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Investigating Green Marketing Implementation with the Hedonic Price Model in Residential Projects: The Case of Istanbul

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Abstract: *The strategic importance of green marketing (GM) in value creation for the end customer (VCEC) and the contribution of the spatial and structural characteristics of a residential project (RP) to the final price have been acknowledged in the literature. However, GM features that can lead to price increases have not been evaluated from the VCEC perspective. This study examines the impacts of GM strategies on RPs. This study applies Hedonic Price Modelling to newly built RPs in Istanbul and evaluates the results from the perspective of the Attractive Quality Attributes Theory. The results showed that the total price of the RPs was affected more by design-related sustainable features of RPs and revealed that there is a relationship between GM and sustainable design. The study highlights the importance of GM, which companies can use to operate effectively in a competitive market and increase the satisfaction of end customers through value creation. The study's findings can be considered useful information for policies on creating a sustainable built environment.*

Keywords: hedonic price modelling; green marketing; residential buildings; value creation.

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Introduction

In recent decades, green marketing has become one of the most significant strategic marketing approaches and has started to attract more attention from consumers (Haws et al. 2014; Maniatis 2016). Consumers who reflect their environmental awareness and concerns in their purchasing behaviours and want to purchase environmentally friendly products and services that meet all environmental standards (Boztepe 2012; Grimmer and Bingham 2013; Suki et al 2016) have become the targets of green marketing activities (Papadopoulos et al. 2010; Kumar and Ghodeswar 2015). Consumers do not make purchasing decisions solely on the basis of perceived quality and an acceptable price and have also started to prioritise in their decisions how environmentally friendly the product or service is (Boztepe 2012; Grimmer and Bingham 2013; Suki et al. 2016).

Green marketing consists of all the production and post-production activities that focus on minimising harmful impacts of goods and services on the natural environment, where the focus is on the end customers' 'green satisfaction' (Kumar and Ghodeswar 2015). What customers are willing to pay for a housing unit depends on tangible characteristics, such as spatial and structural housing features, and intangible characteristics, such as the environmental friendliness of housing units that meet customers' expectations (e.g., Nepal et al. 2020; Casado et al. 2017; Neill et al. 2007).

Sustainable housing emphasizes the achievement of economic and social benefits in line with harmonisation of environmental needs with housing units (Pickvance 2009). The environmental impacts of housing can be categorised under four main headings as (Pickvance 2009): (1) the location, (2) construction phases and resource allocation, and (3-4) the spatial and structural characteristics of RPs (Pickvance 2009). Sustainable housing policies build on the environmental, social, and economic principles of sustainability with the integration of a zero-energy-zero-carbon-oriented production process and resource allocation in the supply chain of the housing industry (Golubchikov and Badhiva 2012). The housing industry has become the primary focus of the New Urban Agenda (NUA) and the United Nations Policy Unit as an industry where opportunities can be expanded in line with UN Sustainable Development Goals (especially goal 11 and target 11.1) and policies (United Nations 2017).

The housing literature recognises the strategic importance of the relationship between the spatial and structural characteristics of a housing unit and its offered price (Nepal et al. 2020; Baumont 2009). The relationship between the final price and heterogeneous characteristics of a housing project has been the subject of many studies (e.g., Nepal et al. 2020; Casado et al. 2017; Rabassa and Zoloa 2016; Bulut et al. 2015; Koramaz and Dokmeci 2012; Ebru and Eban 2011). The literature suggests that, besides spatial and structural features, the sustainable housing features and environmentally friendly production processes of these housing units that enable the housing unit to create value for end customers also affect the offered price (Nepal et al. 2020).

This study focuses on sustainable value creation for end customers. It investigates green marketing implementation in RPs and how it may affect the sale price of RPs. Therefore, the research questions have been formulated as:

(1) Which tangible characteristics of a housing unit affect the total price the most?
(2) Is there any green marketing application in the RP for sale?

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Research Methods

Housing construction is a process that results in a product with heterogeneous/varied characteristics and provides a long-term investment, where different features contribute to the final price and are not priced separately. Therefore, Hedonic Price Theory is the research method used here. It was developed from the contributions of two primary approaches: Lancaster's (1966) Consumer Theory and Rosen's (1974) Model (Chin and Chau 2003). These two approaches proposed to specify the price relationship between the goods, their attributes, and their characteristics.

