



Publisher

<http://jssidoi.org/esc/home>

THE IMPACT OF SUSTAINABLE DESIGN ON RESIDENTIAL PROPERTY VALUES: ECONOMIC IMPLICATIONS FROM THE CZECH HOUSING MARKET

Dagmar Frejlichová ^{1*}, Jaromír Vrbka ², Jiří Máška ³

^{1*,2,3} *Institute of Technology and Business in České Budějovice, Okružní 517/10, 370 01 České Budějovice, Czech Republic*

^{1*} *Pan-European University (PEU), Tomášikova 20, 820 09 Bratislava, Slovakia*

E-mails: ^{1*} frejlichova@znalci.vste.cz (Corresponding author); ² vrbka@znalci.vste.cz; ³ maska@znalci.vste.cz

Received 11 October 2025; accepted 6 February 2026; published 30 March 2026

Abstract. Sustainable design has become an increasingly important element of residential real estate development, yet its economic effects remain ambiguous across different market contexts. This paper examines the impact of sustainable design on residential property values in the Czech Republic, with particular attention to whether sustainability-oriented features translate into measurable price effects under real market conditions. From the perspective of sustainable development and investment decision-making, understanding whether sustainability generates economic benefits is crucial for investors, developers, and policymakers. The study is based on a dataset of residential property listings and applies standard statistical methods to examine the relationship between sustainable design features and market value. The analysis focuses on the independent effect of sustainability as well as its interaction with key market factors such as location and floor area. The results indicate that sustainable design alone does not function as an independent price driver in the residential housing market. However, when combined with traditional valuation factors, particularly location and property size, sustainable design features are associated with statistically significant differences in market value. These findings suggest that the economic effects of sustainability are context-dependent rather than universal. The paper provides relevant implications for sustainable investment strategies, housing policy, and decision-making processes in residential real estate markets, highlighting the importance of aligning sustainability objectives with local market conditions and economic feasibility.

Keywords: sustainability; sustainable design; market value; real estate; sustainable investment

Reference to this paper should be made as follows: Frejlichová, D., Vrbka, J., Máška, J. 2026. The impact of sustainable design on residential property values: economic implications from the Czech housing market. *Entrepreneurship and Sustainability Issues*, 13(3), 377-387. <http://doi.org/10.9770/x9797925564>

JEL Classifications: R31, Q56, C12

1. Introduction

With sustainability and environmental issues coming to the fore, sustainable design is becoming a key element in many industries (Katafygiotou et al., 2023). Sustainability is also an important trend in residential building design and there is an emphasis on energy efficiency and the use of environmentally friendly materials. In the context of the real estate market, sustainable design is thus an important factor that influences not only the attractiveness but also the market value of real estate (Goh et al., 2022). Residential properties with sustainable features are increasingly preferred by buyers who are aware of their long-term benefits. These benefits include lower operating costs, improved indoor environmental quality and greater resilience to climate change. Sustainable technologies such as solar panels, heat recovery systems or smart home systems are becoming not only the standard but also a desirable feature that can increase the value of a property on the market (Massimo et al., 2022).

The market value of residential properties is therefore increasingly influenced by whether and how sustainable design elements have been implemented in their construction or renovation. While traditional criteria such as location or size remain important factors, sustainable aspects are playing an increasingly important role in the decision-making of potential buyers (Lambourne, 2022). This is creating a new dynamic market where sustainable properties are in greater demand and may command higher prices in some markets than their conventional counterparts. At the same time, this trend creates opportunities for developers and investors who can focus on projects that meet sustainable design principles. Evidence suggests that sustainable properties are more profitable in the long term and have a higher market value, which strengthens their attractiveness in a competitive market. As a result, sustainable design is becoming not only a responsible approach to the future, but also a strategic advantage in residential real estate (Goh et al., 2022; Warren-Myers, 2022).

Sustainable design, which focuses on minimising negative environmental impacts and using resources efficiently, is becoming increasingly important in the construction industry. This approach not only promotes environmentally responsible practices but also brings economic and social benefits (Katafygiotou et al., 2023). One of the key issues that arise in relation to sustainable design is its impact on the market value of real estate. Although it is widely accepted that sustainable architecture can reduce operating costs and improve quality of life, there are still concerns about the higher upfront costs associated with implementing these features (Toivonen, 2021).

