather than monitoring the building for long periods. This highlights the dependence on anecdotal or practical information, rather than evidence-based data and accepted methodologies.

The focus group discussed current attitudes of a wide range of stakeholders towards SRBH, noting that:

- government entities have not shown leadership, choosing to react rather than take affirmative measures, such as the formalisation of a dedicated strategy;
- the market is not yet structured for the consideration of energy in heritage buildings, and without this drive, periti tend to revert to an approach of restoration, rather than one which brings the building into the modern era; and
- the Chamber of Architects and Civil Engineers has taken proactive measures by volunteering to produce a position paper on building regulations, amongst other aspects, addressing environmental design issues.

### 3.3. *The Planning Authority's Approach towards the Sustainable Regeneration of Built Heritage*

These results successfully addressed research objective 4, as outlined in Table 2.

#### 3.3.1. Dedicated SRBH Policy and Design Guidelines

The lack of adequate policy provision, guiding sustainable interventions on heritage buildings, was highlighted as a major concern of both workshops and the focus group. Participants of the Stakeholders Workshop referenced the need for policy and design guidelines on the subjects of heritage building interiors, retrofitting heritage buildings and environmental performance of heritage buildings. The Senior Management participants of the Planning Authority Workshop emphasised missing links between heritage and energy conservation guidelines, and noted potential conflicts. For instance, whereas double glazing apertures are encouraged as a retrofit solution, this is not widely accepted within Urban Conservation Areas.

#### 3.3.2. Case-by-Case Assessment of Eco-refurbishment Proposals

The Stakeholders Workshop placed particular emphasis on the uniqueness of each heritage building and, in turn, on each eco-refurbishment proposal. Participants agreed that, although guiding principles are useful and should be defined through policy, assessment of such proposals must be carried out on a case-by-case basis by the Planning Authority. The implementation of this method of assessment was seen to be impeded by a lack of recorded, effective interventions on heritage buildings, and by a lack of guidance documents in this regard, as highlighted in the previous section. In this context, participants of both workshops suggested a collation of best practice guidelines and examples, accessible to the Planning Authority (for assessment purposes) and the profession (for reference in designing bespoke solutions).

Best-practice techniques, existing technologies and appropriate materials were discussed by participants of the Stakeholders Workshop, but focus was heavily placed on the need for knowledge sharing across professionals and the industry, particularly in the context of a lack of guidance documents. The Periti Discussion Board was once again referenced as an effective platform, used regularly by professionals, to ask questions and discuss issues related to policy requirements. Participants emphasised the importance of utilising similar platforms to disseminate information regarding best-practice cases for eco-refurbishment projects, as well as mistakes.

The concepts of reversibility, legacy and authenticity were discussed during the Stakeholders Workshop. Respondents listed a number of examples of how these concepts could be implemented in practice, including “conservation of authentic fabric”, “keeping a building’s history legible” and “striking a balance between wants and needs so that the old building is not overshadowed by new services”. It was felt that modern interventions should clearly demonstrate the original fabric, keeping this intact.

#### 3.3.3. Performance-Based Regulations

In encouraging a shift towards case-by-case assessment, whereby relaxation of conservation rules may be appropriate in certain scenarios, participants of the Stakeholders Workshop and the focus group emphasised the importance of performance-based regulations. The discussion focused on a need to develop the knowledge base and awareness of the profession, particularly in assessing the implications of interventions on building performance. It was also felt that policy should not be rigid, but rather should allow for an element of flexibility, depending on the context. The physical changes implemented at San Anton Palace over the centuries were referred to as an example of this.

Participants felt that this should be coupled with increased respect for, and a balanced approach towards, heritage and energy conservation. Intensive training of officers within the Heritage Planning Unit of the Planning Authority was considered necessary in supporting a transition in the direction

adopted by the Authority with regards to heritage buildings and environmental design, specifically a shift towards facilitating bespoke interventions for heritage buildings.

#### 4. Discussion

Previous literature has highlighted the successes of education and training programmes as valuable and effective tools in reaching energy-saving goals [5,38,44,48]. However, the results of the research presented in this paper clearly demonstrate the need for deeper education at varying levels, including training programmes targeting a number of stakeholders in the field of SRBH in Malta. These are listed below:

- students and young graduates;
- professionals, particularly periti (the term periti is defined in Section 1.2.5);
- policy-makers and operators; and
- the public.

