sustainability

MDPI

Article

An Analysis of Preferences in Housing Demand by Means of a Multicriteria Methodology (AHP). A More Sustainable Approach

Roberto Cervelló-Royo [1,*], Marina Segura [2], Regina García-Pérez [1] and Baldomero Segura-García del Río [1]

[1] Faculty of Business Administration and Management, Economics and Social Sciences Department, Universitat Politècnica de València, Camino de Vera s/n, 46022 Valencia, Spain; regape@doctor.upv.es (R.G.-P.); bsegura@upvnet.upv.es (B.S.-G.d.R.)
[2] Financial Economics and Statistics Department, Campus de Somosaguas, Universidad Complutense de Madrid, 28223 Madrid, Spain; masegu04@ucm.es
* Correspondence: rocerro@esp.upv.es; Tel.: +34-963877007

Abstract: This paper examines key aspects of the behavior of housing demand from a sustainable standpoint. Most studies have mainly focused on housing supply, looking at quantitative predictions without considering the qualitative relationship found between housing values and housing demand on a sustainable and microeconomic scale. We used a multicriteria decision methodology (analytic hierarchy process—AHP) for the analysis of preferences in demand, based on the theory of multi-attribute utility of housing, to determine the relative importance of each characteristic of housing and its influence on the decision-making process. For this purpose, we carried out the study over three main groups of stakeholders in the housing market: real estate surveyors, real estate agents, and housing buyers (the latter representing the housing demand). Results show that although there might be some slight discrepancies among the three groups in the decision-making process and the weighting of housing attributes, the three groups agree in most of the process, especially when defining the criteria and the importance that each criterion has on the process of valuation. This study provides important managerial and sustainable implications for the real estate market related to urban public policy, as we highlight which criteria are most preferred.

Keywords: preferences; sustainable real estate market; housing demand; housing supply; multicriteria; AHP; public urban policies

Citation: Cervelló-Royo, R.; Segura, M.; García-Pérez, R.; Segura-García del Río, B. An Analysis of Preferences in Housing Demand by Means of a Multicriteria Methodology (AHP). A More Sustainable Approach. *Sustainability* **2021**, *13*, 7550. https://doi.org/10.3390/su13147550

Academic Editor: Francesca Pagliara

Received: 3 June 2021
Accepted: 3 July 2021
Published: 6 July 2021

1. Introduction

There is a broad consensus in scientific literature on the multi-attribute nature of housing and there are many studies that, based on the hedonic price model [1], have analyzed the contribution of different attributes in the formation of housing prices [2–4]. Thus, these studies have introduced diverse solutions to the qualitative character of some of these attributes [5–8].

Most of these studies focus on the supply side and are based on broad housing databases that include the sale price (or supply). The values they reach and those attributes which are considered relevant in the study usually explain the final price of the house. However, there are many studies based on demand and on the a priori desirable characteristics of these economic goods [9,10].

In fact, most studies on the demand for housing have a strong macroeconomic approach, in which housing appears as a mono-attribute good, and the willingness to pay for it is determined by a series of economic variables (population, per capita income, GDP, etc.); the ultimate objective is usually to quantify the global demand for space to cover this basic need and to give some insights for property valuation and future urban public policies [11–14].

However, the use and growth of buildings' environmental performance assessment methodologies has contributed greatly to the integration of methods and practices that favor sustainability in the housing sector. Those methods are built upon various principles and different data, criteria, and evaluation [15].

Among them, it is worth mentioning:

- Green Building Tool (GB Tool), an international project coordinated from Canada;
- Leadership in Energy and Environment Design (LEED), a method developed in the USA with worldwide application;
- Comprehensive Assessment System for Building Environmental Efficiency (CASBEE), a method developed in Japan;
- Building Research Establishment Environmental Assessment Method (BREEAM). a method developed in the U.K.

Focusing on Europe, the most frequently used are:

- High environmental quality (HQE), developed in France during the last decade;
- The VERDE method developed in Spain.

Thus, in this study we consider the analysis of the demand for housing from a sustainable microeconomic perspective, considering the characteristics desired by the potential buyers of the good that would determine their initially willingness to pay [16].

Therefore, given the importance of the decision when buying housing and the lack of transparency of the market, it is logical that in the decision-making process leading to the purchase, a series of intermediary real estate agents and/or surveyors (experts) can influence the demand [15–17]. On the other hand, the high value of housing implies that the acquisition process requires financing in which the home itself serves as a guarantee, triggering a valuation process whose result can also condition the decision of the potential housing buyer.

From this approach we developed the present study to determine to what extent does the appraisal of the attributes of the dwellings made by the potential housing buyers in determining their willingness to pay coincide, in a sustainable way, with the valuation of the intermediary real estate agents of those same attributes and with that of the real estate surveyors.

With this aim, we conducted a survey of a set of recent housing buyers (we gave preference to real housing buyers rather than potential because the goods can be identified and their attributes contrasted in a more suitable and sustainable way), real estate agents, and real estate surveyors in the city of Valencia [16]. For the weight of the different attributes in determining the value of the good, the methodology of the analytic hierarchy process (AHP) was used, considering that it is the most suitable method to analyze the decision-making process of housing purchases as evidenced by the abundant literature on the subject [18–22].

The remainder of the paper is structured as follows. The first part deals with Saaty's AHP methodology [23] and its different stages of fulfilling decision making in a business context. The next part outlines the case study for the analysis of the preferences in demand, based on the theory of multi-attribute utility of housing. Similar analyses thus focus on the real estate surveyors' and real estate agents' opinions. Then, the new AHP model is clarified with the dissimilar hierarchy levels and variables. Finally, the results from the interviews are evaluated and a comparison is made based on the interview results.

2. Materials and Methods

AHP sets out a hierarchical structure of the decision-making problem with the purpose of presenting, deconstructing, and ordering all of the information to carry out the process in the following context: social preferences on housing by considering the individual and the sustainable function of the attributes. The AHP model was created by Thomas L. Saaty in 1980. It is a technique for analyzing and realizing decision making and is used across wide-ranging fields within the business sector [24,25]. For Saaty and Vargas, this

technique is a universal theory of measurement. The AHP is a descriptive theory, which treats individuals independently from their basic circumstances [26–28].