Despite the growing interest in sustainable design, there are still relatively few studies that quantitatively assess its impact on residential property prices. (Rathnayake & Pushpakumara, 2023). This may be due to the complexity of the real estate market, where the price of a house is not only determined by its design, but also by its location, availability of services, the economy of the region and the overall demand (Massimo et al., 2022). However, sustainable design can provide a competitive advantage in the form of increased energy efficiency, lower operating costs, and increased occupant comfort, factors that are increasingly becoming critical in housing choice (Dobrovolskiene et al., 2021).

In the context of sustainable entrepreneurship and regional economic development, investments in sustainable housing represent an increasingly important segment of real estate markets. However, the economic outcomes of sustainability-oriented design are not always straightforward and depend on local market conditions, investor awareness, and traditional valuation factors. This study contributes to the debate by examining whether sustainable design features translate into measurable market value effects and under which conditions such effects emerge. The results are relevant for investors, developers, and policymakers seeking to promote sustainable housing without creating unrealistic market expectations.

The increased demand for sustainable real estate leads to the research objective of determining the impact of sustainable design on the market value of residential real estate. To meet the research objective, two research questions were posed.

Buyers often look for properties that offer energy efficiency, reduced operating costs and a positive environmental impact. This shift in preferences, coupled with legislative standards aimed at improving the energy efficiency of buildings, raises the first research question:

RQ1: Does sustainable design affect the market value of residential properties?

In examining the impact of sustainable design on the market value of residential property, it is necessary to consider other factors that may influence this relationship. For example, the location in which a property is situated plays a key role in determining its value; some areas may have a higher demand for environmentally friendly solutions than others. Similarly, the size and floor area of a property can influence how sustainable features are perceived by buyers. Given these variables, a second research question arises:

RQ2: How does the impact of sustainable design on the market value of residential properties vary depending on other factors such as location or floor area?

2. Literature review

Sustainable design in the context of residential real estate focuses on creating living spaces that are environmentally friendly, economically viable and improve the quality of life of their occupants (Samour et al., 2023). Sustainable features such as green roofs and walls bring a range of environmental, social and economic benefits that improve building performance and contribute to the urban environment (Manso et al., 2021). Emphasis is also placed on the design of buildings that promote natural lighting and ventilation, thereby improving indoor microclimates and reducing energy costs. In addition to environmental aspects, sustainable design focuses on creating quality of life through healthy and comfortable environments, which may include the use of low-emitting materials and the design of spaces that promote social interaction and community life. This integrated approach not only contributes to the conservation of natural resources, but also increases the longterm value of properties and responds to the growing demand for sustainable and responsible residential solutions (Jalaei et al., 2020; Richter et al., 2022).

The impact of sustainable design on the market value of residential real estate is becoming an increasingly significant factor influencing the decisions of buyers, investors and developers alike (Dobrovolskiene et al., 2021). Properties designed with sustainability in mind, incorporating energy efficient technologies, renewable energy sources and environmentally friendly materials, not only contribute to lower operating costs but also increase occupant comfort and health (Aydin & Mihlayanlar, 2020). This positive impact translates into a higher demand for such properties, which often leads to an increase in their market value (Joshi et al., 2020). Moreover, with the increasing emphasis on environmental responsibility and legislative requirements, properties with sustainable design are perceived as less risky investments, further enhancing their attractiveness in the market (Tang et al., 2021). As a result, sustainable design is becoming not only a key element of modern architecture, but also a strategic advantage that can significantly influence the financial return on residential real estate investment (Ringel & Capeluto, 2020).

Although the importance of sustainability is increasing, its consideration in valuation practice is still insufficient and inconsistent, requiring further development and standardisation of methods (Warren-Myers, 2022). The valuation of sustainable elements is also addressed in Hossain et al. (2023). The research identified that although some valuers do incorporate sustainability in valuations, there is a lack of standardised methodologies and a consistent approach.

Leutner et al. (2024) investigates whether green buildings that are more energy efficient obtain more favourable terms in commercial financing compared to conventional buildings. The results show that green buildings have a lower interest rate and a lower target rate. However, no effect on the loan-to-value ratio was found. These findings suggest the financial benefits of investing in sustainable real estate. The issue of energy efficiency valuation is dealt with in Warren-Myers et al. (2020). Valuation of energy efficiency is often inconsistent and depends on different factors, making it difficult to accurately and fairly reflect these aspects in the market value of real estate. Korol and Shushunova (2022) focus on the valuation of energy efficient residential buildings that use innovative modular green walls. The integration of green walls significantly improves energy efficiency and increases the attractiveness and value of these buildings in the real estate market. Leskinen et al. (2020) investigates how on-site renewable energy production, for example by photovoltaics, affects property values. According to them, the presence of on-site renewable energy has a positive effect on property values. This effect has been attributed not only to energy cost savings but also to increasing awareness of the environmental benefits.