The results of this research have shown that the existing education framework, both undergraduate and in CPD, does not equip students, young graduates and professionals with an effective, evidence-based approach in addressing issues related to SRBH. Alternative problem-driven, solution-oriented methods, such as case-based learning, have been shown to address the challenges of training in sustainability, in academia and beyond [5]. However, the educational system in Malta remains traditional in nature, and CPD training on the subjects being addressed in this paper is neither obligatory nor available.

Through this study, knowledge gaps were identified as a barrier to successful eco-refurbishment interventions. For example, a limited understanding of how the fabric of heritage buildings performs as a result of the collective impact of inherent PEDS was highlighted. Also, methods of assessment have not been validated in a local context. Although professional-to-professional knowledge sharing is improving through online platforms, there is a lack of best-practice guidelines and examples to support periti and policy-makers, and decision making is generally based on anecdotal evidence and practical experience rather than scientific research. Academic research is neither systematic, targeting the identified knowledge gaps in this field, nor disseminated.

In the case of periti, the results of the focus group also noted a limited awareness of professional obligations in terms of certifying adherence to minimum energy performance standards. The ability to fulfil this legal responsibility was also identified as lacking. Whereas minimum standards are defined for contemporary buildings, these are not available for heritage buildings, leaving the profession at a serious disadvantage.

The results of the public survey gave an indication of the respondents' attitudes towards heritage buildings. Although the majority of respondents indicated a preference for heritage buildings over contemporary buildings, their perceptions regarding the environmental performance of heritage buildings were, for the most part, negative. This research demonstrated that, in general, respondents are aware of the benefits of PEDS at a basic level, but unaware of the impact of PEDS in heritage buildings. Moreover, the conservation of heritage features was prioritised over maximising the benefits of PEDS in heritage buildings. However, the research noted a receptive attitude of participants towards garnering information on this subject, and anecdotal information received following the Public Survey demonstrated a willingness to compromise and balance the requirements of modern day living with the principles of PEDS in terms of comfort.

Responses regarding available information demonstrated that access to information and guidance documents is limited at both generic and specific levels. This was supported by the results of the Planning Authority Workshop, which highlighted a lack of policy documents appropriately addressing the subject of heritage, and the links between heritage buildings and energy conservation.

The results of the Stakeholders Workshop emphasised a need for training Planning Authority officers, and the results of the Planning Authority Workshop demonstrated a lack of expertise of

operating staff. Moreover, the focus group considered existing training programmes to be superficial, highlighting a need for review.

## 5. Conclusions

Within the wider context, this research aimed to identify areas of priority in the sensitive eco-refurbishment of heritage architecture. The study revealed a lack of understanding of the benefits of passive environmental design strategies (PEDS) across a wide range of stakeholders. This has serious implications on the drive towards the sustainable regeneration of built heritage (SRBH). The overarching conclusions of this paper are described below. These centre on the attitudes and perceptions of stakeholders in the SRBH in Malta, and the low levels of awareness and understanding of the role of PEDS in maximising the environmental performance of heritage buildings. Recommendations, which are both specific to the local context and wider in its implications, have been designed to address the conclusions of this research.

Attitudes towards the current state of regenerating heritage buildings in Malta were found to be negative with the respondents of the public questionnaire, noting that, despite improvements, far more support is required. However, in general, the value of heritage buildings was attributed to aesthetic, charm and character, rather than energy performance, and comfort was not perceived to meet modern expectations. This may be related to the fact that PEDS were not associated with heritage buildings. Their potential to improve environmental performance and maximise occupant comfort could not be appreciated and maximised.

This low level of awareness is not limited to the public, but rather spans various groups and disciplines. Stakeholders of the SRBH were found to lack an understanding of the benefits of PEDS inherent to heritage buildings, and of the implications of particular interventions on environmental performance. Moreover, awareness regarding the roles and responsibilities of the key players in the field was found to be insufficient to enable and drive the SRBH. For example, *periti* are perceived as being unaware of their obligations to meet minimum requirements for energy performance, and mainly guided in their designs by practical experience and anecdotal information, rather than evidence-based data. The attitudes and perceptions identified through this research can be changed using a holistic and comprehensive strategy to increase awareness and improve education. This initiative should target all key stakeholders at different levels, and be customised to their needs, as advocated by Jenkins [49].

