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Identification of Gaps and Barriers in Building Renovations through a Targeted Survey to Professionals of the Built Environment to Upgrade the Quality of Building Stock and Mitigate Climate Change

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Abstract

Deep energy renovations (DER) in buildings are now required to satisfy the European Union's low carbon emission efficiency standards in order to confront the climate crisis and boost the economic recovery of Europe after the pandemic outbreak. With annual energy renovation rates expected to double in the next 10 years, the building sector is expected to make a substantial change to achieve high energy efficiency goals by 2050. The construction sector and building experts are urged to upskill their workforce. This implies both meeting the targets and learning to use innovative approaches and technological solutions to ensure high-quality construction and to increase the energy performance of buildings. However, there are aspects that prevent the implementation of DER to a large extent. The aim of this research is to identify gaps and barriers for energy efficiency implementation methods in Greece and Cyprus through a targeted survey for building experts related to technical, financial, and policy issues that may pose challenges to further boost building renovations. The first results revealed that limited access to funding, poor legislative frameworks for renovations, and poor expertise of professionals in the renovation market are among the constraints that delay the renovation wave's propagation. Based on the findings, recommendations are provided for the development of qualitative university training courses as a means of upgrading existing knowledge and paving the way towards a sustainable, energy efficient, and decarbonized European building stock.

Keywords: buildings, renovations, barriers, technical survey, professionals.

JEL Classification: I25, J24, K32, L74, O18.

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1. Introduction

The construction industry is a major energy user worldwide. Buildings, in particular, account for 16-50% of total global energy consumption (Saidur et al., 2007), with buildings accounting for 40% of Europe's energy use (European Parliament and Council, 2012). As a result, upgrading older buildings offers tremendous opportunities to reduce energy usage and greenhouse gas emissions.

Building rehabilitation is becoming increasingly important in nations across Europe. One cause for this is an aging construction stock. Another factor is the requirement for more ecologically efficient buildings that reduce energy usage and greenhouse gas emissions in order to prevent the damaging climatic effect. At the same time, many structures must be upgraded to improve the quality of life – social sustainability, for example, by improving indoor climate – and to raise efficiency in the building process to provide cheap housing – economic sustainability.

Deep building renovations are now necessary to meet the European Union's high-energy and low-carbon emission efficiency criteria, as well as to help Europe's economic recovery following the pandemic epidemic. The European Commission (EC) communicated the policy "A Renovation Wave for Europe – Greening our Buildings, Creating Jobs, and Improving Lives" in 2020 to achieve this dual goal of increased energy efficiency and economic growth. According to this, EC intends to double annual energy renovation rates over the next ten years. These upgrades in the building stock will not only help Europe fulfill its decarbonization ambition, but will also improve the quality of life for those who live in and use the buildings, as well as create a large number of new green employment in the construction sector.

To reach decarbonisation targets, the deployment of Nearly Zero-Energy Buildings (NZEB) refurbishment packages in Europe must be hastened. To achieve this goal, the way buildings are being renovated must be improved (Jensen et al., 2018), boosting both the rate and depth of renovations (Artola et al., 2016). To achieve this goal, a good remodelling strategy aimed at zero-energy buildings that balance a lower energy demand against locally generated power is required.

Despite several good attempts to increase the energy performance of Europe's building portfolio, it is evident that a slew of impediments is significantly restricting full potential. This underperformance is due to a combination of obstacles. There are several classifications for obstacles, and they have been defined in numerous ways over the years. The BPIE 2011 survey found four major kinds of impediments that have a specific impact on existing buildings: 1) Financial, 2) Institutional and administrative, 3) Awareness, guidance, and skills, and 4) Spending and benefit separation.

There are several impediments to knowledge, information, and technical skills. Without a question, accurate and timely information is critical for the market to function properly. Ambitious renovations are a huge choice that can only be successful if the correct energy advice to take action is accessible, the energy efficiency service sectors are capable of providing such measures, and finally, adequate customer satisfaction levels can be ensured.

