Resource□based view of city quality: Scales development and validation

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Abstract

As the urban world population grows steadily, cities have become the main habitat for human beings. Against this backdrop, city quality or the level of development of the city's habitat that ensures the satisfaction of objective and subjective human needs become a matter of growing inter- est and concern for academics, policy makers, and citizens. Building on a resource□based view of city quality, the aim of this paper is twofold. First, it proposes and validates scales for six city sub□habitats: political, economic, social, natural, artificial, and technological. Second, it tests a model and the underlying hypothesis about the ranking of those sub□ habitats and of the perceived controversy regarding decision making upon them. For those purposes, a survey of 768 city inhabitants was conducted in Portugal to measure city quality and their sub□habitats. Both the predicted ranking of importance of the sub□habitats and the perceived ranking of controversy were empirically validated. The results constitute a novel and important contribution to understand city quality and its sub□habitats, whose conceptual power relies on hierarchized factors linked to citizens' happiness and to the level of controversy of the solutions.

1 | INTRODUCTION

Cities are an evolving concept, whose complexity results from interdependent facets, such as social, economic, infrastructural, and spatial systems that exist in similar but changing forms over a huge range of scales (Bettencourt, 2013). What are the factors that attract most people and businesses to a city? What are the most important city resources for citizens' perceived well‐being and happiness? To answer these ques- tions, Carvalho, Costa, Marnoto, Sousa, and Vieira (2018) conducted an extensive literature review around the concepts of intelligent city, smart city and happy city, as well as their impact on well‐being, quality of life, and happiness, concepts which are being used interchangeably (Veenhoven, 2012). The concept of hap- piness is central in this debate. Happiness, which is as much influenced by individual factors (e.g., health, wealth, and social relations), as it is by where people live, is a key measure of quality of life. Happiness is a central to understand what makes cities liveable (Cloutier, Larson, & Jambeck, 2014; Goldberg, Leyden, & Scotto, 2012; Potapov, Shafranskaya, & Bozhya‐Volya, 2016). Next to the personal characteristics and the presence of amenities (manmade and natural), citizen's perception of quality of life is highly dependent on the *choices* people can actually make as regards accessibility to services, individual allocation of time, and social interactions (Biagi, Ladu, & Meleddu, 2018, our emphasis). At a different, yet related level, neighborhood characteristics, which have been commonly used as proxies to examine built environments, are believed to constitute an important predictor of subjective measures of well‐being (Mouratidis, 2018).

Despite theoretical tensions between traditional and contemporary views on the livability in cities (cf. Lee & Kim, 2018), and its major determinants, namely economic vitality versus culture and entertainment amenities, what surfaces from the literature is that city quality is a complex, multidimensional, and evolving concept amenable to dispute. However, what is probably less contentious in this debate is that human‐made and natural resources coexist, in different stages, combinations, and con- figurations enabling and constraining the subjective perceived quality of life in cities. Therefore, it is argued that in order to better understand the determinants of city quality, its relevance and its hierarchy for citizens' happiness, an approach is needed that takes into account its multidimensional character. A resource‐based view of city (Carvalho et al., 2018), which targets different yet interrelated cities' sub‐habitats—political, economic, social, natural, artificial, and technological (the PESNAT model, see Table 1), seems to be a suitable candidate for the task. Unsurprisingly, perhaps, these authors did not provide any solid guidance about scales or items in their seminal yet conceptual article.

Based on scholars' consensus about the importance of intangible resources management for the success of organizations, Carvalho et al. (2018) extended the resource‐based view of the firm (Barney, 1991; Wernerfelt, 1984) to the analysis of the cities' environment, seeking for competitive advantages related to the processes of accumulation, management, and distribution of resources within the city. Thus, they defined city quality as "the level of development of the city's habitat that may allow the satisfaction of objective and subjective human needs, individually or in relation to business activities" (Carvalho et al., 2018, p. 276).

These authors have also proposed two hypotheses based on the literature: (a) a decreasing order of impact in the expected level of citizens' happiness: first, social, and natural sub‐habitats; second, economic, and artificial sub‐habitats; and third, political and technological sub‐habitats; and (b) a decreasing order of controversy concerning decision making on these subjects, respectively, political, economic, social, natural, artificial, and technological.

Consequently, to further develop this research stream, this paper poses five research questions:

1. Is it possible to create six constructs and their measurement scales upon the six sub‐habitats?
2. Can these scales reflect the concept of city quality?
3. Can a model that relates city quality with the level of citizens' satisfaction with the city be validated?

TABLE 1 Sub□habitats (Carvalho et al., 2018)

Sub□habitats	Include aspects…
Political	that depend highly on political decisions from the municipality authorities and inhabitants, such as level of participation in decision making, city governance and e□governance, identity, promo- tion, provision of public services, and public support to inhabitants' activities
Economic	for retaining and attracting people and businesses such as dynamics of the local economy, jobs, income, entrepreneurship, innovation, resources, taxes and prices
Social	that were considered to contribute to citizens' happiness, well□being, and life satisfaction such as private support to culture and vulnerable people, entertainment, hospitality, lodging, social cohesion, work–life balance, security, level of discrimination and social participation
Natural	are seen by people as essential to their subjective well□being and happiness such as nature, envi- ronment, landscape, quality of utilities, and existence of ecological policies
Artificial	that are related with physical space, construction and availability of infrastructures like housing, transports, schools, courts of law, hospitals, power plants, water supplies, etc
Technological	that have particular impact in digital and informational societies, differentiating them from traditional analogical cities, and enabling to measure the level of technological development, which has been demonstrated to be fundamental to the well□being of the population. It includes ICT jobs, E□relationships, I□relationships, Internet□of□Things, existence of Wi□Fi spots and fiber– optic networks, and level of use of web□based applications

4. Is the level of citizens' happiness impacted by sub□habitats in this decreasing order of importance: first, social, and natural sub□habitats; second, economic and artificial sub□habitats; and third, politi- cal and technological sub□habitats?
5. Is the level of perceived controversy in decision making by local authorities and/or citizens decreasing in this order: political, economic, social, natural, artificial, and technological?

