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URBAN QUALITY OF LIFE IN ISTANBUL : PRIORITIES AND SEGMENTATION

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ABSTRACT

The purpose of this paper is to model the desires, expectations and priorities of the inhabitants of Istanbul, a city with a population of about 15 million, from a **multidimensional** perspective. In this way, effective allocation of the city's resources can be achieved to improve the quality of life for such a large number of people, which is the primary concern of the local authorities as well as the urban planners. A survey is conducted in Istanbul so that the priorities of the inhabitants are revealed and the city where they would like to live is portrayed. The data obtained are used as input for **hierarchical conjoint analysis**, a **decompositional** multivariate data analysis technique frequently used in marketing. The survey is primarily based on the evaluation of hypothetical, orthogonally-designed city profiles for four different constructs and a bridging construct on a 0-10 rating scale. The relative importances of the constucts and their attributes are estimated at both the individual and the aggregate level. A segmentation is made based on the demographic and social characteristics of the respondents to reflect different classes. The research is an interdisciplinary group work acting as a bridge between urban planning and multiattribute decision making, thus judgments of experts from different disciplines are used in every stage of the study.

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1. INTRODUCTION

Researchers from a variety of disciplines have studied Quality of Life (QOL) since the 1930s (Wish, 1986). They tried to identify the components of QOL and compared various geographical areas such as cities, states and nations by means of QOL indices that they developed (Liu, 1976; Boyer and Savageau, 1981; Blomquist et al., 1988; Stover and Leven, 1992; Sufian, 1993). In addition to the researchers, international organisations such as UNDP (Human Development Report, 1994), UN and Overseas Development Council developed their own measures for QOL (ICPQL, 1996).

An important reason for such an interest in QOL lies in the question of effective allocation of scarce resources (Megone, 1990). Given the limited resources, policymakers need to find the most efficient way of distributing them in line with the needs and the priorities of people. This can be achieved by using the results of the related research as input in the decision making processes. In other words, such studies are the means of producing appropriate policy recommendations for authorities.

These recommendations are of crucial importance to policymakers. As integration (globalisation and regionalization) removes the physical and economic barriers between nations, multinational companies become the actors of the global economic system, and cities, instead of countries, constitute the building blocks of this system, leading to a global hierarchy of cities. Thus, cities need to fulfill a number of conditions in order to attract investments from multinational companies. They will have to offer high-quality infrastructure, communications, transportation, legal systems, safety, well-trained personnel and a technological basis to provide the necessary medium for economic growth. This, in turn, will lead to a significant increase in the residents' standard of living. The cities in the coastal region of China constitute a noteworthy example since they experienced an economic boom due to their integration in the global and regional economic system (Kennedy, 1993).

The urban QOL concept gains more importance when it is considered that the world population is expected to reach somewhere between 7.6-9.4 billion (Kennedy, 1993), and the urban population is expected to reach 50% (Sufian, 1993) in the beginning of the next century.

In this study, the priorities and the expectations of the inhabitants of Istanbul, a city with a population of approximately 10 million, are investigated from a multidimensional perspective. These priorities and expectations are modelled by using Hierarchical Information Integration (HII) and conjoint analysis (CA) (a decompositional multivariate data analysis technique frequently used in marketing) in conjunction with pairwise comparisons, which constitute the basis of AHP. Data gathered through a survey conducted in Istanbul are used as input to obtain the weights attached to QOL factors by individuals. In this way, the ideal city in the minds of the inhabitants of Istanbul is portrayed.

2. STATE OF THE ART

Different results were obtained from studies on QOL due to the differences in the chosen sets of variables, the weighting scheme of the variables, the approaches adopted, the methodologies used, the people that the data were gathered from, and the homogeneity of the geographical analysis units that the research is based on. These points are discussed below. QOL is a multidisciplinary, hence a multidimensional concept (Baldwin et al., 1994). This is clearly seen in the studies summarised in Table 1, where QOL is admitted to have multiple components (Liu, 1976; Boyer and Savageau, 1981; Blomquist et al., 1988; Stover and Leven, 1992; Burnell and Galster, 1992; Sufian, 1993; UNDP, 1994; ICPQL, 1996; Protassenko, 1997).