To meet these challenges and opportunities, the National & Kapodistrian University of Athens (NKUA) joins forces with Hellenic Passive House Institute (HPHI), Cyprus Energy Agency (CEA), and Da-Di-Werk municipal enterprise in Darmstadt – Dieburg, Germany, in the UPGREAT project. The UPGREAT project aims to create the necessary conditions for the minimization of the performance gap between design and construction phase, especially in school buildings in Greece and Cyprus. UPGREAT proposes the development, application and dissemination of a Total Training Toolkit – an educational package- which comprises of three different training programs. One for institutions of higher education, one for vocational high schools, and one for lifelong training for professionals coming both from public and private sector. The overall capacity development in UPGREAT includes the upgrade of knowledge and experience on energy efficiency measures & circularity processes in school renovations, the enhancement of competence between engineers, architects, and building experts, and the strengthening of national and international interaction between target groups.

2. Problem Statement

Much research has been conducted to investigate the obstacles to building retrofit adoption. Bjørneboe, Svendsen, and Heller (2018) found three major barriers: information, financing, and procedure. Davies and Osmani (2011) identified four major barriers: 1) financial and economic problems, 2) design and technological challenges, 3) regulatory challenges, and 4) environmental and cultural issues. Tuominen et al. (2012) classified building retrofit hurdles into four categories: regulatory, organizational and decision-making, financial, and information, promotion, and education. Building retrofit hurdles were categorized by Baek and Park (2012b) into four categories: 1) lack of knowledge of energy performance, 2) financial reasons, 3) insufficient information, and 4) lack of regulatory mechanisms. Bertone et al. (2016) classified the obstacles as follows: 1) knowledge barriers, 2) regulatory hurdles, 3) financial barriers, and 4) modeling issues. The primary impediments to public building retrofit, according to Alam et al. (2019), include a lack of political will, finance mechanisms, department/agency expertise, industry competency, quality assurance, and misaligned incentives. Seven major bottleneck types have been identified by Konstantinou et al. (2021) which are the following: (1) a lack of knowledge; (2) ambiguous definitions; (3) normative and compliance issues; (4) coordination and communication; (5) duties and assurances; (6) untrustworthy assessments; and (7) technological obstacles. As can be seen, barriers can be classified in a variety of ways, although most research highlights three types of barriers: administrative, financial, and knowledge/information.

Furthermore, numerous EU initiatives (i.e., 4RinEU, P2ENDURE, Pro-GET-OnE, and MORE-CONNECT) have addressed the primary challenges to comprehensive renovation in recent years by looking for creative technology solutions to overcome the restrictions existing in the energy requalification market. We categorize the major impediments discovered during extensive refurbishment

activities into the following macro-groups: Technical impediments; financial impediments; and social impediments (D'Oca et al., 2018).

3. Research Questions / Aims of the Research

The primary purpose of this study is to address the most significant bottlenecks in order to improve renovation efficiency by conducting an experts' survey in Greece and Cyprus. The goal is to identify the prominent barriers for financing building energy renovations, the most important policy gaps for the applicability of energy efficiency policies, the difficulties that were hard to overcome in deep energy renovation (DER) projects and the drivers that may boost the DER projects in both countries, which can then be utilized to enhance the workflow between all players.

4. Research Methods

In order to identify the barriers for energy efficiency implementation methods, a targeted survey for building experts related to technical, financial, and policy issues that may pose challenges to further boost building renovations and the achievement of high quality retrofits was developed. An online version of the questionnaire survey was created on LimeSurvey in Greek and English and was distributed between April and May 2022. The questionnaire was disseminated to participants through emails and social media and it was targeted to blue & white collar professionals (technicians, installers, architects and engineers and other building experts) responsible for the design and implementation of deep energy renovation measures. This purposeful sampling technique was used to identify information-rich cases for the most effective use of limited resources. Out of the 94 participants who opened the survey, 72 responses were considered as valid, with the vast majority of them (61) being from Greece. The questionnaire includes multiple- and single-choice questions. In the first type of close-ended questions, participants were offered a set of answers they have to choose from, while in the second type, respondents can choose one option. Finally, the answers were collected online, and afterward they were coded, quantified, and analyzed using the statistical computer-based programs Microsoft Excel and IBM SPSS. For the derivation of the results, a quantitative analysis that involves bar charts and percentages was used.