Awareness campaigns and short lectures may be used to disseminate information to the public. This should be bolstered by the publication of an easily accessible guidance booklet targeted to home-owners, highlighting the benefits of PEDS in heritage buildings. Occupant behaviour has been shown to have a significant impact on energy demand [13,14]. In addressing this, education has been highlighted as key to promoting a more energy-conscious integration with the building [20]. Therefore, the information sessions and reference guide may support positive behavioural change.

Further to the results of this research, a strategy aimed at growing the knowledge base and expertise regarding PEDS, and their role in the SRBH, should start with children and span all levels, culminating in continued professional development (CPD). In sustainability education, the literature [38,43,45] encourages the inclusion of subjects not traditionally associated with this topic. However, this research has not identified any studies that make specific reference to whether this has been effectively implemented in the context of heritage. In view of this, it is recommended that principles of sustainability are embedded in curricula from primary education to post-graduate studies, within various subjects such as local history, so that students may develop an appreciation for the multifaceted value of heritage architecture.

This research has determined that the existing academic programme at both a bachelor's and master's level, does not adequately equip graduates of the Faculty for the Built Environment in Malta to harmoniously address issues of heritage and energy conservation. The adequacy of traditional architectural programmes in meeting modern requirements has been questioned [42]. In the Maltese context, conventional teaching methodologies focused on information delivery through lectures,

discussions, problem sets and written assignments do not support the development of integral competencies for professionals in the SRBH. The academic programme addressing heritage conservation and the environmental performance of buildings should better focus learning outcomes [38]. It is being recommended that emphasis should be placed on innovative content delivered effectively through contemporary teaching methods, such as workshops, e-learning tools and site work, centring on a case-based, problem-driven approach to deep learning. Mentoring would support young graduates in developing skills and competences in the practice, as suggested in the literature [43].

Gaps in the educational framework at the professional level were identified through this research. For example, energy performance assessors are not supported in making recommendations to improve building performance by maximising the impact of PEDS. Moreover, the existing legislation governing the profession does not oblige practising periti (defined in Section 1.2.5) to undertake CPD [56], and neither are specialised training courses offered in this area. As a result, periti, interior designers, energy performance assessors and Planning Authority officers, all of whom play an active role in the field, are not supported in developing skills and competences in the sustainable regeneration of heritage architecture. It is, therefore, being recommended that seminars and specialised CPD courses are offered within a training framework.

This study highlighted a lack of information guiding various stakeholders in the SRBH, including periti and policy-makers. A framework for systematic academic research should be designed to address knowledge gaps surrounding PEDS, to develop a better understanding of the impact on environmental performance resulting from interventions on heritage buildings and to assess the efficacy of eco-refurbishment solutions in this context. The data derived should be proactively disseminated in order to allow stakeholders to make evidence-based decisions in their respective roles. This will bolster periti in designing sensitive proposals that effectively maximise the environmental performance of heritage buildings through inherent PEDS.

The approach towards increasing awareness and education outlined by this research will support policy-makers, including the Planning Authority and the Building Regulations Office, in a number of ways. Firstly, systematic academic research should enable the formulation and validation of policies that support the SRBH, built on the specificities of PEDS and their added-value in heritage buildings. This is an important contribution given the significant lack of appropriate and holistic policy, regulation and specific guidance documents that have been identified through this study. Secondly, academic research should address a gap in scientifically robust data supporting the assessment of proposed interventions on heritage buildings, and enabling a case-by-case, performance-based assessment process. Lastly, in order to support policy-implementers in the assessment of bespoke interventions, specialised training is being recommended to garner an understanding of the different aspects of PEDS and how they affect energy performance.

The limited ability to share knowledge, as identified through this research, is a barrier to developing a better understanding of PEDS and their role in the SRBH. It is, therefore, recommended that best practice guidelines are collated in an online repository, facilitating more informed decisions, implementation and post-intervention monitoring within a structured framework. The examples of best-practice should be based on local case studies, as well as case studies from other Mediterranean countries, illustrating successful and unsuccessful eco-refurbishment interventions on heritage buildings. Knowledge sharing, both within Malta and with other communities, will be supported through the launch of the SRBH Platform. The platform emerges from this research as a tool for the establishment of a stakeholders network, including built environment professionals, academics, students, policy-makers and NGOs, and enabling effective and structured knowledge sharing between the various stakeholders.

It is also proposed that a larger public survey be undertaken, in order to elicit statistically significant responses based on which inferences can be made regarding the wider population.



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