This methodology forecasts a way of measuring demand on a non-monetary scale and its results can be interpreted and validated in terms of sustainable and social utility, since it rates the priority of the intervening groups. There is existing literature in which this methodology is applied and compared with other methods [5,18–22] showing this new approach can overcome some of the problems faced by the traditional methods. Given the multifunctional role of housing, we study the preferences of demand and two other collectives: real estate agents and real estate surveyors. By aggregating the individual preferences and determining the sustainable and social preferences from a representative sample, we will see if the aggregated preferences can be used as representative of sustainable and social preferences.

The foundation of Saaty's mathematical statistical methodology is the creation of the AHP hierarchy with the objective at the highest level, followed by the criteria as well as sub-criteria in the next levels. In the following stages, there is an in-depth assessment of the variables by realizing pairwise comparisons and the calculations of the weights in every level, followed by the calculations of the weights of the entire AHP hierarchy. These pairwise comparisons lead to matrices, from which ratio scales result in eigenvectors [27,28].

A set of alternatives enables these to be prioritized, by comparing elements pairwise, using a fundamental scale designed for this purpose (see Table 1).

Table 1. Fundamental scale for pairwise comparisons.

Numerical Scale	Verbal Scale	Explanation
1	Equal importance	Both elements contribute equally to the property or criterion
3	One element is moderately more important than the other	Judgement and prior experience favor one element over the other
5	One element is significantly more important than the other	Judgement and prior experience strongly favor one element over the other
7	One element is much more important than the other	One element is favored very strongly over the other. Its dominance is demonstrated in practice
9	Extreme importance of one element over the other	One element is dominant over the other to the highest possible order of magnitude

Source: [23]. Note: The values 2, 4, 6 and 8 can be employed to express intermediate situations. We have not considered these values to get a greater defined position of the interviewed individuals.

By comparing the alternatives two-by-two in terms of a particular criterion and using the pairwise comparison scale, square matrices are obtained:

$$A = \lfloor a_{ij} \rfloor, \qquad 1 \leq i, j \leq n \tag{1}$$

which must fulfil the properties of reciprocity, homogeneity, and consistency.

$$a_{ij} = \frac{1}{a_{ji}} \tag{2}$$

$$\text{If } a_{ij} = x \text{ then } a_{ji} = \frac{1}{x},\ 1/9 \leq x \leq 9 \tag{3}$$

The eigenvector of the proposed matrix indicates the importance or weight of each alternative in terms of this criterion [29–31].

Therefore, the consistency matrix must fulfil the characteristics:

$$a_{ik} \times a_{kj} = a_{ij} \tag{4}$$

$$\text{for all } 1 \leq i,\ j,\ k \leq n$$

$$\partial \lambda_{max} / \partial \lambda a_{ij} = \partial \lambda_{max} / \partial \lambda a_{ji} \tag{5}$$

$$\text{for all } i \text{ and } j$$

AHP enables the evaluation of inconsistency of the decision maker when making judgements. To measure this, what is known as the consistency ratio (CR) is calculated. In general [32], inconsistencies below 10% are accepted for matrices of the range $n \geq 5$ (5% for $n = 3$ and 9% for $n = 4$). Otherwise, the judgements made must be revised or the matrix discarded.

AHP possesses two important characteristics which are worth nothing. The first is that it can be applied individually or collectively, with the latter case involving consultation with real estate agents and arriving at an ultimate solution by aggregating the opinions of everyone involved. This aggregation takes place using the geometric mean [33]. The second characteristic, referred to above, is that by means of the CR we can determine the consistency of the information used in the process and therefore eliminate the inconsistent information.

The variables that can exert influence on housing price are turned into questions to study the weight each variable adds to the final valuation through the individual preferences; to check the weight each variable adds to the final valuation through individual preferences and the differences that might exist among the three groups.

2.1. Data Collection

During the first stage, we gathered a group of 15 real estate agents to build a decision tree with all the characteristics and/or variables reflecting the kind of housing which will eventually make the difference among values. To avoid any kind of preceding influence, those real-estate agents were independent and not included in the group of analysis. As Saaty [32] states, the participation of a group of real estate agents will help to validate the results. Thus, this supports our selection of a hierarchy to be used as the basis for our survey.

Although the study in origin was focused on the demand preferences, we considered it useful to carry out the same survey over a group of real estate surveyors and real estate agents, with the aim of showing differences in opinion regarding the importance each group might give to the preferences and, therefore, the real estate valuation. Thus, we sought an additional support to contrast the housing demand group preferences, considering most of the housing types were condominiums. Therefore, we identified three groups of analysis:

Demand: male and female adults who bought a property in Valencia (Spain) before the survey took place. Thus, from a total population of 6000 people who bought housing, we randomly took a sample of 153 individuals. This amount fulfilled the requirement of confidence level (95%) and margin of error (10%), since the minimum number of recommended surveys was of 95. We carried out individual and private surveys at the place of residence or workplace.

Real estate surveyors: a group of 13 architects, engineers, economists, etc., whose main professional activity is related to real estate surveyors and work for real estate companies.

Real estate agents: a group of 28 real estate professionals whose main professional activity is related to real estate and property brokerage between buyers and sellers.

The surveys consisted of pairwise comparisons which were carried out following a hierarchy and from the high-level characteristic or variable standpoint. Thus, individuals compared the alternatives two-by-two in terms of a particular criterion and using the pairwise comparison scale (from 1 to 9) according to Saaty [23]. Figure 1 and Tables 2–6 show the hierarchy and comparisons carried out in the survey. The survey had the same structure. We considered that the survey results might be extrapolated to other territorial areas outside Valencia. However, we also considered the fact that the housing demand group preferences have strong local influences. For example, the low-level of air pollution and contamination in relation to housing environment; the importance given to a balcony or air conditioning installations; the energy performance of the dwelling; existence of infrastructures; access to public transport, environment, etc. These might affect the preferences of environment or the choice of neighborhood. Therefore, we should consider the

condition of the local housing market, even though the methodology used can be applied to any location.