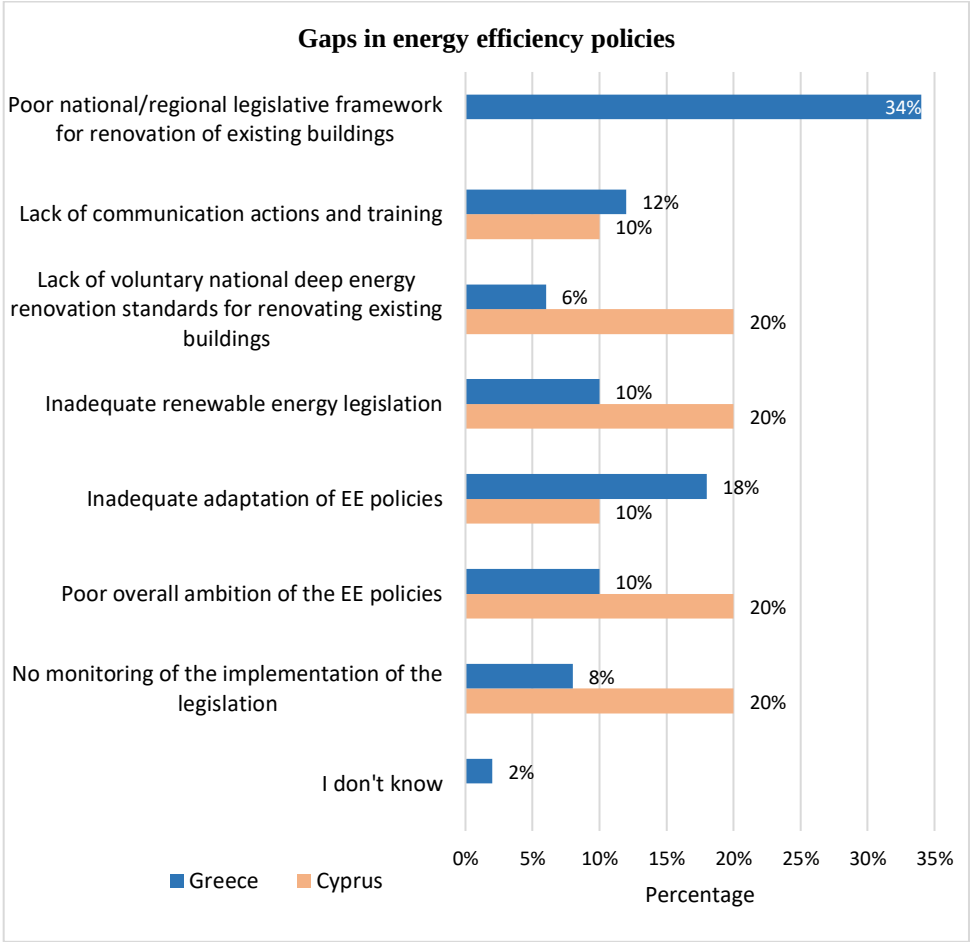
5. Findings

In the following paragraphs, a comparison of the main findings of this work between Greece and Cyprus is presented. The gaps in energy efficiency policies are presented in Figure 1, the financial barriers to implement deep energy renovations in buildings are shown in Figure 2, while the particular difficulties that were hard to overcome in deep energy renovation projects and the drivers that may boost DER are illustrated in Figure 3 and Figure 4 respectively.

5.1 Gaps in Energy Efficiency Policies

In Greece, "Poor national legislative framework for renovation of existing buildings" was considered as the most important gap in energy efficiency policies, selected by the 34% of the participants. Eighteen percent (18%) of those surveyed stated that the "inadequate adaptation of Energy Efficiency (EE) policies" is the most important policy gap, while another 12% regard the lack of communication actions on the benefits of energy efficiency and lack of training as the most important policy gap. In Cyprus, the options "Poor overall ambition of the EE policies", "No monitoring of the implementation of the legislation", "Inadequate renewable energy legislation" and "lack of voluntary national DER standards for renovating existing buildings" was equally selected by the 20% of those surveyed.