Cortesi et al. (2022) investigated the impact of sustainable property design on the comfort of its residents. The research found that sustainable architectural features such as energy efficiency and the use of natural materials have a positive impact on the psychological and physical well-being of residents.

For an analysis in which it is necessary to effectively compare means between multiple groups and identify whether statistically significant differences exist between them, we can use ANOVA (Kim, 2022). Another statistical method we can use is the chi-square test. Study Shen et al. (2022) shows that this test can be used to

detect correlation based on the distances between data points, which is useful when analysing the impact of different sustainable features in different locations or for different property types. This flexibility makes the chi-square test a method for examining dependencies that are not always directly apparent but can still have a significant impact on the market value of properties. To better understand the relationships between factors and their impact on the market value of properties, we can use cluster analysis. This allows us to identify natural groups in the data based on the similarity of their characteristics (Kondruk & Malyar, 2021).

Despite the growing body of literature examining sustainability in residential real estate, several gaps remain evident. Existing studies primarily focus on individual aspects of sustainability, most notably energy efficiency, or rely on specific indicators such as green certifications, while often neglecting the combined effect of sustainability-oriented design features under real market conditions. Moreover, empirical evidence remains fragmented across different national and regional contexts, with limited attention paid to Central and Eastern European housing markets, where market maturity, buyer awareness, and valuation practices may differ substantially from those in more frequently studied regions. In addition, many studies assess sustainability effects in isolation, without sufficiently considering their interaction with traditional valuation determinants such as location and property size. This study addresses these gaps by empirically examining whether sustainable design features translate into measurable differences in residential property values in the Czech housing market and by analysing how their effects vary when combined with key market factors.

3. Methodology

The objective of the study is not to develop a predictive pricing model but to identify statistically observable relationships between sustainable design attributes and residential property values in a specific market context. A market analysis was carried out to answer both scientific questions. First, a database was created from the real estate server Sreality.cz. Listings were collected from publicly available advertisements on Sreality.cz between August 2024 and October 2024. Duplicated advertisements were removed to avoid repeated observations across listings. By analysing the text of advertisements from this server, data on family houses and development projects for the construction of family houses were collected, taking into account only properties with the energy label A (extremely energy-efficient) for the relevance of the comparison. All observations meet the A energy label criterion; therefore, sustainability in this study refers to additional explicitly stated sustainable features (e.g., photovoltaics, heat recovery, green roof, passive-house elements) beyond the energy label itself. The samples were distributed throughout the whole Czech Republic to create a sufficiently comprehensive database. For all samples, information was also recorded on their price, floor area, land area and identification of whether the property was sustainable and what specific sustainable element was present.

The first method used was the collection and analysis of data from advertisements on the real estate server Sreality.cz. The data were analysed only on this server because the advertisements on different real estate servers are often repeated and would then lead to data distortion. Data collection was done manually. Subsequently, the entries were recorded in a list, with information on their price, usable area, land area and identification of whether it was a sustainable property and what specific sustainable feature was present for each entry.

Subsequently, a one-factor analysis of variance (ANOVA) was used to assess differences in mean values between groups of properties with different levels of sustainable features. ANOVA was applied to test the hypothesis of equality of means between multiple groups and was used to determine whether the differences between these means could be considered statistically significant. The null hypothesis (H_0) in this case assumed that there was no statistically significant association between property price and the presence of sustainable features, i.e., that the differences between the average prices were random. In this research, a significance level of 5% ($\alpha = 0.05$) was chosen.

A Chi-square test was then performed to answer the RQ2. The Chi-square test is a statistical method used to test the relationship between two categorical variables. Its main objective was to determine whether there was a significant relationship between these variables (in this case, the presence of sustainable elements and location) or whether they were independent. The test was based on a comparison of observed and expected values in a contingency table and assessed whether differences between them could be attributed to chance. The initial null

hypothesis (H0) assumed that there was no statistically significant association between the variables. In this research, a significance level of 5% ($\alpha = 0.05$) was chosen.

$$\chi^2 = \sum \frac{(O_i - E_i)^2}{E_i} \quad (1)$$

Where: χ^2 is the chi-squared value of the test, O_i is the observed value, E_i is the expected value, $\sum$ means the sum over all categories or cells in the table.