Table 1. QOL Components In Literature

Resource	**QOL Components Employed**
Liu (1976)	(1) economic, (2) political, (3) environmental, (4) social, (5) health and educational
Boyer and Savageau (1981)	(1) climate, (2) housing, (3) health care and environment, (4) crime, (5) transportation, (6) education, (7) arts, (8) recreation, (9) economics.
Blomquist et al. (1988) Stover and Leven (1992)	(1) precipitation, (2) humidity, (3) heating degree days, (4) cooling degree days, (5) wind speed, (6) sunshine, (7) coast, (8) violent crime, (9) teacher-pupil ratio, (10) visibility, (11) total suspended particulates, (12) NPDES effluent discharges, (13) landfill waste, (14) superfund sites, (15) treatment, storage and disposal sites, (16) central city.
Sufian (1993)	(1) public safety, (2) food cost, (3) living space, (4) housing standard, (5) communication, (6) education, (7) public health, (8) peace and quiet, (9) traffic flow, (10) clean air.
Human Dev. Index (UNDP, 1994)	(1) expected life, (2) adult illiteracy rate, (3) average purchasing power.
Physical QOL Index (ICPQL, 1996)	(1) infant mortality, (2) expected life, (3) adult illiteracy rate
Protassenko (1997)	(1) monthly income per person, (2) distribution of income, (3) monthly food expenditures.

As seen in Table 1, it is almost impossible to find the same component set in the literature. Though they have common components, they are rarely measured by the same units. What is more, the names of the components can be misleading in many cases. For example, as Wish (1986) criticizes, Liu (1976) measures his social component by 54 indicators most of which are irrelevant. In addition, political and economic components have indicators in common with the social component, which leads to double counting, and to bias.

Another point most studies suffer from is the ad hoc weighting schemes of the components and/or variables. In most studies, the weighting process (either equal weights or not) is based on the researchers' judgment (see, for example, Liu,1976; Boyer and Savageau, 1981). Wish (1986) compares the two studies by Liu (1976) and Boyer and Savageau (1981), both of which compare SMSAs (Standard Metropolitan Statistical Area) in the USA, and calculates the Spearman's rank correlation as 0.08.

3. WHY CONJOINT ANALYSIS ?

The concept of weight is defined with regard to a specific theory of preference. Many different theories have been proposed for this purpose such as the Analytical Hierarchy Process (AHP) (Saaty, 1990), Electre-type methods (Roy, 1990), Multiattribute Value Theory (MAVT) for decision under certainty (Dyer and Sarin, 1979) and Multiattribute Utility Theory (MAUT) for decision under risk (Keeney and Raiffa, 1976). MAVT is concerned with the aggregation of the attributes. The simplest aggregation is the additive model. MAVT has an axiomatic basis, which is especially important in dealing with the measurement of weights. Its axiomatically founded theory allows the user to carefully investigate the behavioural influences on weight judgments. Electre-type methods as well as AHP so far do not offer a convincing foundation for the meaning of weights, but the rankings generated by them may still be useful in some contexts, especially when applied under the guidance of a skilled facilitator. In other words, they need to be used with considerable caution.

On the other hand, the basic reason for using the logic of AHP not for the whole hierarchy but only for obtaining the relative priorities of the higher order constructs in achieving the goal, is that the analysis is conducted with different inhabitants from different socioeconomic classes and not with experts. It is therefore impossible to get an excessive number of pairwise comparison matrices from 200 respondents. In fact, the inhabitants did not feel comfortable in filling even one pairwise comparison matrix.

In this study, it is thought that it will be more appropriate to evaluate the problem through a CA, which is a decompositional method based on MAVT. The OR/MS approaches such as Keeney's MAUT and Saaty's AHP assume that the total value or utility of an alternative is found by combining the separate amounts of utility provided by each attribute. They typically focus on small numbers of decisionmakers faced with high-level decisions. However, CA usually deals with hundreds or thousands of respondents faced with day-to-day decisions, such as what brand of soap or automobile to buy (Green and Krieger,1996), which makes it suitable for our particular purposes.

4. METHODOLOGY OF CONJOINT ANALYSIS

CA is a multivariate data analysis technique used to model the individuals' preferences as trade-offs among multiattribute alternatives (Hair et al.,1995; Green and Srinivasan, 1978; McDaniel and Gates, 1993). Each alternative is considered as a bundle of attributes and described in terms of its level on the set of attributes characterizing it. Thus, the respondents evaluate the value or utility of an alternative by combining the separate amounts of utility provided by each attribute. CA is designed to measure the relative importance that the individuals attach to each salient attribute (factor) and their degree of preference for each level of each attribute, which are expressed in terms of utilities called part-worths (Malhotra, 1993; Tull and Hawkins, 1993).

