

Article

# The role of sustainability in property renovation: Preferences, challenges, and market perspectives

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**Abstract:** During property renovations, sustainability is increasingly playing a crucial role in reducing environmental impacts, utilizing resources efficiently, and improving the quality of living environments. In our research, we examined the environmentally conscious thinking of potential clients for sustainable renovations, including their requirements for materials, which encompass enhancing energy efficiency, the importance of waste reduction, the significance of using alternative energy, and the application of eco-friendly, durable, and local materials. According to the results of our quantitative survey, respondents recognized the importance of sustainability considerations and expressed their commitment towards energy-efficient and eco-friendly solutions, although costs and payback periods continued to be decisive factors. We found that advocates of sustainable property renovations in our sample displayed environmentally conscious characteristics, and environmentally conscious consumers are willing to spend more for significant and long-term results. As part of our research, we conducted in-depth interviews with real estate agents and general contractors to understand sustainability considerations in the decision-making process of property renovations. The key lesson from the interviews was that buyers can be segmented into different groups, with those prioritizing environmental awareness being of significant importance. Based on the findings, sustainability is increasingly coming to the forefront in property renovations. Thus, our publication offers a detailed insight into market trends and practices.

**Keywords:** sustainable property renovation; environmental awareness; energy efficiency; eco-friendly materials; consumer preferences; cost-effectiveness

## 1. Introduction

Property renovation involves upgrading existing buildings to improve functionality, aesthetics, or value. This can range from minor changes (painting, replacing fixtures) to major projects (adding rooms, structural modifications). Property renovation increasingly combines modernization with sustainability. Field Progress:

- **Sustainability:** Use of eco-friendly materials, energy efficiency, and renewable energy systems.
- **Technology:** Integration of smart home systems like automated lighting and heating.
- **Adaptive Reuse:** Repurposing old buildings for modern use while preserving cultural heritage.
- **Economic Benefits:** A cost-effective alternative to buying new properties, especially in high-price markets.

The purpose of this article is to raise awareness among SMEs, clients, and the general public about the importance of sustainability in the construction industry,

while highlighting its unfortunately higher initial investment requirements. At the same time, it emphasizes that such investments pay off in the long term. Our study addressed certain aspects of sustainable property renovation but overlooked others. This equally applies to the activities of SMEs, but they must also consider their specific characteristics when adapting these principles (Larionov and Smirnova, 2020). Primarily, we focused on the decision-making mechanisms of private owners; for some, cost-saving solutions were paramount, while others were attracted by exclusive designs. Fortunately, an increasing number of owners viewed sustainability as a primary consideration. We considered a renovation sustainable if it resulted in reduced energy and water consumption. In addition, an important criterion was the use of local materials, which, whether installed or during potential demolition, did not prove to be environmentally harmful. If the materials used in the renovation were durable, then subsequent material usage and work are not needed, allowing for lower costs over the years. Experienced contractors are familiar with various practices of sustainable property renovation and the range of materials involved. The aim of our research was to demonstrate two correlations. The first was that those who prefer sustainable renovations, recycling, using alternative energy sources, and minimizing household waste have these play significant roles in their daily lives. Our second correlation showed that clients of sustainable renovations are aware of which materials should be used without compromising the concept. They know to choose local, durable, health and environmentally-friendly materials. Sustainability is perhaps the most significant challenge of our times. Several definitions exist, but we accept the three-pillar definition by Kota and Waseem (2017). The concept of the three pillars of sustainability includes a balance of environmental, economic, and social dimensions. This means protecting natural resources, ensuring that our economic activities are viable in the long term, and promoting social justice and equality (Purvis et al., 2019). Additionally, financial stability plays a key role in fostering economic sustainability, as seen in Hungary’s recent analysis of financial security, which offers a dual perspective on the economic recovery after the COVID-19 pandemic (Németh et al., 2024). Ensuring financial inclusion and fighting corruption are also crucial for achieving sustainable development in both developed and developing countries (Kálmán et al., 2024b). Using these three pillars, we have summarized the elements of sustainable renovation in **Table 1** below. When compiling Table, we combined personal experiences with the literature for elements related to the three well-known aspects of sustainability (Djokoto et al., 2014; Hossain et al., 2020; Meade and Presley, 2010).