In the next stage of the analysis, an extended ANOVA was conducted to include property location as a variable in addition to sustainable elements. This approach allowed the assessment of whether location affected the differences in property prices along with sustainable elements, and whether interactions could be identified between these factors. In a follow-up phase, another variable was added to the model – the usable area of the properties. In this way, it was possible to take into account not only environmental aspects and location, but also the size of the property, which is an important factor influencing its market value.

A cluster analysis was then performed. This method allowed the classification of properties into homogeneous groups that exhibited similar characteristics, which facilitated the analysis of patterns in the market data. Cluster analysis was used to examine the interrelationships between factors such as sustainable design, location and property size. The analysis included visualisation of the clusters, allowing for easier interpretation of the results and identification of market segments that may have specific needs and preferences.

4. Results

First, a database of residential properties was created to serve as the source of information for all other methods. A total of 134 single-family homes and single-family home development projects were registered, all with an energy label of A - extremely energy efficient.

Table 1. Sample overview

Continuous variables		
Variable	Mean (SD)	Min - Max
Asking price (CZK)	13 628 606 (5 877 665)	4 625 000 - 39 950 000
Floor area (m²)	160.5 (64.9)	75 - 550
Land area (m²)	639.7 (431.9)	49 - 3686
Categorical variables		
Variable	n (%)	
Prague area	33 (24.6)	
Other localities	101 (75.4)	
Specific sustainable feature stated in listing	73 (54.5)	
No additional sustainable feature stated	61 (45.5)	
Type of stated sustainable feature (among listings with stated feature)		
Feature type	n (%)	
Photovoltaics	35 (47.9)	
Heat recovery	34 (46.6)	
Energy-efficient	20 (27.4)	
Green roof	7 (9.6)	
Passive house	5 (6.8)	

Source: own study

Table 1 above summarises the basic characteristics of the analysed sample, including property prices, size, location structure and the prevalence of sustainable features. The dataset exhibits substantial heterogeneity in both price levels and property size, which supports the use of group-based statistical methods in subsequent analyses.

To answer the first research question, an ANOVA was conducted. The results of the ANOVA analysis indicate that the calculated p-value is 0.148, which is above the established significance level of 5% ($\alpha = 0.05$). This result leads to the acceptance of the null hypothesis (H_0), which states that there is no statistically significant relationship between property price and the presence of sustainable features. This means that the differences in house prices in this case cannot be attributed to the influence of sustainable elements and are more likely to be random rather than showing a statistically significant association with this variable. From an economic perspective, this result suggests that sustainability alone does not function as an independent price driver in the residential housing market.

Subsequently, analyses were conducted to answer the second research question.

A Pearson chi-square test focused on the association between location and sustainability. The results of the chi-square test show that the calculated p-value is $9.421e-05$, which is significantly lower than the established significance level of 5% ($\alpha = 0.05$). This result suggests that the null hypothesis (H_0), which assumes that there is no statistically significant relationship between the categorical variables analyzed, must be rejected. Based on these results, the alternative hypothesis (H_1), which confirms the existence of a statistically significant relationship between the variables under study, can be accepted. This result indicates that the relationship between the variables is statistically verifiable and cannot be considered random.

The results of the second ANOVA analysis confirm this relationship and show that both sustainable elements and location have a statistically significant effect on property price. In this case, the p-values suggest that the differences in house prices can be attributed to the combined effect of these two factors. That is, both the presence of sustainable features and the location of the property play a role in shaping its market value, and this relationship is not random but statistically demonstrable. This result confirms the importance of both environmental factors and property location for the real estate market.

The results of the third ANOVA analysis confirm that, in addition to sustainable features and location, the usable area of a property plays a significant role as another factor influencing its price. The p-values show that usable floor area has a statistically significant effect on the market value of properties, and its inclusion in the analysis contributes significantly to explaining price differences. In this way, it can be concluded that all three variables - sustainable elements, location and usable area - together constitute the key factors that have a statistically significant impact on property prices.

The cluster analysis showed how the properties group together based on their price and floor area, see Figure 1.