The Hedonic Price Model (HPM) can be defined as the representation of individual characteristics of heterogeneous goods, the relation between the characteristics of goods and their price (Nepal et al. 2020), and a valuation of goods based on their utility-bearing attributes and characteristics and on the functional formulation of unit price changes of goods depending on utility-bearing attributes (Chin and Chau 2003).

The customer is represented by *i* with the environmentally friendly characteristic *pi* and the customer is willing to buy a housing unit (H) that maximises the expected benefit of the customer with its heterogeneous properties, such as structural (ST) and spatial (SP) properties [$H = H\ (ST_1, ST_2, \ldots ST_i, SP_1, SP_2, \ldots SP_i)$] and environmentally friendly (EF) features (Nepal et al. 2020). Therefore, the maximisation of utility (U) from an H is based on the relationship between *pi* and H and other goods and services, X, as shown in Equation 1 (Nepal et al. 2020).

$$U_i = U\ (X, H; p_i) \qquad \text{(Eq.1)}$$

The normalisation of the price effect of X with the consideration of not losing generality to 1 provides the offered price (OP) of the H, which consists of the structural features of the housing unit, ST, spatial qualities, SP, and important environmentally friendly EF (Equation 2) (based on Nepal et al. 2020):

$$OP = X_i + P\ (H)_i \qquad \text{(Eq.2)}$$

The partial derivation of the price that is developed in the housing attributes, where the EF of each dependent variable can be described as explanatory where the maximisation of U provided by the housing units meets the end customers' green expectations reveals the customers' willingness to pay (WTP) (Nepal et al. 2020). The optimisation of utility (U) and P determines the WTP for the housing unit (H) depending on the environmentally friendly (EF) characteristics of the ST and SP. Thus, the incremental effects of green marketing on customers' WTP can be formulated as shown in Equation (3) (based on Nepal et al. 2020):

$$WTP = \frac{\partial U/\partial Hi}{\partial U/\partial X} = \frac{\partial Pi}{\partial Hi} \qquad \text{(Eq. 3)}$$

Price-benefit optimisation reveals that the price of a housing unit – which reflects the structural features of the housing unit (H), ST, spatial properties, SP, and the degree of environmental friendliness of these features, the EF – should meet the customer's expectations. Therefore, the HPM processes the relationship between P and the H properties, as shown in Equation (4) (based on Nepal et al. 2020):

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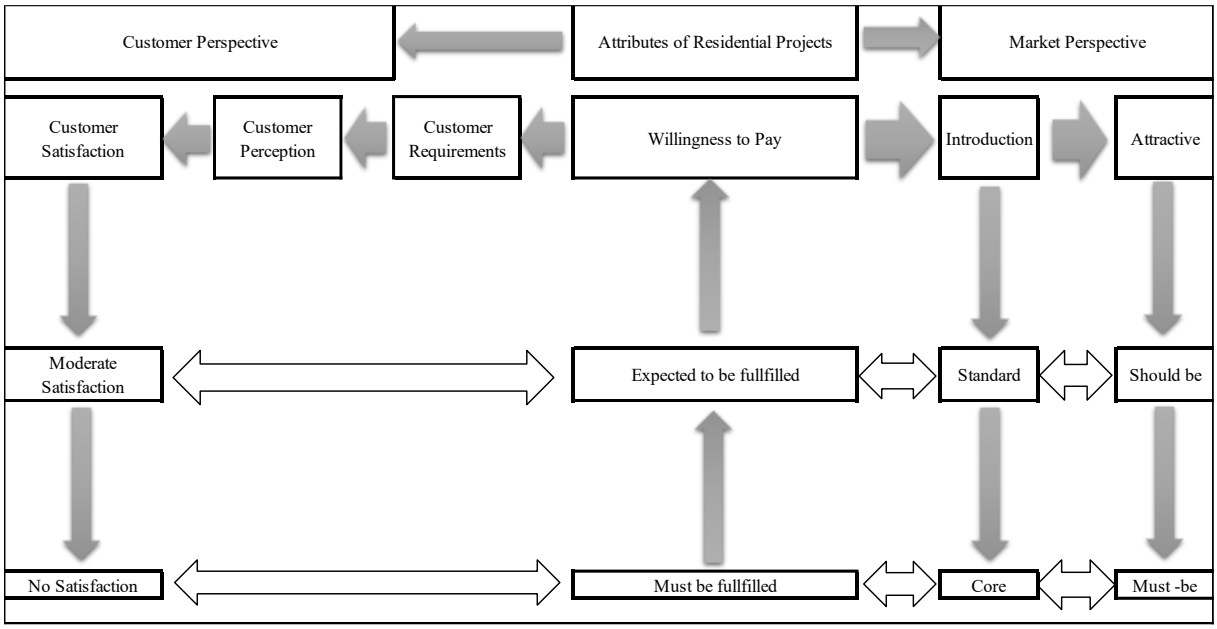
$$P = f(SPi, STi; EFi) \quad \text{(Eq. 4)}$$