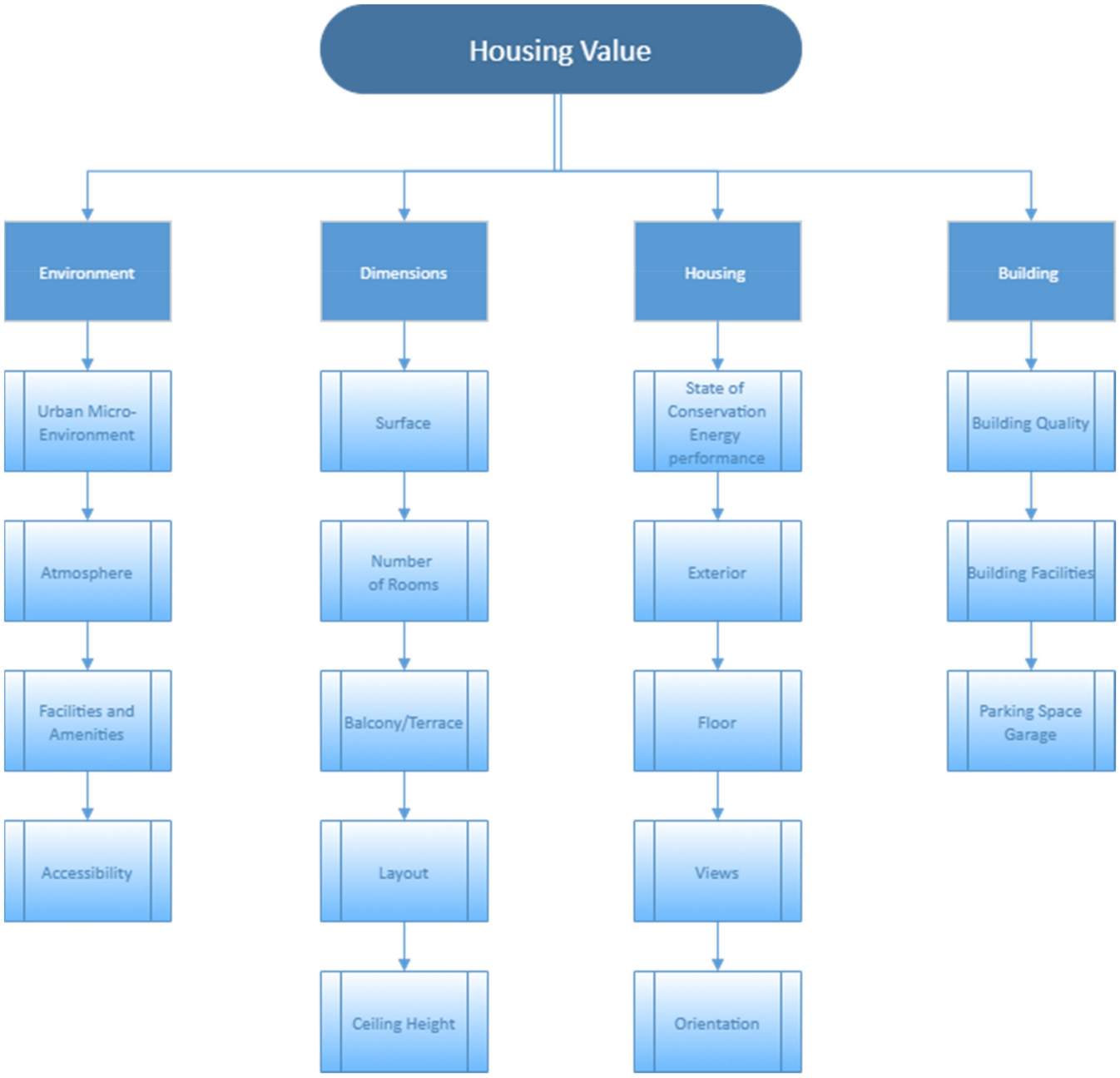

Figure 1. AHP hierarchy for housing value. Source: authors' own elaboration.

Table 2. Housing value matrix example for housing demand.

Housing Value	Environment	Dimensions	Housing	Building
Environment	1	2.13	2.37	4.35
Dimensions	0.47	1	1.48	3.74
Housing	0.42	0.68	1	3.20
Building	0.23	0.27	0.31	1

Source: authors' own elaboration.

Table 3. Environment matrix example for housing demand.

Environment	Urban Micro-Environment	Atmosphere	Facilities and Amenities	Accessibility
Urban micro-environment	1	1.45	1.54	1.92
Atmosphere	0.69	1	0.82	1.21
Facilities and amenities	0.65	1.22	1	1.48
Accessibility	0.52	0.83	0.67	1

Source: authors' own elaboration.

Table 4. Dimension matrix example for housing demand.

Dimensions	Surface	Rooms	Balcony/Terrace	Layout	Ceiling Height
Surface	1	2.62	3.59	4.01	6.32
Rooms	0.38	1	1.71	1.55	3.80
Balcony/terrace	0.28	0.58	1	1.00	3.25
Layout	0.25	0.64	1.00	1	3.34
Ceiling height	0.16	0.26	0.31	0.30	1

Source: authors' own elaboration.

Table 5. Housing matrix example for housing demand.

Housing	State of Conservation	Exterior	Floor	Views	Orientation
State of conservation	1	1.18	1.45	2.18	1.59
Exterior	0.84	1	1.34	2.34	1.54
Floor	0.69	0.75	1	1.91	1.34
Views	0.46	0.43	0.52	1	0.80
Orientation	0.63	0.65	0.74	1.24	1

Source: authors' own elaboration.

Table 6. Building matrix example for housing demand.

Building	Building Quality	Building Facilities	Parking Space/Garage
Building quality	1	2.12	1.45
Building facilities	0.47	1	0.47
Parking space/garage	0.69	2.14	1

Source: authors' own elaboration.

As we have previously commented, one of the secondary objects will be to show if there are any differences of opinion among the real state surveyors, real estate agents, and the housing buyers. Real estate agents and real estate surveyors were asked to answer as if they were walking in buyers' shoes when discussing which variables they consider important regarding housing demand preferences. House buyers were asked about their wishes, requirements, and beliefs.

2.2. Data Analysis: Measurement and Assessment of Model

In the interaction of multiple factors which affect complex decisions such as the choice of housing, it is essential to identify the importance of each factor and to determine the level at which they have an effect. To determine our hierarchy, we structured the situation by identifying the criteria and other tangible and intangible factors, so that we could measure the interaction among them and synthesize all the information to obtain the priorities, in our case, about the housing demand group preferences.