To answer these questions, we designed and conducted a survey among citizens as described in the next section.

2 | METHODS

Several references were consulted to decide the best way to conduct this exploratory study (e.g., Blunch, 2008; Bollen, 1989; DeVellis, 2012; Diamantopoulos & Siguaw, 2000; Hair, Anderson, Tatham, & Black, 1998; Kaplan, 2000; Kelloway, 1998; Loehlin, 2004; Marôco, 2010; Netemeyer, Bearden, & Sharma, 2003). The research study followed 12 sequential steps: (a) creation of an initial pool of items based on the literature review; (b) analysis of this pool by five field experts that subsequently chose the items they considered to be more adapted to the six constructs; (c) creation of a questionnaire that includes the chosen items and some questions to characterize respondents; (d) pretesting of the questionnaire; (e) creation of the final version of the questionnaire to apply to a sample of citizens; (f) data collection and analysis; (g) analysis of the dimensionality of constructs through an exploratory factor analysis; (h) analysis of the reliability of the scales; (i) analysis of validity of the scales; (j) analysis of common method variance (CMV); (k) analysis of the proposed model; and (l) analysis of the validity of the hypothesis.

2.1 | The questionnaire

The PESNAT model, based on a resource□based view of city quality, considers six sub□habitats or dimensions: political, economic, social, natural, artificial, and technological (Carvalho et al., 2018).

In order to measure these sub‐habitats and define their contents, we relied on models that have been developed around smart city‐related concepts (Table 2).

The analysis of these frameworks enabled us to determine 170 items that could measure the constructs adequately, which are reflective of the latent variables (political, economic, social, natural, artificial, and technological resources), which, in turn, are reflective of the core concept of city quality. In these cases, the most adjusted approach is the use of structural equation modeling (SEM).

Subsequently, five experts assessed the content and face validity of items and their response format and instructions. Its representativeness, specificity, and clarity were evaluated through a scale of three points (1—not adjusted; 2—adjusted in part; and 3—completely adjusted). This analysis led to the choice of 140 items that represented the agreement of the experts. The interjudge reliability index (IRI), based on the Cohen Kappa variation in Perreault and Leigh (1989) was equal to 0.86, which is considered very good (Leiva, Ríos, & Martínez, 2006).

These 140 items were chosen to address the first two research questions concerning the measurement of the six sub‐habitats/dimensions of city quality: 68 in a 5‐point Likert scale (1—totally disagree; 2—disagree; 3—neither agree nor disagree; 4—agree; and 5—totally agree); and 72 in a 5‐point Type‐Likert scale (1—very low; 2—low; 3—medium; 4—high; and 5—very high). These two different scales were needed to answer the questions, based on the specific content of each item.

To answer the third research question, besides the 140 items, we asked the participants: "What is your level of satisfaction with the city chosen for your analysis?" The answer scale was: 1—very unsatisfied; 2—unsatisfied; 3—little satisfied; 4—moderately satisfied; and 5—very satisfied.

To address the fourth and fifth research questions, we presented the definitions of the six sub‐habitats to respondents and asked them to mark a ranking (1–6) in relation to those two questions (order of importance of each sub‐habitat to the level of citizens' happiness, and level of controversy in the decision‐making process for each sub‐habitat).

In the instructions of the questionnaire, we defined the level of controversy for each dimension as the level of difficulty to reach consensus on decisions by local authorities and/or citizens.

The questionnaire was then elaborated containing 140 items; the particular questions regarding the level of citizens' happiness and the degree of controversy in decisions; the place of birth; the city

TABLE 2 Smart city‐related models

Framework	References
Urban audit	http://ec.europa.eu/regional_policy/index.cfm/en/policy/themes/urban-development/audit/
European smart city model	Giffinger et al. (2007)
City's knowledge‐based capital	Schiuma and Lerro (2008)
Quality of life and business environment	Chen and Rosenthal (2008)
Global cities index	http://globalsherpa.org/world-rankings/global-cities-index/
Life‐satisfaction ranking	Oswald and Wu (2010)
Happy city index	http://www.happycity.org.uk/
City's intellectual capital framework	Užienė (2013)
The coverage index	Neirotti, De Marco, Cagliano, Mangano, and Scorrano (2014)
Knowledge city index	López‐Ruiz, Alfaro‐Navarro, and Nevado‐Peña (2014)
Smart city intellectual capital	Dameri and Ricciardi (2015)
Business excellence attraction composite index	Murillo, Romaní, and Suriñach (2015)

where the respondents live, study, work, or invest in, which will be the focus of the survey; how many years has he/she lived, studied, worked or invested in that city; his/her age; his/her gender (male, female, and other); his/her main occupation (business owner, self‐employed, employee, unemployed, student, retired, and other); other occupations besides the main one; main sector of activity (public, private, and social); education (4, 6, and 9 years of basic education, secondary education, and higher education); and level of satisfaction with the selected city for the analysis.

Obviously, the sub‐habitats have many aspects in common, but they intend to represent particular dimensions (types of resources) included in the city quality construct.

The questionnaire was pretested with 45 citizens leading to some changes in the wording of 21 questions. Then, the final version of the questionnaire was made available online, using Google Docs, and was also printed to be handed and filled in manually.

2.2 | The sample

There are many rules of thumb and studies that intend to help determine the best sample size when using SEM (e.g., Bollen, 1989; MacCallum, Widaman, Zhang, & Hong, 1999; Nunnally & Bernstein, 1994; Wolf, Harrington, Clark, & Miller, 2013). We started with a minimum of five observations for each initial variable in the study. So, we had 140 items, which led to a minimum of 700 observations. Our sample has 768 participants, which is also enough for all subsequent analysis with SEM.