According to the Attractive Qualitative Attributes Theory (AQAT), the attributes/features of a product/service have dynamic properties (Tontini et al. 2013). This means that features that initially increase customer satisfaction with their attractiveness can become standard over time and turn into basic features that must be met in order to satisfy the needs of customers (Högström et al. 2010). These core features, which do not produce an increase in customer satisfaction, must be provided as part of the product (Thölke et al. 2001) and may not cause an increase in the customer's WTP. Figure 1 shows the AQAT from the perspective of the customer and the competitive market.

Figure 1: AQAT from the customer and competitive market perspectives



Source: authors' adaptation from Kano et al 1984 and Batarfi et al 2017.

Figure 1 shows that the features of the housing project that are presented to the end customer may transform over time and go from being attractive to becoming core features that do not have an effect on the offered price but must be fulfilled (e.g. concept design). Therefore, as Figure 1 shows, it is important to identify the tangible characteristics of a housing unit that can have the biggest effect on the total price, so that companies can focus on the housing features from the GM perspective and in terms of value creation for the end customer (VCEC) and gain a competitive advantage in the housing market. There is a lack of studies on the implementation of green marketing in the construction industry (Tuz and Sertyesilisik 2020a). There are also no studies on customer survey related to the customer's impressions/feelings about the green features of residential projects in Istanbul. However, since the impression of a product on customers is one of the significant characteristics of demand and one of the inputs of demand, an examination of the changes between T1 and T3 data made it possible to evaluate how green features can affect the OP during time changes. Therefore, the relationship between the OP and demand under free market conditions can provide an understanding of the positive changes in the customers' impressions/feelings regarding the 'green features' of residential projects in Istanbul.

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Study Focus

Istanbul has been experiencing a rapid increase in the size of its urban population because of its geopolitical position. According to statistical data, Istanbul was home to 19% of the total population of Turkey in 2019 (TSI 2020). The rapid increase in the urban population has therefore transformed Istanbul from a mono-centric city to a poly-centric city with 39 districts (TSI 2020). Aspects and patterns of development in the city have influenced which districts the population has been moving to. For this reason, in Istanbul there are 6 districts in the Asian and European continents in which new RPs are intense: Maltepe, Kartal, and Pendik districts on the Asian side, and Avcilar, Beylikduzu, and Esenyurt districts on the European side of Istanbul. This study focuses on these districts, where the city's population has started to increase, and where new RPs are seen intensely. RPs located in these districts have been examined to answer the study's research questions. We collected out data from one of the largest and most widely used real estate agent's website with more than 15 years of experience, where advertisements are visualised in 3D, virtual roaming of housing units is offered, and complete information about a unit's spatial and structural features is provided. We filtered advertisements for newly built RPs in these 6 districts for the different time periods of T1, T2, and T3, resulting in 8040 advertisements. The sample populations were determined at a 95% confidence level and a 2% confidence interval. Statistically, 1380 advertisements for T1, 1243 for T2, and 1153 for the T3 time period were identified and evaluated as the sample population. We examined the sample population of RPs to evaluate the effects of housing attributes on OP. We categorised the 119 identified housing attributes into 6 main categories: design, location and transportation, materials and resources, water efficiency, energy and atmosphere, and indoor quality.

Data Analysis Results

We analysed the collected data in terms of hedonic price modelling using Eviews 11 to answer the first research question of this study. The data were collected from one of the largest and most widely used real estate agent's website. Using this website, we were able to determine the variables with complete information on spatial and structural features. Initially, the HPM was created from the 119 variables provided. Finally, statistically invalid and mismatched variables were omitted from the models to create a statistically valid and fit model according to the fitness and validity criteria of the HPM. The model creation process is summarised in Figure 2. The district-based HPM fitness and validity results for the T3 period are summarised in Table 1.