The conjoint methodology is based on a decompositional approach, since the respondents provide only their overall preferences and "it is the job of the analyst to find a set of part-worths for the individual attributes that, given some type of composition rule (e.g. an additive one), are most consistent with the respondent's overall preferences" (Green and Srinivasan, 1978). This is decomposing the preferences to determine the value of each attribute (Hair et al.,1995). The decompositional nature (stated preference) of CA makes it more realistic than compositional techniques (revealed preference) such as simple rank orderings of attributes, various versions of the paired-comparison technique and constant-sum scales, since the self-explicated methods suffer from normative responses instead of eliciting the actual ones.

The main advantages of stated preference studies based on experimental design methods in comparison to revealed preference methods are as follows (Louviere and Timmermans, 1990): i) Decision making is studied under controlled conditions, ii) Choice alternatives outside the domain of experience can be created, and iii) Interattribute correlations are minimised. What is more, the cited research states that the predictive ability of these methods may be better than that of models estimated according to the revealed behaviour data. The temporal stability of the preference functions was shown to be satisfactory.

CA can be carried out at either the individual (disaggregate) level or the aggregate level, a feature of the technique that almost all other multivariate techniques lack. Because of the substantial amount of among-person variation in preference structures, CA is usually carried out at the individual level.

However, the composition rule is assumed to be the same across individuals (Green and Srinivasan, 1978). Compared to the disaggregate-level analysis, the aggregate-level CA not only provides a greater statistical efficiency by using more observations in the estimation but also reduces the data collection task through more complex experimental designs.

5. HIERARCHICAL INFORMATION INTEGRATION

The basic problem faced during the application of CA is the excessive number of cards that have to be evaluated by the respondents. This is due to the number of attributes and attribute levels. One possible way of reducing the number of cards is using an orthogonal design instead of the full factorial design. This enables the estimation of only the main effects but not the interactions. However, even in this case, the number of cards to be evaluated in a real case study may be beyond the reasonable limit. For example, if the full design were adopted in our study, it would have been necessary to generate 196608 (2^{16}*3) cards to be evaluated. This number could only be reduced to 856 through orthogonal design. In such a situation, the Adaptive Conjoint, the Hybrid Conjoint or the HII technique is adapted as a new approach that reduces the number of cards to be evaluated to a manageable size thereby increasing the practicality of CA.

In this study, the HII approach is used. The details about this approach can be found in Louviere (1984), Louviere and Gaeth (1987), Louviere and Timmermans (1990), Timmermans et al. (1992). This approach assumes that the preference formation process of individuals can be described in a hierarchical structure. The first stage is the decomposition of the decision variables into independent clusters, each of which is referred to as a higher construct. The decomposition has to be based on expert judgment, empirical findings, theory and design. The second stage is concerned with the construction of an experimental design for each higher construct. According to the number of the attributes and their levels, those designs may be either full factorial designs or orthogonal designs.

At the third stage, the data collected by using designed experiments based on the second stage are analysed and the utility of each attribute is estimated based on the developed statistical models. The main-effects-only model is the only way to model preferences when the orthogonal design is used. However, when the full or fractional factorial design is applied, it may be possible to model the interaction terms in addition to the main effects. The last stage is the “bridging stage”, where the designs constructed at the second stage are integrated. For this purpose, each higher construct is treated as an attribute. Its utility and relative importance are calculated. This stage is traditionally an experimental design which is treated with CA as in the previous stages. In this study, a different approach based on pairwise comparisons and eigenvector calculation is proposed for the bridging stage in order to further reduce the number of cards to be evaluated by the respondents. Finally, the information gathered in the third and fourth stages are integrated by a linear additive model with the assumption of mutual utility independence.

6. RESEARCH DESIGN

Based on the in-depth interviews with the experts, a pilot survey of the inhabitants of Istanbul, and a literature survey, four higher constructs are accepted to describe the QOL in a city. Those are physical environment (PE), social environment (SE), economic environment (EE) and transportation-communication facilities (TC). The numbers of attributes corresponding to each higher construct are, 5, 6, 3 and 3 respectively. Each of the attributes has two levels except one attribute with 3 levels in PE. This situation prevents giving higher priority to those attributes with relatively more levels.

In this study, PE has 5 attributes, 4 with 2 levels and 1 with 3 levels. The attributes are building arrangement, house type, green areas, recreational areas, infrastructure and municipal services. Since 48 ($2^4 * 3$) cards are generated in the full factorial design, the orthogonal design is used, reducing the number of cards to be evaluated to 8.