To achieve this aim, a wide range of variables were positioned at the next levels of the hierarchy: environment, dimensions, housing, and building. On the second level,

the criteria (macro-variables) were positioned. The first criterion, environment, comprised the environment, micro-urban environment, low-level of pollution, urban and retail prestige of the area, existence of equipment, facilities and amenities, socio-economic environment, security, heritage areas, green areas, accessibility, etc. The second criterion, dimensions, focused on the real estate equipment and layout, number of rooms and bathrooms, balcony/terrace, height of ceilings, etc. The third criterion, housing, covered housing state, energy performance, orientation, floor, views, etc. The fourth criterion, building, covered the state of conservation and features of quality (aesthetics, age, state of conservation, eco-efficiency, eco-construction, health and safety, comfort, and sensory including visual, olfactory, acoustic, etc.), common facilities (swimming pools, gyms, children's areas, etc.) and access to garages and/or parking.

We then set the following scheme (see Figure 1).

The pairwise comparisons were carried out from the high-level characteristic or variable standpoint. We were trying to identify the housing demand group preferences which have influence on the housing value. This high level contains this element only. As previously commented, we identified 4 macro-variables that exert influence at the higher level and 17 micro-variables which depend on the macro-variables; thus, every element of a level is related to another at the level immediately above.

First level: Housing value

Second level: Macro-variables

(a) Environment: environment location, low-level of air pollution and contamination, low level of noise pollution
(b) Dimensions: housing surface, capacity, volume, and dimensions
(c) Housing: what makes the housing unique and different
(d) Building: what makes a building which includes a group of housing unique and different

Third level: Micro-variables

(a.1) Urban micro-environment: Environment quality and consolidation, building aesthetic, urban equipment, retail, and residential prestige
(a.2) Atmosphere: low-level pollution, neighborhood socio-economic profile, cohabitation, and security
(a.3) Facilities and amenities: proximity to commercial areas, workplaces, heritage areas, green areas, and social facilities
(a.4) Accessibility: commuting and transport facilities.
(b.1) Surface: length and width of property measured in square meters.
(b.2) Number of rooms and bathrooms
(b.3) Balcony/terrace: open-air areas
(b.4) Layout: spatial relation of all the housing areas
(b.5) Ceiling height: available height, from the floor to the ceiling
(c.1) State of conservation: quality design, energy performance, age, state of conservation, need for renovation, additional facilities
(c.2) Exterior: main rooms have a window or balcony to the street
(c.3) Floor: location inside the building
(c.4) Views: from the property
(c.5) Orientation: location with respect to the sun and cardinal points
(d.1) Building quality: aesthetics, age, state of conservation, eco-efficiency, eco-construction, health and safety, comfort, visual-olfactory-acoustic, etc.
(d.2) Building facilities: common areas, swimming pools, sport zones, children's areas, green areas, surveillance, etc.
(d.3) Parking space/garage

Once the hierarchy was built and defined, we carried out the interviews.

Each survey (see Appendix A) had three levels and each survey respondent, by showing his/her preferences, generated five matrices, a 4×4 matrix about generic preference with respect to 4 macro-variables, a 4×4 matrix about environment preferences, a 5×5 matrix

about dimensions preferences, a 5 × 5 matrix about housing preferences, and a 3 × 3 matrix regarding building preferences. This made a total of 35 pairwise comparisons.

The first level of pairwise comparisons compared the relative importance of the criteria with respect to the overall goal of housing value; data for the housing demand group are shown in Table 2.

The second level of pairwise comparisons compares the relative importance of the sub-criteria with respect to the environment criterion (Table 3) as well as the space criterion (Table 4), housing criterion (Table 5), and building criterion (Table 6).

Because of the involvement of the different interview partners mentioned above, for Aczél and Saaty [33] the necessity of an aggregation of the preferences of each interviewee into a consensus conclusion is essential. Therefore, the geometric mean of the decisions of the individuals, which specifies the principal tendency of a cluster of numbers by realizing the product of the pairwise comparison value into group decision making, is required.

$$f(x_1, x_2, \ldots, x_{n)=} \prod_{k=1}^{n} x_k^{1/n} \quad (6)$$

3. Results

3.1. General Analysis

Focusing on the housing demand group, we carried out a survey over a sample of 153 randomly selected individuals from a population of approximately 6000 homebuyers in the city of Valencia (although the sample size for a 10% margin of error and a 95% confidence level is 95, more surveys were collected in anticipation of the possible eliminations by level of insufficient consistency). Regarding the other two groups of interest, we obtained a total sum of 13 individual surveys in the case of real estate surveyors and 28 individual surveys in the case of real estate agents.

All the consistency ratios of these pairwise comparisons of the three groups lay between 0.0% and 5.0% for the matrices with a rank of three variables and between 0.0% and 9.0% for the matrices with a rank of four variables, which is satisfactory according to Saaty [29]. However, for the matrices with five, whose consistency is considered to range between 0.0% and10.0%, we obtained a slightly superior average consistency. As Saaty states, due to the lack of accuracy in individuals' minds, judgements might not be consistent, especially when valuating intangibles; therefore, a minimum of inconsistency might be good. Moreover, Aull-Hyde, Erdogan, and Duke [34] show how the aggregate consistency is good for large size samples, even when the individual consistencies are not acceptable.

Therefore, some inconsistency might be good for determined situations. In our case—without having eliminated the surveys with a high inconsistency—the consistency mean of the 153 surveys which corresponds to the housing demand group results in 12%, the consistency mean of the 28 surveys which corresponds to the real estate agents results in 11%, and the consistency mean of the 13 surveys which corresponds to the real estate surveyors results in 12%. Furthermore, 45% of the housing demand group, 57% of the real estate agents, and 62% of the real estate surveyors have a consistency ratio lower or equal to 10%. This is the reason we decided to eliminate the surveys whose inconsistency was greater than 20% in order to obtain an average consistency ratio of 10%; thus, the number of surveys was reduced to 12 real estate surveyor interviews, 26 real estate agent interviews, and 132 housing demand group interviews, which implies a total of 170 accepted surveys.

Given the personal preferences of each survey respondent, some characteristics will have more relevance than others. The measure of this relative importance is called weight. We chose the eigenvector as the method for aggregating preferences [35]. Then, we proceeded to aggregate the individual judgements to obtain our global utility function.

We checked how the three surveyed groups behave in a homogeneous way. All the individuals in the surveyed population have similar status, education, and experience; and their answers (preferences and intensities) were similar too. Therefore, because of the involvement of the different interview partners mentioned above, the necessity of

an aggregation of the preferences of each interviewee into a consensus conclusion was essential. Therefore, the geometric mean of the decisions of the individuals, which specifies the principal tendency of a cluster of numbers by realizing the product of the pairwise comparison value into group decision making, is required, as shown in Equation (6) [3,36].