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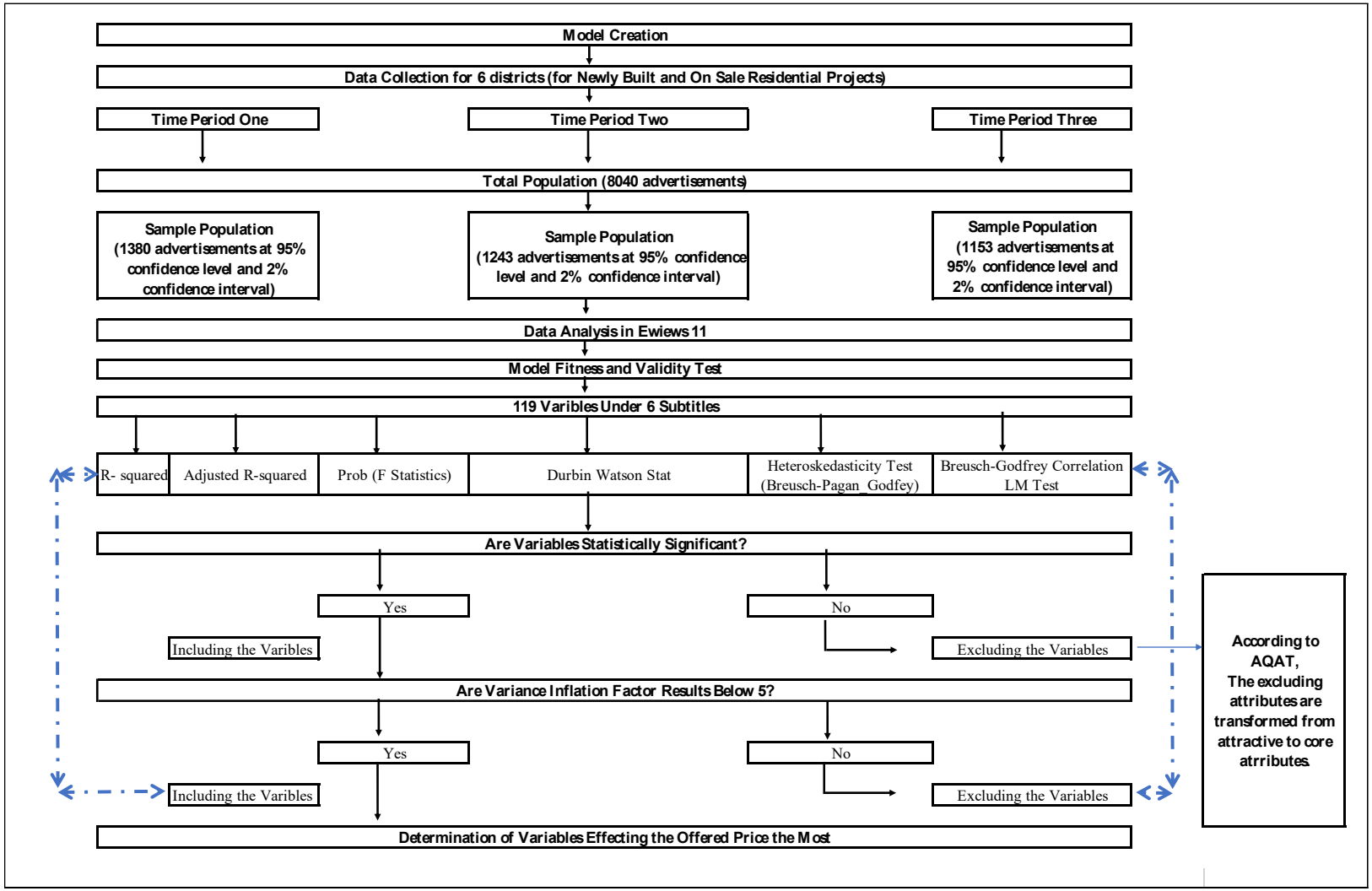
Figure 2: The model creation process



Source: Authors.