SE consists of 6 attributes, each with 2 levels. The attributes are the extent of educational services, price of educational services, the extent of health services, price of health services, cultural activities and entertainment, and safety. The full factorial design generates 64 cards, which are reduced to 8 through orthogonal design.

EE and TC have 3 attributes each. The attributes corresponding to EE are cost of living, opportunity of finding a satisfactory job and accommodation cost. For TC, the attributes are means of communication, means of transportation and traffic flow. Since only 8 cards for each construct are generated by the full factorial designs, no attempt to use the orthogonal designs was made. In fact, the full factorial designs permit the investigation of interaction effects in addition to the main effects.

The design and predictive power of orthogonal designs corresponding to PE and SE are measured by adding two holdout cards to each of the designs generated by this approach. As a result, the number of cards corresponding to PE, SE, EE and TC are 10, 10, 8 and 8 respectively.

In this study, the CA is applied in the second and third stages of the HII approach. In the fourth stage, however, although another CA was planned to be applied, due to the excessive number of cards, it was necessary to find another approach. In fact, if a CA were also conducted between the higher constructs, the number of additional cards to be evaluated would be 16 with the full factorial design or 8 with the orthogonal design. Even if the orthogonal design were selected for this stage, one respondent would have to evaluate 44 (10+10+8+8+8) cards, which is practically impossible in Turkey's conditions.

Due to this fact, first of all, the number of cards to be evaluated by each respondent is reduced by randomly assigning him/her to only one of the four higher constructs. This is followed by the bridging stage based on a pairwise comparison matrix. For example, one respondent randomly assigned to the PE construct has to evaluate only 10 cards for that construct plus a pairwise comparison matrix requiring only 6 (4*3/2) comparisons, instead of 44 cards.

The pairwise comparison matrix reflects the respondent's judgment about the relative importance of one higher construct with respect to another in terms of "having the best quality of life in a city". For this purpose, a 1-9 scale is used by the respondent. In accordance with the Perron-Frobenius theory, in such a positive reciprocal matrix, the eigenvector of the largest eigenvalue will correspond to the relative priority of each higher construct in the achievement of the goal.

In fact, as well known, the pairwise comparison approach also constitutes the basis of AHP (Saaty, 1990). However, in this study, the judgment of all the respondents as a group is more important than those of the individual respondent in terms of relative priorities. That is why the Geometric Mean Approach proposed by Saaty (1990) for group judgments is adopted. This approach is based on gathering individual responses from each respondent for each a_{ijk} of the pairwise comparison matrices and then taking the geometric mean $a_{ij}=(a_{ij1}*a_{ij2}* \ldots.*a_{ijn})^{1/n}$,where n is the number of respondents and a_{ijk} is the comparative evaluation of the kth respondent in terms of the relative importance of the attribute i with respect to attribute j . The eigenvector of the resulting pairwise comparison matrix corresponds to the relative importance vector of the higher constructs according to group judgment. The reason for selecting the Geometric Mean Method (GMM) instead of the Weighted Arithmetic Approach suggested by Ramanathan and Ganesh (1994) is, first of all, the possibility of preserving the ratio scale property in the GMM and secondly, the impossibility of constructing an additional level of hierarchy where each respondent will evaluate the others in terms of their judgments.

7. SAMPLE DESIGN

The sample of the study consists of 200 Istanbul inhabitants. The budget of the research was the primary factor which dictated this size. In fact, in a big and heterogeneous city like Istanbul, the size of the sample must be much larger. In order to reduce the impact of such a drawback, stratified random sampling technique is adopted based on the A, B, C socioeconomic classes. The questionnaires are filled based on face-to-face interviews by trained interviewers. Initially, the aim of the study is explained to the respondent and the basic demographic information about him/her is noted. In the first stage of the survey, the trade-off of the respondent between the higher constructs are investigated based on the pairwise comparison matrix. Then, according to the sum of the digits of his/her age, the higher construct that will be evaluated by him/her is randomly determined. This worked out since 49, 52, 48, 51 respondents were assigned to PE, SE, EE and TC constructs respectively and the gender and socioeconomic class distributions were homogeneous among the constructs. During CA, only the cards corresponding to the selected higher construct are evaluated by the respondent. In addition, the respondent is asked to choose his/her favorite card to compare its card number with that of the card having the highest score. In this way, the matches are used as an measure of the consistency of the respondent. In the second stage of the survey, the respondent is asked to evaluate Istanbul, as a special case, in terms of the attributes used in this study. In the final stage of the survey, additional information about his/her demographic and socioeconomic status is noted. The sample was representative of Istanbul in terms of demographic and socioeconomic characteristics.