**Table 1.** Pillars of sustainable property renovation.

Pillars	Factors
<b>Environmental</b>	Increase energy efficiency, for example through better insulation and energy-saving appliances. Use renewable energy sources, such as solar panels and wind turbines. Utilize eco-friendly, recycled materials. Apply water-saving technologies. Install green roofs and living walls.

**Table 1. (Continued).**

<b>Pillars</b>	<b>Factors</b>
<b>Economic</b>	Ensure long-term return on investment.
	Optimize initial costs and minimize operational expenses.
	Enhance the market value of the property.
	Reduce energy and water costs.
	Achieve long-term cost-effectiveness with sustainable materials and technologies.
<b>Social</b>	Improve living conditions and create a healthier living environment.
	Involve local communities in the planning and decision-making processes.
	Provide local job creation and training opportunities.
	Improve accessibility and the accessibility of the building.
	Develop community spaces and green areas that promote community interaction and social well-being.

Unfortunately, certain obstacles hinder the widespread adoption of sustainable property renovation, with a significant portion of residents choosing not to opt for sustainable building upgrades due to financial considerations. This is similar to the case in wealthier countries, such as Norway, where respondents strongly recommend financial support as a solution to these obstacles. From a future perspective, the needs of urban dwellers and sustainability goals need to be better integrated (Grotte and Kálmán, 2023). Community participation and social acceptance are important (Jowkar et al., 2022). In China, many places still have buildings made of compacted earth according to traditional construction methods. As the population's financial situation improves, renovations become commonplace. The results of such renovations are evaluated based on three criteria: The indoor physical environment, owner satisfaction, and carbon dioxide emissions. The first and last factors are strongly correlated and help in reducing energy consumption (Zhang et al., 2022).

Another study emphasizes that residents should be effectively involved in the planning process at the early stages of renovation. Such projects require special skills and tools for effective communication between the renovators and the residents (Golić et al., 2020). These skills can be developed with the right education (Kálmán and Poyda-Nosyk, 2023). The objectives of sustainable housing renovation can be achieved through monitoring. The collection, evaluation, decision-making, and implementation processes must continuously monitor how costs and expected benefits develop. It is recommended to consistently use some type of green building certification system (Šuman et al., 2020). The process of sustainable housing renovation is fraught with conflicts. There can be conflicts between stakeholders and the sustainability goals themselves may contradict one another. The only solution is an innovative approach, which includes product and process innovation, as well as business and social innovation (Liu et al., 2020). There is a need to reinterpret the concept of renovation, taking into account environmental, economic, and social aspects. The impacts generated during the construction lifecycle must be minimized. It is worthwhile to create an extended lifecycle analysis, as this allows for the selection of the most sustainable modernization option for a typical European building (Jensen et al., 2018). Sustainable renovation is not just a technical and economic issue but requires broad social cooperation and commitment for success (Hauge et al., 2013;

Kálmán et al., 2024a).

Property owners often find themselves in decision-making situations where they lack knowledge and support. However, there is a solution in the form of an integrated renovation process. This process, which is iterative and comprises multiple steps, offers a comprehensive approach. It takes into account the personal interests of the owners, the technical condition of the buildings, and financial possibilities (Galiotto et al., 2016). This integrated approach not only addresses the challenges of sustainable property renovation but also provides a practical and effective way forward (Kálmán et al., 2024c).

## **2. Materials and methods**

Based on a literature review, we developed a questionnaire for our quantitative research, which primarily explores the attitudes of owners who prefer sustainable property renovation. The survey was conducted in Hungary from 1 November to 15 December 2023, and we received 235 evaluable responses. Based on the results, we examined the respondents' environmental awareness and their willingness to spend, checked their preference for materials, and uncovered their environmentally friendly behaviour in everyday life. We corroborate our findings with interviews conducted with two experts. For our quantitative study, we established two main hypotheses related to correlation relationships, each was accompanied by three sub-hypotheses. For the Likert scales, we chose a seven-point scale to provide sufficient levels of evaluation, allowing us to identify and validate differences in paired comparisons. One of the authors has been working in the construction industry for many years, maintaining direct communication with clients. Through daily interactions, they have observed clients' attitudes and decisions regarding sustainability. These observations form the basis of the current research, which aims to generalize the subjective phenomena identified. The hypotheses are designed to organize and model the relationship between clients' sustainability preferences and decisions. The essence of the first set of hypotheses: Respondents who prefer sustainable property renovation are more environmentally conscious, reflected in their lifestyle choices, such as waste reduction, recycling, and preference for alternative energy sources. The second set of hypotheses: Respondents who rate their own environmental awareness as higher are more willing to spend on sustainable solutions, particularly favoring local, environmentally friendly, and durable materials.