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Table 1: Fitness and validity of the HPMs

District	R-squared	Adjusted R-squared	Prob (F Statistics)	Durbin Watson Stat	Heteroskedasticity Test (Breusch-Pagan_Godfey)	Breusch-Godfrey Correlation LM Test
Maltepe	.870	.857	0.000	1.703	.2815	.1124
Kartal	.809	.767	0.000	1.873	.1975	.6285
Pendik	.942	.924	0.000	1.874	.0614	.6853
Avcilar	.822	.800	0.000	1.802	.1355	.9986
Beylikduzu	.750	.730	0.000	1.963	.5203	.6213
Esenyurt	.758	.747	0.000	2.002	.6003	.9636

Source: Authors.

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Table 2: Results of the HPMs on the Asian side of Istanbul

Classification	Variable	Definition	Maltepe		Kartal		Pendik	
			Prob	VIF	Prob.	VIF	Prob.	VIF
Design	STOREY	The storey on which the unit is located					0.000	1.990
	ROOM	Number of rooms in the housing unit	0.000	1.351	0.000	1.860	0.000	1.522
	BFR	Barrier-free (1 for Yes; 0 for No)	0.000	1.450			0.000	1.800
	WEST	West side (1 for Yes; 0 for No)					0.001	2.488
	EAST	East side (1 for Yes; 0 for No)	0.001	1.876				
	SOUTH	South side (1 for Yes; 0 for No)	0.002	1.522			0.000	2.486
	NORTH	North side (1 for Yes; 0 for No)			0.011	1.419		
	PRKL	Parking lot (1 for Yes; 0 for No)	0.001	1.476	0.003	1.404		
	GARAGE	Parking garage (1 for Yes; 0 for No)	0.009	1.756	0.000	4.213		
	OSP	Open swimming pool (1 for Yes; 0 for No)			0.045	3.480		
	OK	Open kitchen (1 for Yes; 0 for No)			0.004	1.767		
	LK	Laminated flooring in kitchen (1 for Yes; 0 for No)					0.001	2.819
Location and Transportation	HWAY	Close to a highway (1 for Yes; 0 for No)	0.004	1.202	0.004	1.487		
	GREEN	Green field view (1 for Yes; 0 for No)	0.000	1.876				
	CITY	Cityscape (1 for Yes; 0 for No)					0.000	1.300
	SEA	Sea view (1 for Yes; 0 for No)					0.008	2.856
	SUBWAY	Close to a subway (1 for Yes; 0 for No)			0.000	1.780		
	SCHOOL	Close to a school (1 for Yes; 0 for No)					0.000	1.532
Materials and Resources	LFT	Lift/Elevator (1 for Yes; 0 for No)	0.002	1.251	0.000	1.441		
	WA	White appliances (1 for Yes; 0 for No)	0.000	1.752	0.004	1.509		
Water Efficiency	WTK	Water tank (1 for Yes; 0 for No)	0.000	1.574	0.009	1.460		
Energy and Atmosphere	HINS	Heat insulation (1 for Yes; 0 for No)	0.016	1.818	0.015	1.189	0.011	1.383
	PP	Power plant (1 for Yes; 0 for No)	0.003	1.578				
	HEATING2	Central heating (1 for Yes; 0 for No)			0.001	1.360		
Indoor Environmental Quality	HC	High ceiling (1 for Yes; 0 for No)	0.000	1.586				

Source: Authors.

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Table 3: Results of the HPMs on the European side of Istanbul

Classification	Variable	Definition	Avcilar		Beylikduzu		Esenyurt	
			Prob	VIF	Prob.	VIF	Prob.	VIF
Design	STOREY	The storey on which the unit is located	0.087	1.603	0.003	1.221	***	1.811
	ROOM	Number of room in the housing unit	0.000	2.137	0.000	2.967	***	3.297
	FLOOR	The net floor area of the housing unit in m2	0.005	3.691	0.047	2.755	***	3.755
	WEST	West side (1 for Yes; 0 for No)	0.000	2.566				
	EASTERN	East side (1 for Yes; 0 for No)			0.053	1.304		
	SOUTH	South side (1 for Yes; 0 for No)						
	NORTH	North side (1 for Yes; 0 for No)						
	HCOMPLEX	If the building is in a housing complex (1 for Yes; 0 for No)			0.000	1.367		
	GARAGE	Parking garage (1 for Yes; 0 for No)			0.000	1.829	***	3.431
	SG	Shared garden (1 for Yes; 0 for No)			0.054	1.496		
	FEP	Fire escape (1 for Yes; 0 for No)			0.024	1.630	***	2.999
	RB	Recessed balcony (1 for Yes; 0 for No)			0.000	1.752	**	2.115
	PB	Parent's bathroom (1 for Yes; 0 for No)			0.000	1.897		
	BT	Bathtub (1 for Yes; 0 for No)			0.000	2.067		
	BFR	Barrier free (1 for Yes; 0 for No)			0.097	1.570	***	2.057
	OSP	Open swimming pool (1 for Yes; 0 for No)					***	2.574
	WTC	Walking track (1 for Yes; 0 for No)					***	2.215
	CT	Closed terrace (1 for Yes; 0 for No)					***	2.309
	OK	Open kitchen (1 for Yes; 0 for No)	0.036	3.261	0.000	1.684	**	1.927
	MINIBUS	Minibus transportation (1 for Yes; 0 for No)			0.021	1.173		