The questionnaire was originally written in Portuguese and disseminated through social networks and word‐of‐mouth. Between March and September 2018, a total of 802 answers were received, of which 768 (95.8%) were validated. The answers stemmed from individuals born in 84 different cities, in 15 countries (93% in Portugal and 7% abroad). However, all of them were living in Portugal at the time of the response. The participants were invited to choose a city where they live, study, work, or invest in to serve as the subject for their responses, leading to the selection of 51 cities (45 in Portugal and 6 abroad). They have lived, studied, worked, or invested on an average of 23.14 years (SD = 16.7), and their age was 36.15 years old (SD = 14.48) on average. There were 318 males (41.4%) and 450 females (58.6%). In terms of their main activity, the sample is constituted by 372 employees (48.4%), 68 self‐employed (8.9%), 48 business owners (6.3%), 228 students (29.7%), 32 retired people (4.2%),

14 unemployed (1.8%), and 6 volunteers (0.8%). In terms of education, six respondents (0.8%) have basic education (9 years), 178 (23.2%) have secondary education (12 years), and 584 (76%) have higher education (15 or more years). Thus, we consider this sample sufficiently diverse in its sociodemographic characteristics, allowing for a good exploratory study of sub‐habitats in cities.

2.3 | Statistical analysis

We used the software IBM‐SPSS 23 and AMOS 23 to analyze the data.

To study dimensionality, reliability, and validity we used the classical test theory, which is the most widely accepted framework in social and behavioral sciences (Malhotra, Mukhopadhyay, Liu, & Dash, 2012).

Following Hair et al. (1998) and other previously mentioned authors, an exploratory factor analysis with principal axis factoring with Promax rotation was used to determine the underlying factors in each dimension of city quality. This approach was chosen because all sub‐habitats should be analyzed in relation to their shared variance in order to fulfill the theoretical base of the city quality construct. In the development of the scales, the degree of correlation between the factors is verified, so the oblique methods, like Promax, are recommended. In our case, it was the type of rotation that allowed us to better define the dimensions of each sub‐habitat.

The number of factors was chosen by the Kaiser–Guttman method that suggests the choice of factors with an eigenvalue higher than 1.

To assess factorial analysis, we used the Kaiser–Meyer–Olkin (KMO) statistics and Bartlett's test of sphericity (BTS). In BTS, if the chi‐square statistic is significant, so are the variables suitable for factorial analysis.

To assess multicollinearity, we used the determinant of the correlation matrix, which, if it is higher than 0.00001, shows that there is no excess of multicollinearity.

We have also analyzed the matrix of residuals (differences between the model‐based correlation matrix and the correlation matrix based on actual data), which, if it shows less than 50% of residuals not redundant with absolute values greater than 0.05, demonstrates that the model does fit the data significantly.

Additionally, a minimum value of 0.33 was required in the factor loadings between the items and the factors for this sample size, in order to ensure that the factor loadings have statistical significance ($\alpha = 5\%$) and the minimum test power of 80%.

In the next section, we present the results of the purification of scales using factor, reliability, and validity analysis.

3 | RESULTS

3.1 | Dimensionality and reliability of the constructs

Table 3 shows that all the scales have very good results on assessing the suitability for factorial analysis, as well as good fitness of the model with the data.

Table 4 presents the number of items in each scale after dimensionality and reliability analysis.

The items were removed because they presented similar loadings from different factors or they were not congruent with the content of the extracted factors.

The "political" scale and its factors presented good reliability alphas (>0.7; Nunnally & Bernstein, 1994) for an exploratory study. In the other scales, there were several factors with low reliability (<0.7), which led us to eliminate 17 items among them and to carry out a new factor analysis (Table 5). As a general practice in such cases, we denominated these factors on the basis of their items' contents.

In Appendix 1 (Tables A1–A6), we present the results of the factor analysis for the six scales.

In summary, the scales were purified until a good Cronbach's Alpha was obtained, assuring the reliability of the measures. However, in order to deepen this analysis, we have also calculated composite

TABLE 3 Factor analysis and model assessment

Scale	KMO[a]	BST[b]	Determinant[c]	Residuals[d]
Political	0.894	4,175.372	0.004	21 (23%)
Economic	0.818	2,712.928	0.028	17 (16%)
Social	0.817	3,523.048	0.01	14 (13%)
Natural	0.871	4,700.634	0.002	17 (16%)
Artificial	0.874	7,022,994	0.000096	25 (11%)
Technological	0.862	3,241,397	0.014	3 (4%)

[a]All very good.

[b]$p < 0.001$.

[c]Higher than 0.00001.

[d]Less than 50%.

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TABLE 4 Number of items in the six scales

Scale	No. of items in a 5□point Likert scale			No. of items in a 5□point Type□Likert scale			Total		
	Initial pool	After di- analysis	After analysis	Initial pool	After di- analysis	After analysis	Initial pool	After di- analysis	After analysis
Political	18	14	14	0	0	0	18	14	14
Economic	11	6	5	10	9	5	21	15	10
Social	7	0	0	21	15	11	28	15	11
Natural	9	6	6	12	9	8	21	15	14
Artificial	10	5	4	28	16	13	38	21	17
Technological	0	0	0	14	12	9	14	12	9
Total	55	31	29	85	61	46	140	92	75