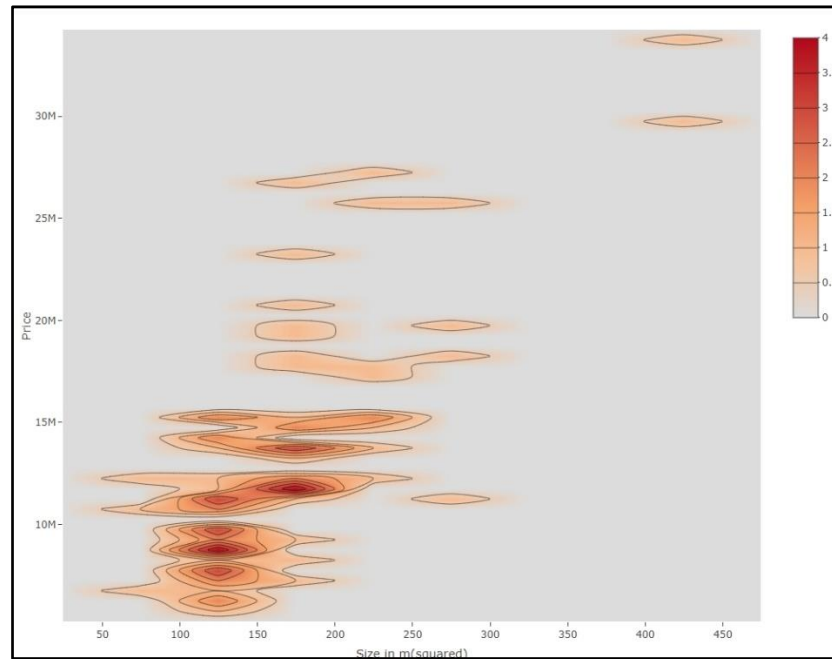


Figure 1. Cluster analysis results

Source: own study

The horizontal axis shows the usable area, while the vertical axis represents house prices. This analysis reveals different segments of the market, and individual clusters may indicate specific categories of properties that exhibit similar price and space characteristics.

The colours in the chart correspond to the density of data in each area, with darker red areas indicating a higher concentration of properties with given parameters, while lighter shades indicate a lower density. The chart shows that there are several distinct clusters that may indicate specific market segments.

- Smaller houses with a lower price (around 50-150 m² and CZK 5-15 million): this segment probably represents ordinary family houses with a smaller area, which are more affordable.
- Medium-sized houses (150-300 m²) with prices around CZK 10-20 million This segment is characterised by larger family houses with average prices. Most properties are concentrated in this area, which may mean that this category represents the most common offer on the market.
- Larger properties (300-450 m²) with prices above CZK 20 million These clusters indicate more luxurious properties that are larger and significantly more expensive.

Although the cluster analysis was primarily focused on property prices and floor area, it is important to note that the resulting clusters also reflect complex interactions with the presence of sustainable features and location. These factors are not isolated but interact and contribute to the overall market value of properties. For example, location can play a key role in what sustainable features are in demand in the market and can also influence the price of a property. In this way, the clusters provide a comprehensive picture of how sustainability trends are manifesting themselves in the property market and allow the identification of specific segments that may be sensitive to a combination of these factors.

5. Discussion

The findings address both research questions and can be summarised as follows.

RQ1: Does sustainable design affect the market value of residential real estate?

Research has shown that the existence of the sustainable element alone does not affect the market value of residential properties in this case. Compared to the results of our study, where there was no statistically significant effect of sustainable design on the market value of residential properties, there are different perspectives on this issue within the current research.

Katafygiotou et al. (2023) looked at how sustainable design and awareness of it affect the real estate market. Their study shows that awareness of the benefits of sustainable design among buyers and investors is key for sustainable features to be perceived as adding value. In regions where this awareness is lower, the impact of sustainable features on market value is not significant. This result is consistent with our finding of no significant effect of sustainable design on market value. In our market, the lack of significant awareness and demand for green solutions may explain why market price was not affected by the presence of sustainable features. Why in some cases sustainable features do not lead to higher property prices could be explained by the results of the research Leutner et al. (2024). The research suggests that while sustainable buildings may have lower operating costs and energy savings, banks and investors may value these benefits less, leading to lower financing - i.e. a 'green discount'. There may be some scepticism on the part of financing institutions or buyers that prevents sustainable elements from being fully integrated into property valuations.

RQ2: How does the impact of sustainable design on the market value of residential properties vary depending on other factors such as location or floor area?

Our results clearly showed that the impact of sustainable design on the market value of residential properties varies significantly depending on other factors such as location and floor area. The analysis of the combination of these variables led to the conclusion that their synergistic effect contributes to the increase in the market value of properties with sustainable features. Our findings suggest that sustainable features gain in value mainly in certain locations or when specific property characteristics such as usable area are taken into account, which is in line with several other studies focusing on market valuation of sustainability.