Figure 1. Most important policy gaps for the applicability of energy efficiency policies

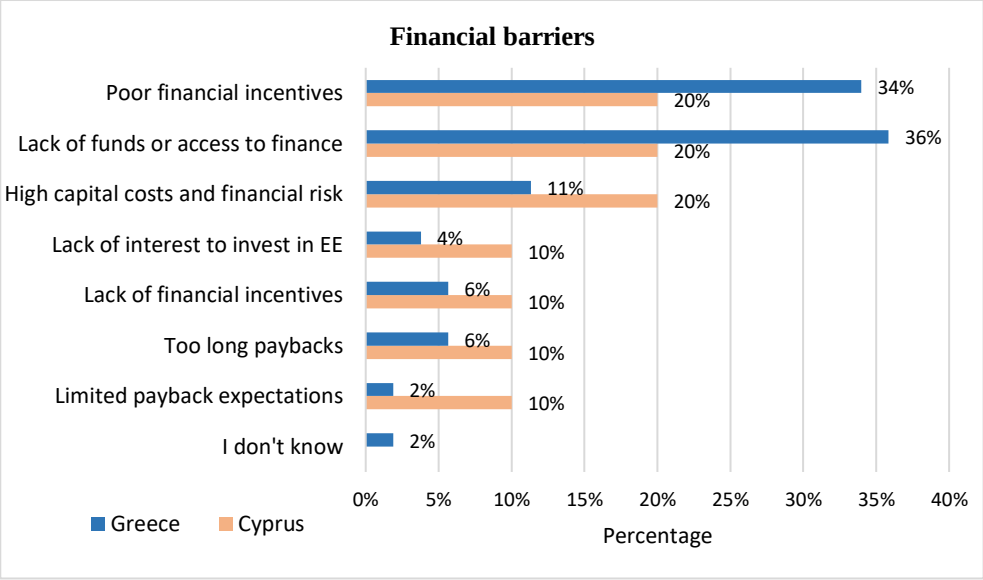


Source: Authors' own contribution.

5.2 Financial Barriers

With regard to the financial barriers (Figure 2) that pose a challenge for DER, the top 3 prominent barriers for financing building energy renovations are the same for Cyprus and Greece. "Lack of funds or access to finance" is regarded as the most important financial barrier in Greece, selected by the 36% of those answered while in Cyprus this option was chosen by the 20% of those surveyed. "Poor financial incentives" was selected by the 34% and 20% of the Greek and Cypriot respondents, respectively, while "High capital costs and financial risks" was chosen by the 20% of Cypriot respondents and 11% of the Greek participants.