TABLE 5 Number of items in the dimensions of the six scales and α□Cronbach

Scale Dimensions	Code	No. items	α	explained	ance explained
Political		*14*	*0.87*	*51.11%*	*43.70%*
City governance	CG	10	0.87		
Digital relationship between Town Hall's and the citizens	DR	4	0.76		
Economic		*10*	*0.83*	*52.03%*	*41.25%*
Resources and innovative climate	RIC	6	0.75		
Jobs and salaries	JS	4	0.76		
Social		*11*	*0.81*	*64.62%*	*52.43%*
Support to people, culture, and work–life balance	SPCWLB	5	0.78		
Openness to the world	OTW	3	0.70		
Security	S	3	0.80		
Natural		*14*	*0.88*	*60.53%*	*50.81%*
Natural conditions	NC	5	0.82		
Quality of the environment	QE	3	0.75		
Green activities	GA	6	0.82		
Artificial		*17*	*0.90*	*65.13%*	*54.96%*
Public space for sports and leisure	PSSL	6	0.89		
Theaters, libraries, museums, and courts of law	TLMCL	4	0.81		
Street conditions	SC	3	0.81		
Accessibility	A	4	0.73		
Technological		*9*	*0.82*	*63.53%*	*53.56%*
Private use of ICT	PRICT	6	0.86		
Public use of ICT	PUICT	3	0.77		
City Quality		*75*	*0.96*	*65.93%*	*56.28%*

reliability and the mean of variance extracted to confirm the reliability of the latent variables (Fornell & Larcker, 1981; Hair et al., 1998), using the results obtained with factorial analysis (Table 6).

The composite reliability should be greater than 0.6 (Bagozzi & Yi, 1988) or, preferably, 0.7 (Hair et al., 1998, p. 612). All values of composite reliability of the six scales are higher than 0.9.

The variance extracted by the latent variable should be higher than 0.5 (Fornell & Larcker, 1981). All values of the mean□variance extracted from the six scales are higher than 0.5.

However, reliability is a necessary but not sufficient condition for validity (Churchill, 1979). So, we present the validity analysis in the next section.

3.2 | Validity analysis

In this section, we present the assessment of construct validity, which includes content, face, convergent, discriminant, and criterion validities. To assess all these validities, we used the mean scores of

TABLE 6 Composite reliability

Scale	Composite reliability	ance extracted
Political	0.943	0.550
Economic	0.905	0.501
Social	0.926	0.543
Natural	0.939	0.537
Artificial	0.967	0.638
Technological	0.942	0.648
City quality	0.990	0.572

the items in each factor that represent each manifest variable of all the scales in the analysis of the structural equations model, as it is normal to do whenever one wants to go from factor analysis to another type of multivariate techniques (Hair et al., 1998, p. 129).

We considered that the items used in the study formed a relatively representative sample of all aspects of city quality, based on a resource□based view. Moreover, the type of questionnaire, including the answers formats, was tested, corrected, and accepted. Thus, we concluded that the questionnaire had adequate content and face validity.

To assess convergent validity, a confirmatory factorial analysis (CFA) provides the size and statistical significance of standardized factor loadings and squared multiple correlations for each measure (Bollen, 1989). Convergent validity is also supported when the mean of the variance extracted for each factor exceeds a threshold of 0.5 (Fornell & Larcker, 1981).

All correlations presented in Table 7 are significant ($p < 0.001$) reinforcing the existence of a second□order latent variable concerning city quality.

Our data suggest that correlations between dimensions and their respective latent variable are greater than 0.633 and higher than the correlations between dimensions and other latent variables, showing, simultaneously, convergent, and discriminant validity of the scales.

We can also show discriminant validity when the average of the mean of the variance extracted is greater than the square of the correlation between the scales (Fornell & Larcker, 1981; Malhotra, 2010). As we can see in Table 8, all the means of the variance extracted are greater than the square of the correlations, showing discriminant validity among the scales.

Nomological validity concerns the reasonability of the correlation among the constructs in a theory. The theoretical and empirical frameworks were established by the seminal work of Carvalho et al. (2018), as well as the specification of the connections between them (Cronbach & Meehl, 1955). So, we analyzed this validity, as well as the criterion validity in the context of the model analysis.

Other aspect that we need to evaluate concerns the analysis of CMV.

3.3 | Common method variance

CMV is the variance that is attributable to the measurement method rather than to the constructs that the measures represent and it is said to introduce a spurious correlation between the variables of interest.

To prevent the CMV effect, the following techniques were used (Podsakoff, MacKenzie, Lee, & Podsakoff, 2003): (a) procedural remedies—psychological and methodological separation of predictor,

TABLE 7 Correlations between the factors

Factors	Political	Economic	Social	Natural	Artificial	Technological
City governance	**0.955**	0.615	0.660	0.612	0.613	0.463
Digital relationship	**0.702**	0.273	0.295	0.304	0.322	0.165
Resources and innovative climate	0.543	**0.924**	0.567	0.413	0.482	0.504
Jobs and salaries	0.479	**0.828**	0.470	0.460	0.453	0.386
Support to people, culture, and work–life balance	0.656	0.567	**0.845**	0.565	0.599	0.434
Openness to the world	0.392	0.435	**0.734**	0.362	0.500	0.456
Security	0.299	0.294	**0.644**	0.398	0.331	0.181
Natural conditions	0.480	0.422	0.535	**0.851**	0.656	0.368
Quality of the environment	0.392	0.315	0.489	**0.711**	0.521	0.357
Green activities	0.554	0.435	0.469	**0.871**	0.606	0.435
Public space for sports and leisure	0.512	0.445	0.550	0.725	**0.866**	0.452
No. of theaters, libraries, museums, and courts of law	0.417	0.331	0.486	0.362	**0.703**	0.443
Street conditions	0.450	0.382	0.494	0.595	**0.697**	0.349
Accessibility	0.437	0.454	0.462	0.486	**0.744**	0.455
Private use of ICT	0.297	0.409	0.381	0.378	0.392	**0.883**
Public use of ICT	0.421	0.435	0.432	0.394	0.554	**0.712**

The bold values in this table show that the correspondent dimensions in each factor present the higher correlations.