For example, the study Warren-Myers (2022) highlights that sustainable element are priced differently according to market conditions, local regulatory frameworks and market awareness. In some regions or locations where sustainability is more integrated into valuation practices, higher 15 values for properties with these features can be observed, which is consistent with our finding of the increasing influence of location on price. Further Lambourn (2022) mentions that in some countries where sustainable construction is just developing, the impacts of these factors may be more pronounced. These observations suggest that taking into account local factors, such as local preferences for sustainable housing, can significantly alter how sustainable features affect property prices. This result resonates with our finding that locality plays a key role in how sustainable features are valued.

Further support for this thesis comes from research Khodabakhshian and Toosi (2021) who focused on life-cycle cost-based real estate valuation using Building Information Modelling (BIM). The study showed that long-term savings associated with sustainability can increase the value of real estate if properly calculated and included in the overall economic valuation. This confirms our finding that the value of sustainable properties increases when combined with other factors such as floor area - for example, larger spaces can benefit more from energy savings and other advantages of sustainable solutions, which in turn increases their value.

Our results can also be placed in the broader context of research such as Leskinen et al. (2020) which found that the impact of renewable energy on real estate increases depending on the specifics of the region and the type of property. The combination of sustainable design with factors such as usable floor area can deliver greater value where the demand for energy efficiency and sustainable living is stronger. This is in line with our findings, where a significant synergistic effect of sustainability, location and usable floor area on the market value of properties has been demonstrated.

Overall, our results confirm that the impact of sustainable design on property prices is not unambiguous and is strongly dependent on other factors. When analysing the relationship between the market value of properties

and sustainable features, it is essential to take into account local market conditions, the usable area of the property and other specific characteristics that may influence this relationship.

The results indicate that sustainability-oriented investments in residential real estate should not be evaluated in isolation. For investors and developers, this implies that sustainable design features generate economic value primarily when aligned with location-specific and market-based factors. From a policy perspective, the findings suggest that promoting sustainable housing requires targeted and context-sensitive instruments rather than assuming uniform price premiums for sustainable features across regions. This has important implications for sustainable entrepreneurship, where investment decisions must balance environmental objectives with economic feasibility.

6. Conclusions

The aim of the research was to find out how sustainable design affects the market value of residential properties. The results show that the research objective was met. ANOVA, chi-square analysis and cluster analysis were used to meet the objective. This research can be beneficial to real estate agents, investors and developers, or owners and potential buyers of residential properties. It may also be beneficial to academics and researchers who would like to build on or extend this research.

The analysis has shown that the presence of sustainable features alone does not automatically lead to an increase in the market value of the properties. This result underlines the fact that the contribution of sustainability to property values is not always clear-cut. In practice, this may mean that sustainable technologies and design features are not perceived by buyers as decisive in determining price unless they are supported by other relevant factors. This finding is in line with some existing research that shows a limited direct impact of sustainability on property values, although these elements are often considered beneficial for the future life and running costs of buildings.

However, on deeper analysis, we found that when sustainable features are considered in conjunction with other factors such as location or floor area, their impact on market value changes significantly. This shows that while sustainability alone may not always influence price, when combined with factors that traditionally shape the property market, it can have a significant impact. In particular, the location and floor area of a property play a key role in determining its ultimate value. This is consistent with views that the property market is multi-dimensional and that combining sustainable elements with conventional factors such as geography and property size have a greater impact than a stand-alone sustainability assessment. The cluster analysis subsequently provided a comprehensive picture of the market structure, suggesting that similarities in market value and floor area are also intertwined with the presence of sustainable features and location. The results therefore show that these aspects are not isolated, but complement each other and together influence the overall value of the properties. This finding has important implications for future research and for property valuation practice, where sustainable elements should always be considered in a broader context. A limiting element of the research was the relatively small sample size of the sample studied. A larger sample set would have reflected reality in more detail, but despite this limitation, the results provide valuable insights into the relationship between sustainable design and the market value of residential properties. Thus, this paper contributes to the understanding of the potential economic benefits of sustainable features in the context of market valuation. In conclusion, sustainable design has the potential to influence the market value of real estate, but only in conjunction with other factors that have a key influence on the market. Although sustainable features alone may not always lead to an increase in value, their synergistic effect with factors such as location and floor area can have a significant impact. This study thus provides important insights for the real estate industry, investors and other professionals involved in property valuation and sustainability.

The study demonstrates that the economic effects of sustainable design in residential real estate are context-dependent. For sustainable entrepreneurship and housing policy, this implies that sustainability objectives should be integrated with traditional market mechanisms rather than treated as independent value drivers. The findings highlight the need for informed investment strategies and region-specific policy approaches that support sustainability while maintaining economic viability.