By means of the real estate agent choice software package, we found the inconsistency ratio and relative weights with respect to the goal of housing value. We chose the distributive mode, to make clear the dominance (represented by the weight) of one variable with respect to others under the same criterion.

To illustrate the process, we show the application of the first and second levels of the global matrices for the housing demand group (Table 7), real estate agents (Table 8), and real estate surveyors (Table 9):

Table 7. Interview example of criteria comparisons for housing demand.

Housing Value	Environment	Dimensions	Housing	Building	Eigenvector
Environment	1	2.13	2.37	4.35	0.455
Dimensions	0.47	1	1.48	3.74	0.264
Housing	0.42	0.68	1	3.2	0.203
Building	0.23	0.27	0.31	1	0.078
CR *	2%	<8%			1

* Consistency ratio. Source: authors' own elaboration.

Table 8. Interview example of criteria comparisons for real estate agents.

Housing Value	Environment	Dimensions	Housing	Building	Eigenvector
Environment	1	1.62	3.26	6.53	0.471
Dimensions	0.62	1	2.02	4.66	0.300
Housing	0.31	0.49	1	3.69	0.169
Building	0.15	0.21	0.27	1	0.060
CR *	1%	<8%			1

* Consistency ratio. Source: authors' own elaboration.

Table 9. Interview example of criteria comparisons for real estate surveyors.

Housing Value	Environment	Dimensions	Housing	Building	Eigenvector
Environment	1	1.93	2.98	6.12	0.482
Dimensions	0.52	1	2.25	4.01	0.292
Housing	0.34	0.44	1	2.52	0.155
Building	0.16	0.25	0.40	1	0.071
CR *	0.8%	<8%			1

* Consistency ratio. Source: authors' own elaboration.

As we can see, we obtained more than acceptable global inconsistency ratios: 2% for the housing demand group, 1% for real estate agents, and 0.8% for real estate surveyors.

Table 10 shows the environment, dimensions, housing, and building weights assigned by each analyzed group to each one of the sub-criteria.

Table 10. Weights.

	Housing Demand	Real Estate Agents	Real Estate Surveyors
Environment	0.454	0.471	0.482
Urban micro-environment	0.159	0.176	0.240
Atmosphere	0.105	0.104	0.112
Facilities and amenities	0.109	0.136	0.081
Accessibility	0.081	0.056	0.049

Table 10. *Cont.*

	Housing Demand	Real Estate Agents	Real Estate Surveyors
Dimensions	0.264	0.300	0.292
Surface	0.124	0.133	0.106
Rooms	0.054	0.086	0.083
Balcony/terrace	0.036	0.033	0.045
Layout	0.014	0.037	0.039
Ceiling height	0.055	0.012	0.019
Housing	0.203	0.169	0.155
State of conservation	0.055	0.066	0.067
Exterior	0.051	0.046	0.042
Floor	0.041	0.026	0.016
Views	0.025	0.015	0.016
Orientation	0.031	0.017	0.014
Building	0.078	0.060	0.071
Building quality	0.036	0.029	0.040
Building facilities	0.020	0.014	0.015
Parking space/garage	0.022	0.018	0.016

Source: authors' own elaboration.

3.2. Macro-Variables Analysis

The housing demand group, real estate agents, and real estate surveyors agreed in giving the same weight to the environment variable; however, the housing demand group was only given a less than 2.25% percentage weighting than the average of the other two groups.

The three groups practically provided the same importance to the variable dimensions; however, the housing demand group gave a weighting of 3.2% less than the average weighting of real estate agents and real estate surveyors.

For the housing demand group, housing represents a weighting of 4.1% more than the other two groups. It could be explained by the more subjective criteria, tastes, and needs of the housing buyers.

The three groups give similar values to the building.

3.3. Micro-Variables Analysis

In the case of environment, the urban micro-environment is the most valued variable by the three groups; however, real estate surveyors assigned an 8% greater value to this variable than the housing demand group. According to the housing demand group, urban micro-environment can explain 15.9% of the housing value, whereas for the real estate surveyors it explains 24%. The atmosphere and environment variables show no significant differences among the groups.

The real estate agents gave a higher value to facilities and amenities compared with the housing demand group, whereas the housing demand group gave more importance to accessibility than the other two groups. Although the difference is not too significant, it should be noted that it represents a characteristic that real estate surveyors and real estate agents usually do not consider: housing buyers give higher importance to commuting to the workplace, public transport services, proximity to the central business district (CBD), etc.

In the case of dimensions, the surface area represents the second most valued micro-variable according to the preferences of the respondents. According to the housing demand group, it explains 12.4% of the price, not showing significant differences with respect to the other two groups.

The number of rooms is much less valued than the surface attribute. In fact, currently, with an average index of 2.74 family members and a birth rate of 1.2 children per family, large spaces with fewer bedrooms are required. The housing demand group gave a lower weight to number of rooms than the other two groups.

The balcony/terrace and the layout do not show significant differences among the groups.

The variable ceiling height is not considered much by the house buyers, real estate agents, and real estate surveyors. However, in Europe, ceiling height is starting to be considered more and the surface is starting to be measured in cubic meters rather than in square meters.

In the case of housing, it is surprising that, although real estate agents report that it is something taken as assumed, the state of conservation does not represent a highly valued preference and has a relatively low weight. It could be said that it is a response to the housing market maturity and to an increasing interest in architecture, interior design, and decoration, and in an increasing interest in sustainability, energy performance, renovation and refurbishment. The survey respondents only provided weights of 5.50% (housing demand group), 6.60% (real estate agents), and 6.70% (real estate surveyors), to the state of conservation (quality design, age, state of conservation, need for renovation, additional facilities, energy performance certificate, etc.) among all the housing variables, possibly because it represents the only characteristic that can be modified. As we can see, the housing demand group provides a value of 1.10% less than that provided by real estate agents and real estate surveyors. This can be explained by the house buyers' intentions to refurbish, rework, and improve the energy performance of the housing, which implies they are not initially too concerned about the state of it.

Regarding the exterior rooms, there were no significant differences in the group, whereas the floor, views, and orientation were valued by the housing demand group at twice the value given by the other two groups.

In the case of the building (building quality, building facilities, and parking space/garage), there were no significant differences with respect to the real estate agents' and real estate surveyors' opinions.