TABLE 8 Mean of the variance extracted and squared multiple correlations

Comparison between scales	MVE	R^2
Political versus economic	0.526	0.341
Political versus social	0.547	0.394
Political versus natural	0.554	0.350
Political versus artificial	0.594	0.359
Political versus technological	0.599	0.181
Economic versus social	0.522	0.355
Economic versus natural	0.530	0.238
Economic versus artificial	0.570	0.283
Economic versus technological	0.575	0.265
Social versus natural	0.551	0.362
Social versus artificial	0.591	0.429
Social versus technological	0.596	0.243
Natural versus artificial	0.598	0.537
Natural versus technological	0.603	0.224
Artificial versus technological	0.643	0.315

and criterion variables and improvement of scale items; and (b) statistical remedies—Harman's single factor test and Marker variable technique.

We used different types of scales for the predictor and criterion variables. The scales to evaluate each sub‐habitat include multiple‐choice questions. The level of participants' satisfaction with the city was evaluated with a 5‐point single question.

We reduced the evaluation apprehension and the social desirability effects by stating in the questionnaire that there were no right or wrong answers and that respondents should answer questions as honestly as possible, because the objective was measuring their perceptions about city resources. The items of the scales were reviewed by experts and pretested in a small sample assuring content validity.

We used Harman's single factor test and Marker variable techniques to show that CMV did not have a great impact on the correlation between sub‐habitats' measures and the level of satisfaction with the city.

The Harman's single factor test includes performing an exploratory factor analysis of all the variables in the study and to determine the number of factors that are necessary to account for the variance in the variables. This technique assumes that if a substantial amount of CMV is present, then either a single factor will emerge from the unrotated factor solutions, or one general factor will account for the majority of the covariance among the variables (Podsakoff & Organ, 1986, p. 536). However, this technique, like the others, has limitations, namely its well‐known insufficient sensitivity to detect moderate or small levels of CMV effects (Kemery & Dunlap, 1986; Podsakoff et al., 2003).

The factor analysis revealed the presence of 41 distinct factors with eigenvalues greater than 1.0, rather than a single factor. The 41 factors accounted for 71.22% of the total variance, and the largest factor was found to account for only 17.58% of the total variance. Thus, no general factor is apparent. This technique diagnoses the presence of CMV but does not statistically control it. The partial correlation procedure is one technique, which can be used to control the effect of CMV. The marker variable technique is an easy to use and robust partial correlation technique (Lindell & Whitney, 2001) and hence the authors used it to control CMV. It is possible to estimate the effect of CMV in a post hoc fashion without the marker variable identified a priori (Lindell & Brandt, 2000). However, the post hoc approach has the potential to capitalize on chance factors. Thus, according to Lindell and Whitney (2001), researchers can use the second smallest positive correlation among the manifest variables, as a more conservative estimate of the correlation effect caused by the CMV. Thus, we have calculated the CMV‐adjusted correlation between the variables ($r = 0.386$; $p < 0.001$), concluding that the spurious correlation caused by the CMV amounts just to 0.058. Thus, the emergence of more than one factor and the marker variable technique have shown that city quality has a relation with the level of inhabi- tants' satisfaction with the city, over and above the effect of CMV.

After the validation of the six scales, we analyzed the proposed model in the next section.

3.4 | Analysis of the model

In Figure 1, we present the model in evaluation.

First, the distribution of the variables was analyzed. When the estimation methods are maximum likelihood (ML) or generalized least squares (GLS), it is necessary that the manifest variables have a multivariate normal distribution. With large samples, as is the case, the adjustment tests (e.g., Kolmogorov–Smirnov and Shapiro–Wilk) are extremely sensitive to small deviation from normality, having a very high probability of error type I (rejection of normality when in fact the distribution is normal) (Marôco, 2010). So, it is better to evaluate the distribution graphically, as well as by looking at the critical ratios (ratio between skewness and kurtosis statistics, and their respective standard

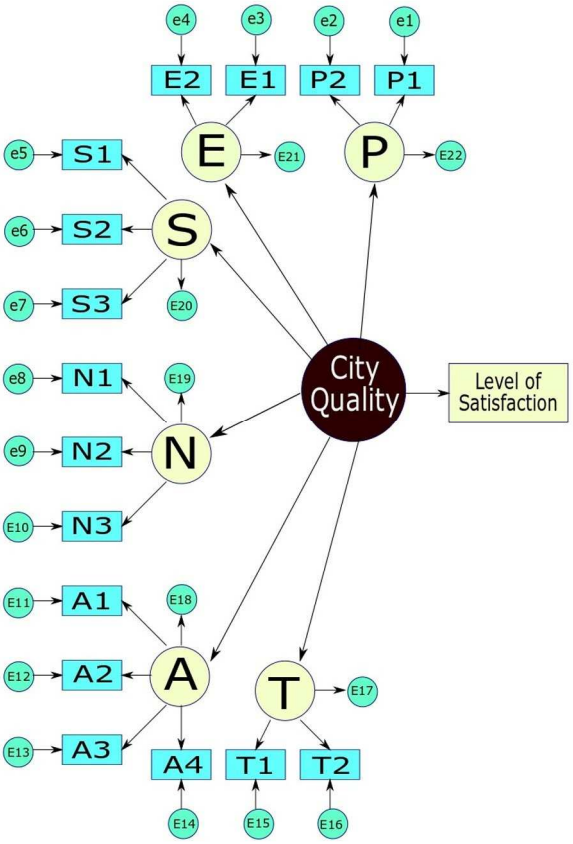

FIGURE 1 The PESNAT model

errors). There are simulation studies that stated that ML and GLS estimators produce biased results for values of variables' skewness and kurtosis higher than 2 and 7, respectively, and values higher than 3 in multivariate kurtosis (Finney & DiStefano, 2006).

One must also be aware of another problem in working with large samples. The χ^2 test, that is used to assess the adjustment of the model, always rejects the null hypothesis (H_0) and states that the proposed model is well adjusted to the data (Blunch, 2008).

However, it is possible to use AMOS for other estimation methods that do not require data multivariate normality, such as unweighted least squares (ULS), scale□free least squares (SLS) or asymptotically distribution□free (ADL).