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Classification	Variable	Definition	Avcilar		Beylikduzu		Esenyurt	
			Prob	VIF	Prob.	VIF	Prob.	VIF
Location and Transportation	BUS	Close to a bus station (1 for Yes; 0 for No)	0.000	1.777	0.005	1.236	***	1.657
	SUBWAY	Close to a subway (1 for Yes; 0 for No)	0.000	1.211				
	METROBUS	Close to a metrobus station (1 for Yes; 0 for No)	0.000	2.310				
	HWAY	Close to a highway (1 for Yes; 0 for No)						
	E5	Close to an E5 highway (1 for Yes; 0 for No)	0.005	1.801	0.000	1.285		
Materials and Resources	GREEN	Green field view (1 for Yes; 0 for No)			0.064	1.669	***	1.916
	CITY	Cityscape (1 for Yes; 0 for No)					***	1.408
	LF	Laminated flooring (1 for Yes; 0 for No)	0.000	1.769	0.002	1.147		
	WP	Wallpaper (1 for Yes; 0 for No)			0.001	1.441		
	WA	White appliances (1 for Yes; 0 for No)			0.000	2.581		
	CERAMIC	Ceramic flooring 1 for Yes; 0 for No)	0.000	2.361			***	1.679
	LFT	Lift/Elevator (1 for Yes; 0 for No)					***	1.310
	SPA	Satin paint (1 for Yes; 0 for No)					**	1.645
Energy and Atmosphere	SINS	Sound insulation (1 for Yes; 0 for No)			0.000	1.542		
	HEATING1	Natural gas combi boiler (1 for Yes; 2 for No)					***	3.659
Indoor Environmental Quality	HC	High ceiling (1 for Yes; 0 for No)			0.001	1.475		
	PVC	PVC (1 for Yes; 0 for No)			0.002	1.297		
	DG	Double-glazing (1 for Yes; 0 for No)			0.034	1.198		

Source: Author.

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The HPM results emphasised that statistically significant independent and dummy variables can explain the changes in housing prices in the range of 75%-94.2% (R-square values). The results showed that the robustness of the models was statistically significant at a 1% level [Prob (F statistics)]. Durbin Watson test results can be used to explain if there is any autocorrelation, and this value should be close to 2 and should range between 1-5 and 2.5. The results showed that the Durbin-Watson coefficient was in the range of 1.703-2.002, emphasising that there was no autocorrelation in the analysed data. In addition, the Breusch-Godfrey serial correlation LM test results showed that there was no autocorrelation (the null hypothesis was accepted). Furthermore, the Breusch-Pagan-Godfrey heteroscedasticity test results presented the acceptance of the null hypothesis that emphasizes homoskedasticity.

We classified the variables according to spatial characteristics, materials and resources usage, water efficiency, energy efficiency, indoor quality, and sustainable design criteria that can be used to evaluate the properties of housing units according to green marketing. The multicollinearity tests were applied to determine the statistically significant variables that affect the OP of the housing unit. The robustness of the statistically significant variables was checked by examining variance inflation factors (VIFs), which should be less than 5 (Sheather 2009). Statistically insignificant variables and variables with a VIF greater 5 were eliminated. The fitness and validity results of the models are presented in Table 1, Table 2, and Table 3, which show the lists of district-based variables that affect the OP of housing units. The advertisements were evaluated from a green marketing perspective according to the results of the HPMs.