Since there are both social and professional interests in studying the causes which determine the variability of housing values (more than macro-economic or interventionist factors), we were able to compile information by means of a survey and the application of the AHP methodology to obtain the social and environment preferences of the housing demand group (and other groups of interest) with the purpose of interpreting them in terms of utility and sustainability. The determination of weights or individual priorities was obtained by applying the eigenvector method; we checked the consistency of the global judgements and obtained a utility global function. The preferences of each group provide the utility functions, without appreciating significant differences among them.

From the comparative study of the three surveyed collectives, we want to highlight the fact that the three groups which participated in the real estate market valuation (real estate surveyors, real estate agents, and house buyers) might disagree in the decision-making process regarding the housing demand group preferences and the housing attributes weighting. In this study, we can state there is a certain criteria harmony among the three groups, which might help the real estate sector if the macro-economic and micro-economic conditions are fulfilled in a sustainable way.

4. Discussion and Conclusions

According to the surveyed results and from a multi-attribute standpoint, we can state there are no significant differences among the importance that the three groups provide to the macro-variables and micro-variables which take part in the valuation when an individual sets their preferences.

The fact that both real estate agents and real estate surveyors think and act in a similar way to the housing buyers is confirmed.

Environment (environment, atmosphere, low-level of air pollution, etc.) and dimensions (surface, rooms, layout, etc.) are given more importance when making the decision to buy a house and, therefore, these variables exert more influence on the housing value (environment: from 0.454 to 0.482; dimensions, from 0.264 to 0.292).

The housing macro-variables were much better valued (0.203, with all its inherent characteristics) than the building (0.078) in which it is located by the housing demand group. The quality of the building, facilities such as a swimming pool, green areas, surveillance, and garage/parking areas acquire value as luxury characteristics; thus, they only begin to be considered if the other housing characteristics preferences are fulfilled.

Regarding the micro-variables, the urban micro-environment (environment quality, etc.) shows the greater weight (from 15.9 to 24) in the case of environment. Surface (from 0.106 to 0.133) and rooms (from 0.054 to 0.086) are the micro-variables which represent almost 70% of the dimensions (from 0.264 to 0.300). In the case of housing, all three micro-variables show similar weights, with views being the one with least influence. Lastly, and as we have previously commented, the building was given lower weights, with building quality (aesthetics, age, state of conservation, eco-efficiency, eco-construction, health and safety, comfort, and sensory including visual, olfactory, acoustic, etc.) being the one with most importance (more than 50%).

Thus, we can state that the weights of the variables have determined and will determine market values in a more sustainable way. The results of our research allow us to deduce that the foreseeable value of housing depends on a set of characteristics which are linked with sustainability. The main novelty comes from the match of the housing demand group preferences and the ones that come from both real estate agents and real estate surveyors, since they are the ones who decide the main characteristics to be considered when enquiring about housing value and, therefore, when obtaining a mortgage.

For the same housing, prices might range depending on the moment the transaction took place, but the value proportion of the attributes will be almost the same, for all kinds of properties. The housing demand group influences supply, in the sense that it expresses the buying intention and buyers' preferences of the determined sustainable characteristics as well as willingness to pay for them.

This study has some limitations which could encourage future works. Since the study was carried out in the Mediterranean city of Valencia, this paper encourages the development of urban public policies that include as many sustainable parameters as possible and help to improve the real estate market in a more sustainable way. For example, as was previously mentioned, several environmental methodologies and methods for evaluating the environmental performance of buildings have been developed in recent years: GB Tool, LEED, CASBEE, BREEAM, HQE, and VERDE, among others. Thus, to include some of the parameters involved in those methods is a worthwhile direction for future research.

Author Contributions: Conceptualization, R.C.-R. and B.S.-G.d.R.; methodology, M.S., R.G.-P., R.C.-R. and B.S.-G.d.R.; software, R.G.-P. and M.S.; formal analysis, R.C.-R. and M.S.; investigation, R.C.-R., M.S., and B.S.-G.d.R.; resources, R.G.-P. and M.S.; funding acquisition, B.S.-G.d.R.; data curation, R.G.-P. and M.S.; writing—original draft preparation, R.C.-R. and R.G.-P.; writing—review and editing, R.C.-R.; supervision, R.C.-R. and B.S.-G.d.R. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Conflicts of Interest: The authors declare no conflict of interest.

Appendix A

The total number of questions were 98 for each survey. The expected time of the interview was 45 min, according to the recommendation by Casley and Lury [37] in order to avoid the fatigue of the parties involved. From the 98 questions; on one hand, there were 28 of personal and general nature; on the other hand, regarding housing characteristics, there were 70 questions related to judgments of pairwise comparison (c), 35 regarding the

most important characteristics, and 35 to rate the importance of one characteristic with respect to another.

Since it may be of interest to study the profile of the respondents in the housing demand group, some personal questions were included, in which we collected the following data:

- Age
- Sex
- Education
- Current or past job position
- Level of knowledge about housing prices and housing characteristics
- Number of housing transactions
- Income level

For the real estate surveyor group:

- Years of experience
- Professional linkage in the real estate sector
- Education
- Professional position where they developed more years of activity
- Level of knowledge about housing prices and housing characteristics
- Number of appraisals or urban valuations

Consideration of the need to incorporate buyer preferences
For the real estate agent group:

- Years of experience in the real estate sector
- Professional linkage in the real estate sector
- Education
- Professional position where they developed more years of activity
- Level of knowledge about housing prices and their characteristics
- Participation in real estate transactions
- Consideration of the need to incorporate the buyers' preferences

There were 70 remaining questions (35 preference + 35 intensity). Each survey had three levels and each survey respondent, by showing their preferences, generated five matrices, a 4 × 4 matrix about generic preference with respect to four macro-variables, a 4 × 4 matrix about environment preferences, a 5 × 5 matrix about dimensions preferences, a 5 × 5 matrix about housing preferences, and a 3 × 3 matrix regarding building preferences. This made a total of 35 pairwise comparisons.

Table A1. Goal: Housing Value.