Although the variable normality tests show that they are not normal, the analysis of the individual histograms shows that they are not far from a normal distribution except for the variable "level of satisfaction." Attempts to correct it proved insufficient to achieve a good adjustment. The use of modification indices, in the part concerning what could be theoretically acceptable, was also insufficient to improve the fitness of the model with multivariate normality as an assumption. Thus, we decided to present the results and comparable fit indices of all five estimation methods (Tables 9 and 10). With ML, GLS, and ADF it is possible to calculate χ^2 tests that show that all estimates have statistical significance ($p < 0.001$).

The available fit indices that are comparable are the minimum value of chi□square (CMIN), root mean square residual (RMR), goodness of fit index (GFI), adjusted goodness of fit index (AGFI),

TABLE 9 Fit indices

	Estimation methods				
Fit indices	**ML**	**GLS**	**ULS**	**SLS**	**ADF**
CMIN	1,063.613	739.971	109.577	435.824	1,123.776
RMR	0.031	0.043	0.031	0.031	0.089
GFI	0.856	0.886	0.978	0.979	0.826
AGFI	0.805	0.846	0.970	0.972	0.767
PGFI	0.632	0.655	0.722	0.723	0.616
NFI	0.810	0.380	0.966	0.970	0.449
RFI	0.771	0.254	0.959	0.963	0.342
PRATIO	0.831	0.831	0.831	0.831	0.831
PNFI	0.673	0.316	0.803	0.806	0.376

parsimonious goodness of fit index (PGFI), normed fit index (NFI), relative fit index (RFI), parsimony ratio (PRATIO), and parsimony normed fit index (PNFI).

Analyzing all fit indices, we choose ULS because it does not make any distributional assumptions and it was the estimation method that presented the best fit to the data. We have several variables that do not have a normal distribution. However, it is not possible to ensure that $C = (n–1) F_{ULS}$ is asymptotically distributed as χ^2, where the fit function, F, is based on the difference between the empirical covariance matrix and the covariance matrix implied by the model and n is the sample size. Thus, AMOS does not compute χ^2 test and other measures of fit based on such statistics. Nevertheless, AMOS gives us the minimum value of CMIN = 109.577 that can be divided by the 113 degrees of freedom in the model, which equals 0.97, assuming a possible χ^2 distribution. Since this figure is less than two, we can suggest that the adjustment of the model is good (Marôco, 2010).

The coefficient of determination in structural equations measures the proportion of the total variability of each endogenous latent variable, which is explained by the independent latent variables. Thus, there is a weak, but significant, explanatory power ($R^2 = 0.112$) for the level of satisfaction with the city. Obviously, there will be other factors explaining the variance in the level of satisfaction which are not considered in this model. It is natural to have lower R^2 values when they are based only on an explanatory variable, as is the case (Hair et al., 1998, p. 637).

Nomological validity is generally indicated by a moderate level of correlation between predictor scores and criteria scores, and the established theoretical relationships should be empirically tested using SEM, as we have done. Thus, we can conclude that nomological and criterion validities exist for the scales.

This final conceptual model presents 113 degrees of freedom and a sample of 768 participants imply close to 100% of test power for the estimates in a structural model of covariance (MacCallum, Browne, & Sugawara, 1996).

Hence, we can conclude that the proposed model is adjusted to the data. Furthermore, the results show that the first three research questions have a positive answer: (a) it was possible to create the six constructs and their measurement scales upon the six sub habitats; (b) these scales actually measure the impact of the concept of city quality; and (c) the proposed model that relates city quality with the level of citizens' satisfaction with the city is valid.

The next section deals with the answer to the fourth and fifth research questions.

TABLE 10 Standardized regression weights

	Estimation methods				
weights	**ML**	**GLS**	**ULS**	**SLS**	**ADF**
Political → P1	0.984	0.975	0.980	0.905	0.999
Political → P2	0.467	0.471	0.469	0.466	0.427
Economic → E1	0.764	0.802	0.781	0.772	0.985
Economic → E2	0.720	0.726	0.705	0.712	0.559
Social → S1	0.774	0.850	0.744	0.756	0.787
Social → S2	0.558	0.667	0.567	0.565	0.878
Social → S3	0.430	0.503	0.430	0.435	0.379
Natural → N1	0.731	0.803	0.750	0.742	0.696
Natural → N2	0.638	0.697	0.637	0.639	0.489
Natural → N3	0.766	0.796	0.738	0.755	0.704
Artificial → A1	0.767	0.854	0.754	0.764	0.810
Artificial → A2	0.575	0.674	0.591	0.569	0.745
Artificial → A3	0.656	0.708	0.654	0.662	0.463
Artificial → A4	0.641	0.656	0.644	0.646	0.687
Technological → T1	0.493	0.530	0.491	0.496	0.679
Technological → T2	0.605	0.659	0.607	0.602	0.709
City quality → Political	0.806	0.843	0.777	0.792	0.788
City quality → Economic	0.832	0.855	0.803	0.814	0.880
City quality → Social	0.989	0.933	0.992	0.992	0.914
City quality → Natural	0.899	0.967	0.903	0.897	0.915
City quality → Artificial	0.952	0.963	0.998	0.975	0.941
City quality → Technological	0.948	0.961	0.947	0.954	0.881
City quality → Level of satisfaction	0.329	0.334	0.334	0.335	0.200

Notes: P1—city governance; P2—digital relationship; E1—resources and innovative climate; E2—jobs and salaries; S1—support to people, culture, and work–life balance; S2—openness to the world; S3—security; N1—natural conditions; N2—quality of the environment; N3—green activities; A1—public space for sports and leisure; A2—number of theaters, libraries, museums, and courts of law; A3—street conditions; A4—accessibility; T1—private use of ICT; and T2—public use of ICT.

3.5 | Citizens' well□being and level of controversy in decision making

In these two questions (level of contribution to well□being and level of controversy in decisions), we counted the frequency of each position (1, 2, 3, 4, 5, and 6) attributed by the respondents to the six dimensions. Then, we multiplied these frequencies, respectively, by 6, 5, 4, 3, 2, and 1, and summed them. We obtained the contribution of each sub□habitat in relation to those questions (Table 11).