H1: Respondents who prefer sustainable property renovation are environmentally conscious.

H1a: Environmentally conscious respondents prefer a waste-reducing lifestyle.

H1b: Environmentally conscious respondents prefer recycling.

H1c: Environmentally conscious respondents prefer alternative energy sources.

H2: Respondents who rate their own level of environmental awareness as higher are likely more willing to spend more on sustainable solutions.

H2a: Those willing to spend more on environmentally conscious solutions prefer local materials.

H2b: Those willing to spend more on environmentally conscious solutions prefer materials that are harmless to the environment, flora, and fauna.

H2c: Those willing to spend more on environmentally conscious solutions prefer materials with a long lifespan.

### 3. Results and discussion

According to the sample’s demographic characteristics, the distribution of men and women among the respondents was very similar, with each gender represented in approximately equal proportions, 48% each (**Table 2**). At the same time, a small percentage preferred not to disclose their gender. In terms of age groups, the majority of respondents were over 65 years old (19.57%), followed by the 55–64 age group (17.02%), and the youngest age group, 18–24 years old, also had a significant portion (17.45%). Regarding educational attainment, most respondents had postgraduate qualifications (23.40%), while those with high school education also comprised a significant proportion of the sample (21.70%). In terms of residence distribution, residents of Budapest dominated (30.64%), while other respondents were from other major cities, smaller towns, and villages.

**Table 2.** Demographic distribution of the sample.

<b>Gender</b>	
Male	48.5
Female	48.1
No answer	3.4
<b>Age</b>	
18–19 years	17.4
20–29 years	16.6
30–39 years	14.5
40–49 years	14.9
50–59 years	17.0
60 years or above	19.6
<b>Education</b>	
8 years of primary education	21.7
vocational qualification	17.4
Bachelor’s degree	16.6
Master’s degree	20.9
postgraduate degree	23.4
vocational qualification	17.4
Bachelor’s degree	16.6
Master’s degree	20.9
postgraduate degree	23.4
<b>Place of residence</b>	
Village	30.6
Small town*	26.4
Large city**	23.8
Capital	19.1

**Table 2.** (Continued).

<b>Income</b>	
Well below average	21.7
Below average	20.4
Average	20.9
Above average	17.9
Well above average	19.1

Note: \* less than 20.000 people, \*\* at least 20.000 people.

**Table 3** summarizes the correlational relationships between respondents’ statements examined on a Likert scale. The relationships were weak to moderately strong and show strong significance. Since our sample is not representative, we strongly assume that the correlations are valid for the entire population. It is noteworthy that the correlation between consumers willing to spend more and the materials used is highest in the case of environmentally harmless materials. This is because, over the past decades in Hungary, asbestos, which has been proven harmful to human health, has been used in many property constructions (Farkas and Weiszburg, 2006). Asbestos removal is currently ongoing and results in high costs. It was also observed that environmentally conscious consumers prioritize recycling and alternative energy sources not only in property purchases and renovations but also in their daily lives.

When evaluating the strong significance shown in the calculations, it should be taken into account that we are seeing self-reported data from respondents, and it is possible that cost-saving considerations may prevail in the case of actual expenses.

**Table 3.** Correlational relationships.

<b>Ordinal evaluated elements</b>	<b>Level of Environmental Consciousness</b>		<b>Willingness to spend on Sustainable Renovation</b>	
	<b>Pearson Correlation</b>	<b>Sig. (2-tailed)</b>	<b>Pearson Correlation</b>	<b>Sig. (2-tailed)</b>
Level of Environmental Awareness	1		0.318	0.000
Priority of Sustainable Renovation	0.446	0.000	0.187	0.004
Importance of Waste Reduction	0.376	0.000	0.134	0.041
Importance of Recycling	0.429	0.000	0.146	0.025
Importance of Alternative Energy	0.429	0.000	0.129	0.048
Preference for Local Materials	0.204	0.002	0.396	0.000
Preference for Eco-Friendly Materials	0.221	0.001	0.471	0.000
Preference for Durable Materials	0.170	0.009	0.392	0.000

Considering only the numerical data, our hypotheses can be validated based on **Table 3**. We visually summarized the results of our research in **Figure 1**. We also intend to support our study qualitatively; therefore, in the next chapter, we will present the key statements from two professional interviews.