Figure 2. Prominent barriers for financing building energy renovations

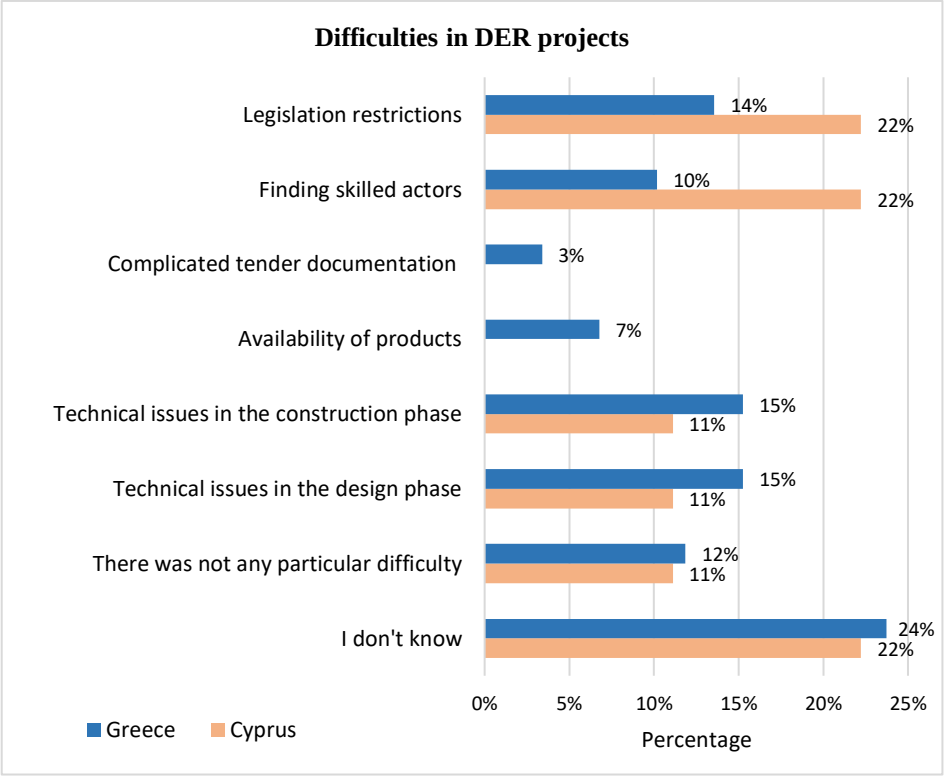


Source: Authors' own contribution.

5.3 Difficulties in DER Projects

When it comes to the particular difficulties that were hard to overcome in the DER projects (Figure 3), the Cypriot respondents equally selected "Legislation restrictions" (22%) and "Finding skilled actors" (22%) as their main difficulties faced during der projects. For Greek respondents, technical issues in the "construction" (15%) and in the "design" (15%) phase followed by "legislation restrictions" (14%) were stated as the most frequent hard to overcome difficulties in der projects. Interestingly, in both countries, a high share (22% Cyprus, 24% Greece) did not know about such difficulties.

Figure 3. Particular difficulties that were hard to overcome in deep energy renovation projects. A comparison for Cyprus and Greece

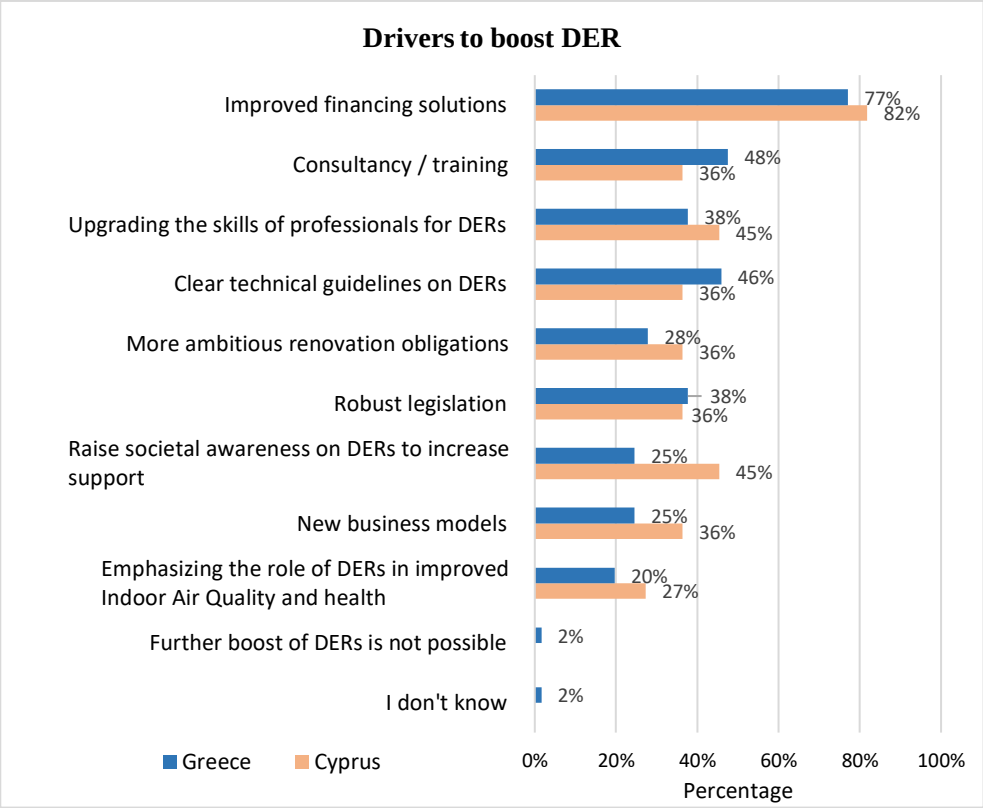


Source: Authors' own contribution.