The differences between all contributions have statistical significance ($p < 0.001$) with the exception of the difference (T□1902 and N□1876; $t = 1.0004$; $p = 0.16$) between the sum of the degree of controversy of the technological and natural sub□habitats.

Consequently, we validated the hypothesis implicit in the fourth research question regarding the level of contribution of each sub□habitat to the inhabitants' well□being and quality of life, concluding

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TABLE 11 Rankings of sub□habitats

Sub□habitats	well□being and quality of life	Confidence interval 95% L_i	Confidence interval 95% L_s	Degree of controversy that you thought to this context	Confidence interval 95% L_i	Confidence interval 95% L_s
Political	1888	1844.55	1931.45	3,886	3,835.061	3,936.939
Economic	2,988	2,944.55	3,031.45	3,286	3,235.061	3,336.939
Social	3,622	3,578.55	3,665.45	2,696	2,645.061	2,746.939
Natural	3,066	3,022.55	3,109.45	1876	1825.061	1926.939
Artificial	2,578	2,534.55	2,621.45	2,482	2,431.061	2,532.939
Technological	1976	1932.55	2019.45	1902	1851.061	1952.939

that the ranking shows that the social and the natural sub‐habitats are the most important, followed by the economic and the artificial ones, and ultimately by the technological and the political dimensions. We partially validated the hypothesis implicit in the fifth research question about the degree of controversy that citizens perceive to exist in society when decisions are made in this context, stating a ranking that has given the name to this framework: PESNAT. The ranking resulting from the data is: PESATN. The participants in this study considered that the natural sub‐habitat is the less controversial subject, rather than the fourth most controversial as we had hypothesized.

4 | CONCLUSION

Urban ecosystems are increasingly attracting the interest of decision makers and scholars from a wide range of scientific fields, triggering the production of multidisciplinary research aimed at studying the governance, competitiveness, quality of life, and sustainability of the cities of today and those of the future. The emerging concepts of intelligent cities, smart cities or happy cities are just some examples of the different paths ensuing from this trend, which ultimately tries to address the challenges and opportunities posed by a dramatic increase in the urban population worldwide.

Inspired by these emerging trends and building on a resource‐based view of city quality, this paper proposes and validates scales for a framework that comprises six city sub‐habitats: political, eco- nomic, social, natural, artificial, and technological.

We started by determining the dimensions of each scale: (a) Political, with two dimensions: City governance and digital relationship; (b) Economic, with two dimensions: Resources and innovative climate; and jobs and salaries; (c) Social, with three dimensions: Support to people, culture, and work–life balance; openness to the world; and security; (d) Natural, with three dimensions: Natural conditions; quality of the environment; and green activities; (e) Artificial, with four dimensions: Public space for sports and leisure; number of theaters, libraries, museums, and courts of law; street conditions; and accessibility; and (f) Technological, with two dimensions: Private use of ICT; and public use of ICT. These dimensions can be considered, in this context, as the manifest variables that enable the assessment of the first‐order latent variables—the sub‐habitats—and the second‐order la- tent variable—city quality. These conclusions establish the answers to the first two research questions. We then tested and analyzed the proposed PESNAT model, which presented good fitness to data, showing that it can be used to assess city quality and to predict citizens' satisfaction with the city. This conclusion is the answer to the third research question.

Finally, we validated the first hypothesis that was put forth on this study (fourth research question). The social and the natural sub‐habitats are the most important to the inhabitants' well‐being and qual- ity of life, followed by the economic and the artificial sub‐habitats and, finally, by the technological and the political sub‐habitats. We also partially validated the second hypothesis (fifth research ques- tion), showing that the ranking of the sub‐habitats based on the degree of controversy that citizens perceive to exist in society when decisions are made in their context, is as follows: political, economic, social, artificial, technological, and natural.

We strongly believe that in order to better inform regional policy makers' thinking about how best to attract people and firms into a city, as part of a wider strategy to increase and promote the quality of citizens life, it is critical to foster more nuanced understanding of the determinants to such quality, as perceived by the people that live and work in cities. We hope that this paper, by proposing a set of resource‐based variables and analytical tools regarding those features, can contribute to attain that goal, ultimately allowing both policy makers and economic development practitioners to make better and wiser use of taxpayer money. Considering our findings, those decision makers should be aware that

their policies have more impact on citizens following the alignment suggested by the firsthypothesis, according to which, the social and natural sub□habitats are perceived as the most critical to the inhabi- tants' well□being and quality of life. This includes, on the one hand, the support to people, culture, and work–life balance, the openness to the world, and security; and, on the other hand, natural conditions, quality of the environment, and green activities. Also, citizens expect issues concerning the natural, the technological or the artificial environment to be less controversial, making it difficult for them to understand why decision making to benefit them is not swifter when it comes to these particular mat- ters. In summary, the results concerning the importance of the sub□habitats in the management of the city, given their attractiveness, show in this context that: (a) Social and natural conditions management are perceived as the main determinants of well□being and quality of life and (b) Natural conditions are very important to city's attractiveness and recognized by the inhabitants as the least controversial factor of city's management. These results are enlightening indications on how, in this context, the inhabitants evaluate and decide on the attractiveness of their city.

There are some limitations in this study, related to the fact that we have used a convenience sample of people who were willing to respond to our survey, but that has as much dispersion as possible in their sociodemographic characteristics. Obviously, there can exist variations in this analysis due to cultural differences among the world population and to diverse levels of economic development, which probably can lead to different results. Thus, it would be important to replicate this study in other countries, validating the proposed scales and testing the hypothesis presented, in order to help decision makers in a more adjusted way.