In the final phase of the research, we asked respondents three questions to assess their attitudes toward sustainability on family, community, and global levels (**Table 4**). The questions were as follows: “How important do you consider it to provide a

comfortable, modern home for your children in the future?"; "How important do you consider it that your locality offers a healthy and clean environment for its residents?"; and "How important do you consider that our world preserves its green and liveable state for future generations?" In analysing the results, we applied descriptive statistical methods, which highlighted that respondent considered all three questions to be more important than average (above 3.5 points). A particularly noteworthy finding was that the highest average score was associated with the first question, which assessed the importance of providing a home for the family. This suggests that respondents have a stronger attachment to ensuring family well-being. This was followed by the community-level question, which measured the importance of a clean and healthy environment for the local community. The third place was occupied by the global-level question, which evaluated the significance of our world's future sustainability. Although the average score for all three questions was above the midpoint, a clear order of priority emerged.

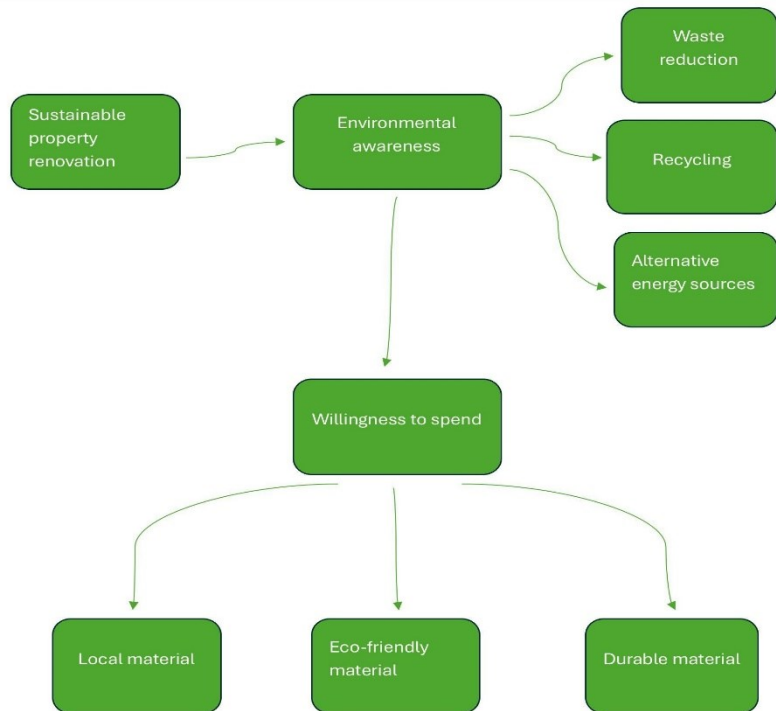


Figure 1. Revealed relationships.

Table 4. Descriptive statistics on the scope of positive thinking.

	N	Minimum	Maximum	Mean	Std. Deviation
How important do you consider it to provide a comfortable, modern home for your children in the future?	235	4	7	5.38	0.778
How important do you consider your locality offers residents a healthy and clean environment?	235	3	6	4.62	1.077
How important do you consider it that our world preserves its green and livable state for future generations?	235	1	6	3.86	1.378
Valid N (listwise)	235				

Continuing the statistical analysis, we standardized the data to improve the

comparability of responses. Then, we applied paired *t*-tests to examine the significance of differences between the questions. The analysis revealed three strongly significant differences: Responses to the family-level questions were significantly higher than those to the community and global-level questions, and responses at the community level also significantly exceeded those at the global level (**Table 5**).

These findings indicate an important trend: Hungarian public opinion, which shows a conservative nature, prioritizes ensuring family well-being, followed by attachment to the local community, with concerns for global sustainability coming in third. This suggests that respondents primarily think at the family level, regard local issues as secondary, and place less emphasis on global environmental concerns.

For construction companies, these results offer valuable insights. The data suggest that building decisions are more effectively influenced by arguments related to the family. This means that clients may be more easily persuaded when promoting sustainable, environmentally conscious solutions if these solutions serve family well-being and comfort. Environmental consciousness could thus be more effectively integrated into the home-building process, particularly when the family is placed at the center of the argument, as it proved to be the most important consideration. However, financial constraints often present a significant challenge in implementing such efforts, which may hinder the widespread adoption of eco-friendly solutions.