5.4 Drivers to Boost DER

Finally, the drivers that may boost DER projects were examined. In both countries, the vast majority of respondents (82% Cyprus, 77% Greece) highlighted that "improved financing solutions" may boost the deep energy retrofits in buildings. Forty-five percent (45%) of the Cypriot respondents, stated that "Upgrading the skills of professionals" involved in der would boost deep energy renovation projects whereas another 45% regarded the raise of societal awareness on DERs as a mean to increase support and therefore boost deep energy retrofits as an important factor. In Greece, 48% of the respondents answered that consultancy and training would be a tool to boost deep energy renovations in the country, followed by a 46% of those surveyed that regard "clear technical guidelines on DERs" as an effective tool that could boost the deep energy renovation projects.

Figure 4. Drivers that may boost the deep energy renovation projects. A comparison between Cyprus and Greece



Source: Authors' own contribution.

6. Conclusions

The findings of the assessment of the survey results in Greece and Cyprus indicated that a percentage of 22% in Cyprus finds that legislation restrictions and a lack of skilled actors prevail in the difficulties faced in DER projects. In Greece 15% indicate technical issues in the design and construction phase as the main difficulty faced, while a significant percentage of 22% approximately in both countries has no opinion on the issue. Economic and financial barriers also play an important role in DER projects (40% in Cyprus and 51% in Greece). Concerning the drivers that may boost the deep energy renovation projects, the results show improved financial solutions by 80% approximately. Consultancy & training, upgrading the skills of professionals and clear technical guidelines for DERs are considered main drivers to boost deer energy renovations. An important policy gap for the applicability of energy efficiency policies is the poor national/regional legislative framework for renovation of existing buildings in Greece by 34%, while in Cyprus the gaps are related to lack of voluntary national DER standards, inadequate renewable energy legislation, poor overall ambition of the EE policies, and no monitoring of the

implementation of legislation (20%). Concerning financial barriers, the most prominent are the poor financial incentives, lack of funds, and high capital cost and financial risks in both countries.

The results presented in this study were collected while the survey was still ongoing, and thus they should be considered as an initial depiction of a broader picture. Due to the small sample size, a factor that limits generalizability, the results should not be considered either representative or sufficient of the entire building professionals' universe but as indicative, and so they should be used with caution. The present work will be extended to add further data, thus becoming more representative of the building professionals' population in each country.

The survey methodology for assessing the experience of building experts in DER projects in order to identify gaps and barriers in energy efficiency implementation is the first level toward the UPGREATs project scope which is the development, application and dissemination of a Total Training Toolkit – an educational package-through capacity building actions for different target groups involved with energy renovations in buildings. However, these first results provide an indication that training and upgrading the skills of professionals are a main driver in upgrading the existing building stock that requires an integrated training methodology.

Within this context, universities can play a key role, firstly by doing cross-disciplinary research to identify the gaps and barriers that prevent the full deployment of deep energy renovations in buildings as a means to boost energy savings and mitigate climate change and secondly by upgrading the skills of the professionals through updated training courses and technical seminars in a lifelong manner. Therefore, the development of qualitative training schemes, the provision of training courses and the upgrade of existing knowledge, the production of reference documents with renovation roadmaps based on real-life examples, the involvement of related stakeholders' groups, as well as the dissemination of information to public authorities and the general public is highly recommended. As a result, universities can become a multi-stakeholder hub that impacts the local, regional, or national economy paving the way for the new European Bauhaus movement, which calls on all of us to imagine and build a sustainable and inclusive society, responding to needs beyond functionality.

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