The novelty of this study lies in its empirical examination of sustainable design features within a real market setting, demonstrating that sustainability does not operate as an independent price driver in residential property valuation but rather exerts its influence through interaction with traditional determinants such as location and floor area. By focusing on observed asking prices and explicitly stated sustainable features, the study provides evidence that the economic effects of sustainability are context-dependent and cannot be assumed to generate uniform market premiums. From a practical perspective, the findings offer relevant implications for real estate investors, developers, valuers, and policymakers. The results suggest that sustainability oriented design choices are most likely to contribute to market value when aligned with location specific demand and property characteristics, rather than being implemented in isolation. This insight supports more informed investment decision making, realistic valuation practices, and targeted housing policies that integrate sustainability objectives with local market conditions and economic feasibility.

References

- Aydin, D., & Mihlaylanlar, E. (2020). A Case Study on the Impact of Building Envelope on Energy Efficiency in High-Rise Residential Buildings. *Architecture Civil Engineering Environment*, 13(1), 5-18. <https://doi.org/10.21307/ACEE-2020-001>
- Cortesi, A., Vardopoulos, I., & Salvati, L. (2022). A Partial Least Squares Analysis of the Perceived Impact of Sustainable Real Estate Design on Wellbeing. *Urban Science*, 6(4), 69. <https://doi.org/10.3390/urbansci6040069>
- Dobrovolskiene, N., Pozniak, A., & Tvaronaviciene, M. (2021). Assessment of the Sustainability of a Real Estate Project Using Multi-Criteria Decision Making. *Sustainability*, 13(8), 4352. <https://doi.org/10.3390/su13084352>
- Goh, Z.-T., Low, S.-T., Choong, W.-W., & Wee, S.-C. (2022). Do green features increase housing value in Malaysia? *International Journal of Housing Markets and Analysis*, 15(5), 1296-1312. <https://doi.org/10.1108/IJHMA-09-2021-0101>
- Hossain, S. M., Van de Wetering, J., Devaney, S., & Sayce, S. (2023). UK commercial real estate valuation practice: Does it now build in sustainability considerations? *Journal of Property Investment & Finance*, 41(4), 406-428. <https://doi.org/10.1108/JPIF-11-2022-0083>
- Jalaei, F., Jalaei, F., & Mohammadi, S. (2020). An integrated BIM-LEED application to automate sustainable design assessment framework at the conceptual stage of building projects. *Sustainable Cities and Society*, 53, 101979. <https://doi.org/10.1016/j.scs.2019.101979>
- Joshi, A., Khandelwal, N., Suryawanshi, Y., & Kurulekar, M. (2020). Energy Conservation Residential Building. *2020 International Conference And Utility Exhibition On Energy, Environment And Climate Change (ICUE 2020)*. International Conference on Energy, Environment, and Climate Change (ICUE), New York. <https://doi.org/10.1109/icue49301.2020.9307101>
- Katafygiotou, M., Protopapas, P., & Dimopoulos, T. (2023). How Sustainable Design and Awareness May Affect the Real Estate Market. *Sustainability*, 15(23), 16425. <https://doi.org/10.3390/su152316425>
- Khodabakhshian, A., & Toosi, H. (2021). Residential Real Estate Valuation Framework Based on Life Cycle Cost by Building Information Modeling. *Journal of Architectural Engineering*, 27(3), 04021020. [https://doi.org/10.1061/\(ASCE\)AE.1943-5568.0000479](https://doi.org/10.1061/(ASCE)AE.1943-5568.0000479)
- Kim, M. (2022). Application of functional ANOVA and functional MANOVA. *Korean Journal of Applied Statistics*, 35(5), 579-591. <https://doi.org/10.5351/KJAS.2022.35.5.579>
- Kondruk, N. E., & Malyar, M. M. (2021). Analysis of Cluster Structures by Different Similarity Measures. *Cybernetics and Systems Analysis*, 57(3), 436-441. <https://doi.org/10.1007/s10559-021-00368-4>
- Korol, E., & Shushunova, N. (2022). Analysis and Valuation of the Energy-Efficient Residential Building with Innovative Modular Green Wall Systems. *Sustainability*, 14(11), 6891. <https://doi.org/10.3390/su14116891>
- Lambourne, T. (2022). Valuing sustainability in real estate: A case study of the United Arab Emirates. *Journal of Property Investment & Finance*, 40(4), 335-361. <https://doi.org/10.1108/JPIF-04-2020-0040>
- Leskinen, N., Vimpari, J., & Junnila, S. (2020). The impact of renewable on-site energy production on property values. *Journal of European Real Estate Research*, 13(3), 337-356. <https://doi.org/10.1108/JERER-11-2019-0041>
- Leutner, S., Gloria, B., & Bienert, S. (2024). Is there a green discount in commercial real estate lending? *Journal of Property Investment & Finance*. <https://doi.org/10.1108/JPIF-11-2023-0102>