We evaluated 1153 advertisements for randomly selected newly built housing units to determine which tangible characteristics of a housing unit have the biggest effect on the total price. From the AQAT perspective, the hedonic price modelling results showed that variables relating to the spatial-conceptual design of the RPs (e.g., the existence of security, a basketball court, playground etc.) have become core attributes of a unit that must be fulfilled. Furthermore, the HPM results also highlighted that these core features do not have any statistically significant effect on the OP. On the other hand, the results given in Tables 2 and 3 showed that sustainable design–related attributes that directly reflect the construction phases and positively affect the post-construction phases have significant effects on the OP. Therefore, the model results highlighted the importance of sustainable design, which can enhance an end customer's WTP and add value to the housing unit from the end customer's perspective. In this context, how the characteristics of sustainable design were emphasised in the advertisements were evaluated from the perspective of green marketing in order to answer the second research question of this study. What was observed, however, is that the green marketing practices that create value for the end customer lack the sustainable design type of qualities of a housing unit. There has been limited green marketing of housing attributes categorised in the 6 main sustainable-design categories (Table 2). Moreover, according to Tuz and Sertyesilisik (2020b), there is limited green marketing of the sustainable/green features of residential projects. Tuz and Sertyesilisik (2020b) indicate that even if the existing green marketing mix implementations in residential projects are more focused on location and transportation (green place), there is little focus on promoting sustainable/green features such as design, materials and resources, energy and atmosphere, and indoor environmental quality.

The districts we analysed are ranked according to when they were developed in Table 2 and Table 3 (e.g., Maltepe (the Asian side) was established as a district before the other districts). Fundamentally, according to the AQAT, the attractiveness of certain features faded with time and as they became more common, and these features have now become standard and core

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features (Figure 1) (Kano et al. 1984). The results of our evaluation of different time periods (T1, T2, and T3) show that the introduction of more RPs that offer the same concept design led to the given concept designs becoming standardised and core features of RPs that then have no impact on OP.

The district-based studies on the Asian side for different time periods (between T1, T2, and T3) showed that design criteria (e.g., design for disabled people, the facades of the residence, proximity to transportation points, proximity to a school, and the materials used – e.g., a lift, white appliances, heat insulation, sound insulation) have significant effects on the OP. On the other hand, conceptual design criteria (e.g., walking track, shared garden) do not have a significant impact on the OP.

The district-based studies on the European side for different time periods (between T1, T2, and T3) revealed that proximity to transportation options (e.g., bus, subway) and the materials used (e.g., laminate flooring, ceramics, white appliances) have significant effects on the OP. On the other hand, conceptual design criteria (e.g., parking garage, shared garden, the storey on which the unit is located) and heat insulation and sound insulation in terms of material attributes (especially in Avcilar) do not have a significant impact on the OP.

Furthermore, the results showed that sustainable design criteria listed in Table 2 (e.g., design for disabled people, the facades of the residence, proximity to transportation points, materials used, indoor air quality, and energy efficiency) have become more important. However, no relevant information has been shared about the production process and/or on how environmentally friendly the evaluated features of sustainable design in the advertisements actually are.

Green marketing and sustainable design can be applied simultaneously and in line with sustainable development goals (e.g., Sustainable Development Goals nos. 11 and 12) (United Nations, 2020). The analysis that focused on green marketing in the sample population revealed that green marketing practices do not cover all sustainable design criteria, which can have a great impact on the OP in the housing industry, where competition is high. While reflecting the sustainable design principles to the RPs, it is expected that applying green marketing strategies to the RPs can increase the attractiveness of the final product and customer satisfaction.

Conclusion

This study focused on sustainable value creation for end customers. Based on HPM applied to 1153 advertisements in new RPs in 6 districts in Istanbul, the study examined the application of green marketing to new RPs and investigated which housing characteristics can affect the sale price of RPs. The main findings can be executively summarised as follows:

- Sustainable design has a direct impact on the OP and can enhance the WTP.
- The spatial conceptual design attributes have a tendency to become the default expectations of customers in their decisions about purchasing housing.
- There seems to be relatively limited use of green marketing in the housing industry, and little green marketing that refers to sustainable design–related housing attributes.

The housing industry has become the main focus of significant initiatives such as the NUA and the United Nations Policy Unit. Thus, it is necessary to implement sustainable design criteria

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that are focused on sustainable development goals in the housing industry. Moreover, sustainable design should be supported with green marketing strategies that work with sustainable design. This can lead to an increase in customer satisfaction and a higher WTP. Future research may focus on exploring green marketing practices relating to sustainable design in different countries / cities.

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