**Table 5.** Paired samples test on the scope of positive thinking.

	Paired Differences			95% Confidence Interval of the Difference		t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	Lower	Upper			
				A-B	0.766			
A-C	1.523	1.685	0.110	1.307	1.740	13.857	234	0.000
B-C	0.757	1.666	0.109	0.543	0.972	6.971	234	0.000

Note: A. How important do you consider it to provide a comfortable, modern home for your children in the future? B. How important do you consider that your locality offers a healthy and clean environment for its residents? C. How important do you consider that our world preserves its green and livable state for future generations?

#### Professional Interviews

Our first interviewee was an experienced property developer and general contractor working in the construction industry for decades. He has collaborated with various customer groups, each with different needs and priorities regarding their homes and properties. He categorizes his clients into four main groups. The first group consists of those who live at a high material standard and seek luxury and the highest quality. They are open to high costs if that solution guarantees the perfect end result. The second group comprises cost-conscious clients who prefer the cheapest possible solutions. This group often compromises on quality to reduce expenses. The third group consists of rational clients who seek long-term value and durability. These clients make balanced decisions, considering the lifespan of materials and technologies, and are willing to invest in solutions that pay off in the long run. The fourth group includes environmentally conscious clients, for whom sustainability is the primary goal. Their decisions are driven by this criterion. They prefer



environmentally friendly materials, energy-saving solutions, and products sourced from local resources. Our interviewee has tailored his business model to meet the needs of each group. For the first group, he provides the most exclusive materials and technologies. For cost-conscious clients, he offers simple yet functional solutions that are cost-effective. For rational clients, he recommends solutions that offer the best value for money, while for the environmentally conscious group, he provides sustainable construction practices and materials that minimize the ecological footprint. In the future, the demand for sustainability is expected to continue to grow and our interviewee considers it important to stay up-to-date with the latest technologies and materials to best meet his clients' needs. In the construction industry, there is increasing emphasis on innovations that reduce energy consumption and minimize the environmental impact of construction. This not only provides a business advantage for him but also offers an opportunity to practice corporate social responsibility.

Our next interviewee has over 15 years of experience in the Budapest property market, specializing in the sale of sustainable residential properties. During the interview, we asked him to categorize his clients. The first group includes those interested in premium locations and environments and are willing to pay a high price. The second group consists of young families who prefer suburban family homes, seeking the best value for money. The third group includes environmentally conscious buyers, for whom energy efficiency and sustainability are primary considerations. These environmentally conscious clients particularly appreciate low-energy homes with solar energy, high-level insulation, and smart home technologies. Additionally, they place a significant emphasis on the sustainability of building materials, such as the use of recycled or naturally sourced materials.

According to our interviewee, although the demand for sustainable properties is increasing, the supply is still limited, often leading to compromises in terms of location and price. The initial costs of sustainable technologies pose an additional challenge for clients. However, the market for sustainable properties is currently undergoing significant growth. New developers are increasingly offering green solutions. Moreover, government incentives, such as green loan programs, are contributing to the expansion of this market. The demand for sustainable properties is expected to continue growing in the long term, partly due to technological advancements and increasing consumer awareness. He advises those considering purchasing a sustainable property to thoroughly inform themselves about the benefits and features of such properties. He emphasizes the importance of working with an experienced real estate agent knowledgeable in sustainability and aware of the higher initial costs of sustainable technologies, which pay off in the long run through lower utility and maintenance costs.

In our article, we consistently view sustainable property renovation favourably, even over the construction of new buildings. Similar findings were observed in an office renovation project in Taipei, which demonstrated how short payback periods can be achieved through refurbishments with minimal use of new materials, resulting in a smaller ecological footprint rather than demolition and new construction (Perng et al., 2017). The success of sustainable renovation projects is crucially dependent on selecting the right project manager or construction contractor. The professional

leading the process must be committed to green technologies and possess work experience, technological knowledge, and experience in managing green projects (Dadzie and Sebitla, 2023).