Manso, M., Teotonio, I., Silva, C. M., & Cruz, C. O. (2021). Green roof and green wall benefits and costs: A review of the quantitative evidence. *Renewable & Sustainable Energy Reviews*, 135, 110111. <https://doi.org/10.1016/j.rser.2020.110111>

Massimo, D. E., De Paola, P., Musolino, M., Malerba, A., & Del Giudice, F. P. (2022). Green and Gold Buildings? Detecting Real Estate Market Premium for Green Buildings through Evolutionary Polynomial Regression. *Buildings*, 12(5), 621. <https://doi.org/10.3390/buildings12050621>

Rathnayake, R. M. K. M., & Pushpakumara, B. H. J. (2023). Evaluating the efficiency of factors influencing valuation of residential buildings: A priority weight-based model. *Case Studies in Construction Materials*, 19, e02371. <https://doi.org/10.1016/j.cscm.2023.e02371>

Richter, T. J., Soliva, E., Haase, M., & Wrase, I. (2022). Corporate real estate and green building: Prevalence, transparency and drivers. *Journal of Corporate Real Estate*, 24(4), 241-255. <https://doi.org/10.1108/JCRE-05-2021-0016>

Ringel, G., & Capeluto, I. G. (2020). An energy profile for greener buildings. *Sustainable Cities and Society*, 61, 102171. <https://doi.org/10.1016/j.scs.2020.102171>

Samour, A., Onwe, J. C., Inuwa, N., Imran, M., Ifelunini, I. A., & Fulu, O. (2023). Assessing the effect of real estate market and renewable energy on environmental quality in Belgium. *Opec Energy Review*, 47(2), 148-159. <https://doi.org/10.1111/opec.12276>

Shen, C., Panda, S., & Vogelstein, J. T. (2022). The Chi-Square Test of Distance Correlation. *Journal Of Computational and Graphical Statistics*, 31(1), 254-262. <https://doi.org/10.1080/10618600.2021.1938585>

Sreality.cz. (2024). *Residential real estate listings database*. Retrieved October 31, 2024, from <https://www.sreality.cz>

Tang, B., Ho, W. K. O., & Wong, S. W. (2021). Sustainable development scale of housing estates: An economic assessment using machine learning approach. *Sustainable Development*, 29(4), 708-718. <https://doi.org/10.1002/sd.2168>

Toivonen, S. (2021). Advancing futures thinking in the real estate field. *Journal Of European Real Estate Research*, 14(1), 150-166. <https://doi.org/10.1108/JERER-01-2020-0003>

Warren-Myers, G. (2022). Valuing sustainability part 1: A review of sustainability considerations in valuation practice. *Journal of Property Investment & Finance*, 40(4), 398-410. <https://doi.org/10.1108/JPIF-02-2022-0013>

Warren-Myers, G., Kain, C., & Davidson, K. (2020). The wandering energy stars: the challenges of valuing energy efficiency in Australian housing. *Energy Research & Social Science*, 67, 101505. <https://doi.org/10.1016/j.erss.2020.101505>

Author Contributions: All authors contributed equally. All authors have read and agreed to the published version of the manuscript.

Ing. Dagmar FREJLACHOVÁ is a researcher and lecturer in the field of real estate economics and valuation at the Institute of Technology and Business in České Budějovice. Her research interests focus on real estate valuation and the influence of sustainability and climate-related factors on property values.

ORCID ID: <https://orcid.org/0009-0002-7974-8654>

doc. Ing. Jaromír VRBKA, MBA, PhD. is the Director of the School of Expertness and Valuation at the Institute of Technology and Business in České Budějovice and an Associate Professor at the Institute of Technology and Business in České Budějovice. His research interests include economic valuation, financial evaluation of companies and neural networks in business.

ORCID ID: <https://orcid.org/0000-0002-6356-4810>

Ing. Jiří MÁŠKA is a researcher and lecturer in the field of real estate economics and valuation at the Institute of Technology and Business in České Budějovice. His research focuses on real estate valuation, sustainability in the built environment and the impact of environmental and energy-related factors on property market values.

ORCID ID: <https://orcid.org/0000-0002-8870-2167>