1	Environment	9	8	7	6	5	4	3	2	**1**	2	3	4	5	6	7	8	9	Dimensions
2	Environment	9	8	7	6	5	4	3	2	**1**	2	3	4	5	6	7	8	9	Housing
3	Environment	9	8	7	6	5	4	3	2	**1**	2	3	4	5	6	7	8	9	Building
4	Dimensions	9	8	7	6	5	4	3	2	**1**	2	3	4	5	6	7	8	9	Housing
5	Dimensions	9	8	7	6	5	4	3	2	**1**	2	3	4	5	6	7	8	9	Building
6	Housing	9	8	7	6	5	4	3	2	**1**	2	3	4	5	6	7	8	9	Building

Notes: Compare the relative importance with respect to: Goal: Housing Value. Circle one number per row below using the scale: 1 = equal; 3 = moderate; 5 = strong; 7 = very; strong 9 = extreme.

Table A2. Goal: Environment.

1	Urban micro-environment	9	8	7	6	5	4	3	2	**1**	2	3	4	5	6	7	8	9	Atmosphere
2	Urban micro-environment	9	8	7	6	5	4	3	2	**1**	2	3	4	5	6	7	8	9	Facilities and amenities
3	Urban micro-environment	9	8	7	6	5	4	3	2	**1**	2	3	4	5	6	7	8	9	Accessibility
4	Atmosphere	9	8	7	6	5	4	3	2	**1**	2	3	4	5	6	7	8	9	Facilities and amenities
5	Atmosphere	9	8	7	6	5	4	3	2	**1**	2	3	4	5	6	7	8	9	Accessibility
6	Facilities and amenities	9	8	7	6	5	4	3	2	**1**	2	3	4	5	6	7	8	9	Accessibility

Notes: Compare the relative importance with respect to: Goal: Environment. Circle one number per row below using the scale: 1 = equal 3 = moderate 5 = strong 7 = very strong 9 = extreme.

Table A3. Goal: Dimensions.

1	Surface	9	8	7	6	5	4	3	2	**1**	2	3	4	5	6	7	8	9	Number of rooms
2	Surface	9	8	7	6	5	4	3	2	**1**	2	3	4	5	6	7	8	9	Balcony/Terrace
3	Surface	9	8	7	6	5	4	3	2	**1**	2	3	4	5	6	7	8	9	Layout
4	Surface	9	8	7	6	5	4	3	2	**1**	2	3	4	5	6	7	8	9	Ceiling heights
5	Number of rooms	9	8	7	6	5	4	3	2	**1**	2	3	4	5	6	7	8	9	Balcony/Terrace
6	Number of rooms	9	8	7	6	5	4	3	2	**1**	2	3	4	5	6	7	8	9	Layout
7	Number of rooms	9	8	7	6	5	4	3	2	**1**	2	3	4	5	6	7	8	9	Ceiling heights
8	Balcony/Terrace	9	8	7	6	5	4	3	2	**1**	2	3	4	5	6	7	8	9	Layout
9	Balcony/Terrace	9	8	7	6	5	4	3	2	**1**	2	3	4	5	6	7	8	9	Ceiling heights
10	Layout	9	8	7	6	5	4	3	2	**1**	2	3	4	5	6	7	8	9	Ceiling heights

Notes: Compare the relative importance with respect to: Goal: Dimensions. Circle one number per row below using the scale: 1 = equal; 3 = moderate; 5 = strong; 7 = very strong; 9 = extreme.

Table A4. Goal: Housing.

1	State of conservation/ energy performance, etc.	9	8	7	6	5	4	3	2	**1**	2	3	4	5	6	7	8	9	Exterior
2	State of conservation/ energy performance, etc.	9	8	7	6	5	4	3	2	**1**	2	3	4	5	6	7	8	9	Floor
3	State of conservation/ energy performance, etc.	9	8	7	6	5	4	3	2	**1**	2	3	4	5	6	7	8	9	Views
4	State of conservation/ energy performance, etc.	9	8	7	6	5	4	3	2	**1**	2	3	4	5	6	7	8	9	Orientations
5	Exterior	9	8	7	6	5	4	3	2	**1**	2	3	4	5	6	7	8	9	Floor
6	Exterior	9	8	7	6	5	4	3	2	**1**	2	3	4	5	6	7	8	9	Views
7	Exterior	9	8	7	6	5	4	3	2	**1**	2	3	4	5	6	7	8	9	Orientations
8	Floor	9	8	7	6	5	4	3	2	**1**	2	3	4	5	6	7	8	9	Views
9	Floor	9	8	7	6	5	4	3	2	**1**	2	3	4	5	6	7	8	9	Orientation
10	Views	9	8	7	6	5	4	3	2	**1**	2	3	4	5	6	7	8	9	Orientation

Notes: Compare the relative importance with respect to: Goal: Housing. Circle one number per row below using the scale: 1 = equal; 3 = moderate; 5 = strong; 7 = very strong; 9 = extreme.

Table A5. Goal: Building.

1	Building Quality	9	8	7	6	5	4	3	2	**1**	2	3	4	5	6	7	8	9	Building Facilities
2	Building Quality	9	8	7	6	5	4	3	2	**1**	2	3	4	5	6	7	8	9	Parking Space/Garage
3	Building Facilities	9	8	7	6	5	4	3	2	**1**	2	3	4	5	6	7	8	9	Parking Space/Garage

Notes: Compare the relative importance with respect to: Goal: Building. Circle one number per row below using the scale: 1 = equal; 3 = moderate; 5 = strong; 7 = very strong; 9 = extreme.