The following study introduces the complex concept of sustainable building renovation, emphasizing a lifecycle approach and a holistic perspective. It proposes an innovative design framework that makes decisions based on multiple criteria. This process helps select the most sustainable option, which is also cost-effective (Passoni et al., 2021). Evaluating the completed work is important for comparability. Šuman et al. (2020) and colleagues offered a solution to this problem through the green building certification system. Malmgren et al. (2016) and co-authors developed a decision support system that provides continuous evaluation during renovations and suggests modifications if necessary. Ferreira et al. (2013) and his colleagues highlight the importance of energy and lifecycle analysis. Kumar and Mani (2023) believe that sustainable renovations are not only capable of reducing environmental impacts but also of restoring ecosystems. The theoretical significance of our research primarily lies in providing deeper insights into the relationship between sustainability and property renovation, especially concerning consumer decision-making and sustainable behavior. The study's findings reinforce the connections between sustainability perspectives and personal choices, which can support the development of new theoretical frameworks for understanding sustainability motivations. Applying the model of sustainable development's three pillars (environmental, economic, and social aspects) in the property renovation sector is particularly relevant, as individual preferences and cost sensitivity have a direct impact on sustainability-related decisions. Another theoretical contribution of this study is demonstrating the link between environmentally conscious behavior and the willingness to adopt sustainable solutions, thus offering an essential foundation for further consumer behavior research in this area. Additionally, the detailed exploration of diverse sustainability preferences enables a refinement in the segmentation of consumer groups, theoretically advancing the understanding of the complex relationships between consumer motivations and sustainability perspectives.

From a practical standpoint, the results of the research provide valuable guidance for construction companies and real estate developers. By precisely segmenting consumer needs, the market offerings can be tailored and optimized with a focus on sustainability, considering the different preferences and financial capabilities of each consumer group. For example, environmentally conscious consumers may be attracted to recyclable, locally sourced materials and energy-efficient technologies, while cost-conscious groups may benefit from sustainability solutions with lower initial investments. The findings also highlight that innovative, long-term, cost-effective solutions hold a crucial role in the real estate market, as the return on investment and added value of sustainable renovations directly influence consumer decisions. Furthermore, the research underscores the need for public policy interventions, as the spread of sustainable renovations often depends on the availability of financial incentives, such as green loans, support programs, and tax benefits. These incentives are essential in making energy-efficient and environmentally friendly solutions more affordable for sustainability-focused consumers. In addition to public policies, the establishment of educational programs and awareness campaigns is of

significant importance, as they contribute to fostering a sustainability mindset and enhancing society's willingness to make environmentally conscious decisions. Support and training programs can also aid construction companies in preparing for sustainability-oriented developments and increase market demand for these solutions.

#### **4. Conclusion**

The most outstanding merit of our research is that it has uncovered the correlations between environmentally conscious behaviour in private life and the willingness to undertake sustainable renovations. In summary, it can be said that sustainability is increasingly playing an essential role in property renovations. According to the results of the interviews, the market is clearly trending towards energy-efficient and environmentally friendly solutions (Bolikulovich and Olimova, 2024). Studies show that consumers are willing to pay more for these solutions, despite the fact that costs and payback periods remain key decision-making factors. Therefore, sustainable property renovations provide both environmental and economic advantages that contribute to developing a more liveable and sustainable future. Sustainability considerations must be continuously taken into account from planning to delivery. (Ortiz et. al., 2009) The creation of green buildings is becoming increasingly common (Negi, 2021). Our research provided valuable insights into the relationship between sustainability and property renovation, focusing on consumer commitment and preferences toward sustainability. However, several limitations affected the generalizability of our results and the comprehensive exploration of the topic. The most significant limitation stemmed from our sample's geographic and cultural characteristics, as the study was concentrated on Hungary, which has its own distinct economic, social, and political context within the Central European region. Although sustainability perspectives are universal in many respects, the local economic environment, government regulations, support programs, and societal expectations significantly influence the decisions of individuals and businesses, especially in the context of property renovations.

Future research offers numerous directions to deepen and validate our findings. First and foremost, conducting international comparative studies could help understand how sustainability preferences and barriers vary across different cultural and economic contexts. Comparisons across various countries or regions would provide an opportunity to identify the key factors in each area, making it possible to recognize global patterns that may also benefit international and regional policy development. Another important research direction involves the long-term analysis of the economic returns on sustainable technologies and materials. Such studies would help reveal how solutions that balance cost-efficiency with environmental benefits could be applied in property renovations, which is particularly valuable for price-sensitive consumers. This future research path could contribute to clearer visibility of the economic viability of sustainable investments within both consumer and corporate decision-making processes.

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SMS; resources, AK, SJ and SMS; writing—original draft preparation AK, SMS and SJ; writing—review and editing, AK, SMS and SJ; supervision, AK, SMS and SJ. All authors have read and agreed to the published version of the manuscript.

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