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APPENDIX 1

Factor analysis

TABLE A1 Factorial analysis of political sub‐habitat scale

Items	Factor 1 City governance	Factor 2 Digital relationship
The advantages of the city are well promoted by the city hall	0.573	
The identity of the city is very strong	0.570	
The participation of city dwellers in public life is high	0.521	
The governance of the city is transparent	0.643	
I know well the city website		0.590
I am satisfied with the information found on the city's website		0.695
The city council makes available on its website the necessary forms to relate to the inhabitants and businesses		0.827
The city council allows the electronic submission of these forms		0.652
Leadership in the city is strong in the defense of citizens	0.792	
The city council works with communities to solve problems	0.820	
There are partnerships between the public sector, the private sector, the social sector, universities, and civil society to solve city problems	0.633	
There is a strategic development plan for the city	0.707	
There are enough quality public services	0.503	
The support from the town hall for social and cultural groups is high	0.542	

Note: All items: 1—totally disagree; 2—disagree; 3—neither agree nor disagree; 4—agree; and 5—totally agree.

TABLE A2 Factorial analysis of economic sub‐habitat scale

Items	Factor 1 Resources and innovative climate	Factor 2 Jobs and salaries
In the city it's easy to find a job"		0.542
In the city it's easy to find skilled workers[a]	0.391	
In the city the number of new companies is increasing[a]	0.544	
In the city there is physical space to install new economic activities[a]	0.595	
In the city there is a favorable climate of innovation[a]	0.786	
What is the average income level of the population?[b]		0.605
What is the level of available employment?[b]		0.897
What is the level of quality of employment?[b]		0.644
What is the level of satisfaction with existing trade?[b]	0.469	
What is the level of attractiveness of the city to	0.628	

[a]1—totally disagree; 2—disagree; 3—neither agree nor disagree; 4—agree; and 5—totally agree.
[b]1—very low; 2—low; 3—medium; 4—high; and 5—very high.

TABLE A3 Factorial analysis of social sub□habitat scale

Items	Factor 1 Support to people, culture, and work–life balance	Factor 2 Openness to the world	Factor 3 Security
What is the level of investment in cultural activities?	0.751		
What is the level of investment in social support for disadvantaged people (disabled people, the elderly, children...)?	0.824		
What is the level of investment in citizens' security?	0.665		
What is the level of balance between personal and professional life?	0.486		
What is the level of violent crime?[a]			0.826
What level of crime in general?[a]			0.861
What is the level of cultural events with national or international impact?	0.408		
What is the level of demand of the city by tourists?		0.643	
What is the level of security of people and goods?			0.538
What is the level of integration of foreigners?		0.705	
What is the level of tolerance and openness to the outside world?		0.794	

Note: All items: 1—very low; 2—low; 3—medium; 4—high; and 5—very high.
[a]Inverted punctuation.

TABLE A4 Factorial analysis of natural sub‐habitat scale

Items	Factor 1 Natural conditions	Factor 2 Quality of the environment	Factor 3 Green activities
There are enough natural parks[a]	0.820		
The climate is mild and comfortable[a]	0.397		
There are good areas of green spaces[a]	0.915		
There are green spaces in less than 15 min on foot[a]	0.664		
There are environmental improvement programs[a]			0.596
Innovations have been implemented that promote circular economy			0.802
What is the level of air quality?[b]		0.651	
What is the level of water quality?[b]		0.712	
What is the level of quality of sanitation and waste collection services?[b]		0.831	
What is the level of quality of recycling services?[b]			0.541
What is the level of power saving?[b]			0.581
What is the level of attractiveness of natural conditions?[b]	0.360		
What is the level of efforts to protect the environment?[b]			0.730
What is the level of construction of self‐sustaining buildings?[b]			0.489

[a]1—totally disagree; 2—disagree; 3—neither agree nor disagree; 4—agree; and 5—totally agree.
[b]

TABLE A5 Factorial analysis of artificial sub□habitat scale

Items	Factor 1 Public space for sports and leisure	Factor 2 No. of theaters, libraries, museums, and courts of law	Factor 3 Street conditions	Factor 4 Accessibility
There are good rail links to the city[a]				0.687
There are good road accesses to the city[a]				0.385
There is a sufficient proportion for pedestrian areas[a]	0.672			
There is a sufficient proportion of areas for recreational and leisure sports[a]	0.947			
What is the level of availability of public spaces for leisure and socializing?[b]	0.624			
What is the level of seats in theaters and cinemas?[b]		0.643		
What is the level of the number of museums?[b]		0.885		
What is the level of the number of public libraries?[b]		0.694		
What is the level of the number of paths for physical maintenance activities?	0.805			
What is the level of the number of tracks for cyclists?[b]	0.704			
What is the level of the number of courts of law?[b]		0.578		
What is the level of quality of public transport systems?[b]				0.511
What is the level of multimodal accessibility (interconnection of sport?[b]				0.773
What is the level of satisfaction with the streets?[b]			0.816	
What is the level of satisfaction with the cleanliness of the city?[b]			0.882	
What is the level of satisfaction with public lighting?[b]			0.629	

[a]1—totally disagree; 2—disagree; 3—neither agree nor disagree; 4—agree; and 5—totally agree.

[b]1—very low; 2—low; 3—medium; 4—high; and 5—very high.

TABLE A6 Factorial analysis of technological sub‐habitat scale

Items	Factor 1 Private use of ICT	Factor 2 Public use of ICT
What is the level of broadband internet access?	0.651	
What is the level of mobile phone usage?	0.735	
What is the level of web application usage?	0.758	
What is the level of investment in information and communication technologies?	0.521	
What is the level of the percentage of dwellings with personal computer?	0.700	
What is the level of regular use of the internet?	0.881	
What is the level of existence of public places with possibility of digital interaction (museums, services, transport...)?		0.649
What is the level of existence of video surveillance equipment in public places?		0.816
What is the level of existence of hot‐spots (free internet access points)?		0.753

Note: All items: 1—very low; 2—low; 3—medium; 4—high; and 5—very high.