References

1. Rosen, S. Hedonic prices and implicit markets: Product differentiation in pure competition. *J. Political Econ.* **1974**, *82*, 34–55. [CrossRef]
2. Chica-Olmo, J.; Cano-Guervos, R.; Chica-Rivas, M. Estimation of housing price variations using spatio-temporal data. *Sustainability* **2019**, *11*, 1551. [CrossRef]
3. Goodman, A.C.; Thibodeau, T.G. Housing market segmentation and hedonic prediction accuracy. *J. Hous. Econ.* **2003**, *12*, 181–201. [CrossRef]
4. McGreal, S.; Taltavull de La Paz, P. Implicit house prices: Variation over time and space in Spain. *Urban Stud.* **2013**, *50*, 2024–2043. [CrossRef]
5. Cervelló, R.; García, F.; Guijarro, F. Ranking residential properties by a multicriteria single price model. *J. Oper. Res. Soc.* **2011**, *62*, 1941–1950. [CrossRef]
6. Ozanne, L.; Malpezzi, S. The efficacy of hedonic estimation with the annual housing survey: Evidence from the demand experiment. *J. Econ. Social Meas.* **1985**, *13*, 153–172.
7. Benson, E.D.; Hansen, J.L.; Schwartz, A.L., Jr.; Smersh, G.T. Pricing residential amenities: The value of a view. *J. Real Estate Financ. Econ.* **1998**, *16*, 55–73. [CrossRef]
8. Song, Y.; Knaap, G.J. New urbanism and housing values: A disaggregate assessment. *J. Urban. Econ.* **2003**, *54*, 218–238. [CrossRef]
9. Chang, C.T.; Ku, C.Y.; Ho, H.P.; Liao, C. An MCGP decision aid for homebuyers to make the best choice. *Q & Q* **2011**, *45*, 969–983.
10. Din, A.; Hoesli, M.; Bender, A. Environmental variables and real estate prices. *Urban Stud.* **2001**, *38*, 1989–2000. [CrossRef]
11. CECODHAS Housing Europe. *Welfare Transformation and Demographic Change in Europe: Challenges for the Social Housing Sector Brussels*; Publications Office of CECODHAS Housing Europe: Brussels, Belgium, 2007.
12. CECODHAS Housing Europe. *Housing Europe Review 2012: The Nuts and Bolts of European Social Housing Systems*; Publications Office of CECODHAS Housing Europe: Brussels, Belgium, 2011.
13. CECODHAS Housing Europe. *Preparing the Future: Affordable Housing and the Challenge of an Ageing Population in Europe: Success Stories*; Publications Office of CECODHAS Housing Europe: Brussels, Belgium, 2012.
14. Wu, Y.L.; Lu, C.L.; Chen, M.C.; Chu, F.N. What forces drive the dynamic interaction between regional housing prices? *Int. J. Strateg. Prop. ManaG.* **2017**, *21*, 225–239. [CrossRef]
15. Sinou, M.; Kyvelou, S. Present and future of building performance assessment tools. *Manag. Environ. Qual. An. Int. J.* **2006**, *17*, 570–586. [CrossRef]
16. Małkowska, A.M.; Uhruska, M.; Tomal, M. Age and Experience versus Susceptibility to Client Pressure among Property Valuation Professionals—Implications for Rethinking Institutional Framework. *Sustainability* **2019**, *11*, 6759. [CrossRef]
17. Han, L.; Strange, W.C. The Microstructure of Housing Markets: Search, Bargaining an Brokerage. In *Hand Book of Urban and Regional Economics*; Duranton, G., Henderson, J.V., Strange, W.C., Eds.; North-Holand: Amsterdam, The Netherlands, 2015; pp. 813–886.
18. Ong, S.E.; Chew, T.I. Singapore residential market: An real estate agent judgmental forecast incorporating the analytical hierarchy process. *J. Prop. Valuat. Investig.* **1996**, *14*, 50–66. [CrossRef]
19. Chauhan, K.A.; Shah, N.C.; Rao, R.V. The analytic hierarchy process as a decision-support system in the housing sector: A case study. *World Appl. Sci. J.* **2008**, *3*, 609–613.
20. Aznar-Bellver, J.; Ferrís-Oñate, J.; Guijarro, F. An ANP framework for property pricing combining quantitative and qualitative attributes. *J. Oper. Res. Soc.* **2010**, *61*, 740–755. [CrossRef]
21. Sarathy, P.S. TQM practice in real-estate industry using AHP. *Q & Q* **2013**, *47*, 2049–2063.
22. Cervelló-Royo, R.; Guijarro, F.; Pfahler, T.; Preuss, M. An Analytic Hierarchy Process (AHP) framework for property valuation to identify the ideal 2050 portfolio mixes in EU-27 countries with shrinking populations. *Q & Q* **2016**, *50*, 2313–2329.
23. Saaty, T.L. *The Analytic Hierarchy Process*; McGraw-Hill: New York, NY, USA, 1980.
24. Afshari, M.; Mafi, E. Land capability assessment for regional planning using AHP and GIS at Shandiz Urban Region, Northeast Iran. *Environ. Urban. Asia* **2014**, *5*, 105–118. [CrossRef]
25. Aznar-Bellver, J.; Cervelló-Royo, R.; Romero-Civera, A. New Spanish banking conglomerates: Application of the analytic hierarchy process (AHP) to their market value. *Int. J. Finance Econ.* **2011**, *78*, 71–82.
26. Saaty, T.L. Making and validating complex decisions with the AHP/ANP. *Int. J. Syst. Sci. Syst. Eng.* **2005**, *14*, 1–36. [CrossRef]
27. Saaty, T.L.; Vargas, L.G. *Models, Methods, Concepts & Applications of the Analytic Hierarchy Process*; Springer Science & Business Media: Berlin/Heidelberg, Germany, 2001.
28. Saaty, T.L.; Vargas, L.G. *Decision Making with the Analytic Network Process*; Springer Science+ Business Media, LLC: Secaucus, NJ, USA, 2006; Volume 282.
29. Saaty, T.L. That is not the analytic hierarchy process: What the AHP is and what it is no. *J. MultiCriteria Decis. Anal.* **1997**, *6*, 324–333. [CrossRef]
30. Saaty, T.L. *Decision Making for Leaders*; RWS Publications: Pittsburgh, PA, USA, 1990.
31. Saaty, T.L. *Theory and Applications of the Analytic Network Process-Decision Making with Benefits, Opportunities, Costs and Risks*; RWS Publications: Pittsburgh, PA, USA, 2009.
32. Saaty, T.L. *Multi-criteria Decision Making: The Analytic Hierarchy Process*; RWS Publications: Pittsburgh, PA, USA, 1996.
33. Aczél, J.; Saaty, T.L. Procedures for synthesizing ratio judgements. *J. Math. Psychol.* **1983**, *27*, 93–102. [CrossRef]

34. Aull-Hyde, R.; Erdogan, S.; Duke, J.M. An experiment on the consistency of aggregated comparison matrices in AHP. *Eur. J. Oper. Res.* **2006**, *171*, 290–295. [CrossRef]
35. Forman, E.; Peniwati, K. Aggregating individual judgements and priorities with the analytic hierarchy process. *Eur. J. Oper. Res.* **1998**, *108*, 165–169. [CrossRef]
36. Grošelj, P.; Stirn, L.Z. Acceptable consistency of aggregated comparison matrices in analytic hierarchy process. *Eur. J. Oper. Res.* **2012**, *223*, 417–420. [CrossRef]
37. Casley, D.J.; Lury, D.A. *Data Collection in Developing Countries*; Clarendon Press: Oxford, UK, 1981.