8. EMPIRICAL FINDINGS

8.1. Results of the Bridging Stage

The relative priorities (weights) of the higher constructs corresponding to the aggregated pairwise comparison matrix of the overall respondents as well as those revealed by the four different groups of respondents, each evaluating a different set of cards corresponding to a specific higher construct is shown in Table 2.

Table 2. Weight Vectors of Higher Constructs and Similarity Measurements

Weights($\underline{w}^t$)*	**PE**	**SE**	**EE**	**TC**	**Similarity with respect to the overall importance vector** $s(\underline{w}^t, \underline{w}^{AGR})$
$\underline{\mathbf{w}}^{PE}$	0.207	0.206	0.383	0.204	0.961
$\underline{\mathbf{w}}^{SE}$	0.178	0.208	0.384	0.230	0.954
$\underline{\mathbf{w}}^{EE}$	0.186	0.173	0.453	0.188	0.854
$\underline{\mathbf{w}}^{TC}$	0.221	0.208	0.308	0.263	0.833
$\underline{\mathbf{w}}^{AGR}$	0.198	0.200	0.381	0.221	

*t= Respondents assigned to Physical Environment (PE), Social Environment (SE), Economical Environment(EE) , Transportation and Communication (TC), and overall respondents (AGR)

The global importance of an attribute is calculated as the multiplication of the relative importance of that attribute within its higher construct by the relative importance of the higher construct. $\underline{w}^{AGR}$, calculated through the GMM, can be used as the vector of relative priorities for higher constructs if it is proved to represent the overall judgment of the 200 respondents. Only in this case the response given by a group of respondents to a specific set of cards corresponding to a specific higher construct can be accepted to represent the point-of-views of all the respondents.

In order to test the validity of this hypothesis, an attempt was made to see whether the relative weights of the higher constructs obtained from each group of respondents $\underline{w}^{t}$ (t= PE, SE, EE, TC) is equal to the relative weights obtained from the respondents as a whole ($\underline{w}^{AGR}$). For this purpose, two indicators proposed by Bryson (1996) are used. Those are the Group Strong Agreement Quotient ($GSAQ_{\alpha}$) and the Group Strong Disagreement Quotient ($GSDQ_{\gamma}$), which indicate whether a reasonably strong level of agreement or disagreement exist between a group weight vector $\underline{w}^{t}$ (t= PE, SE, EE, TC) and the overall weight vector $\underline{w}^{AGR}$. Initially, a similarity function $s(\underline{w}^{t}, \underline{w}^{AGR})=1-sine(\underline{w}^{t}, \underline{w}^{AGR})$ is calculated in order to assess the level of agreement between pairs of importance vectors. Then, the threshold value of 0.826 (sine of 10^{o} angle) is accepted for α and the threshold value of 0.741 (sine of 15^{o} angle) is accepted for γ, as suggested by Bryson (1996). The similarity measures of each group with respect to the overall group of respondents are given in the last column of Table 2. Given these values, $GSAQ_{\alpha}$ and $GSDQ_{\gamma}$ are computed.

The group strong agreement quotient is $GSAQ_{\alpha} = \sum_t AGRMNT(t, AGR)/n$; n being the number of respondents and $AGRMNT(t, AGR) = 1$ if $s(\underline{w}^{t}, \underline{w}^{AGR}) \geq \alpha$ and $AGRMNT(t, AGR) = 0$ if $s(\underline{w}^{t}, \underline{w}^{AGR}) < \alpha$. As can be seen from Table 2, for each group t, the similarity measure is greater than α (=0.826) showing that there is a strong agreement among each group with respect to the overall respondents. In fact, the corresponding $GSAQ_{\alpha}$ is, thus, equal to 1. As can be expected, this value is greater than the threshold value of 0.750 suggested by Bryson (1996) for $GSAQ_{\alpha}$. Therefore, the hypothesis of the equality of $\underline{w}^{t}$ to $\underline{w}^{AGR}$ can be accepted for each t =PE,SE,EE,TC.

Similarly, $GSDQ_{\gamma} = \sum_t DISAGR(t,AGR)/n$; n being the number of respondents and $DISAGR(t, AGR) = 1$ if $s(\underline{w}^{t}, \underline{w}^{AGR}) \leq \gamma$ and $DISAGR = 0$ if $s(\underline{w}^{t}, \underline{w}^{AGR}) > \gamma$. As can be seen from Table 2, all of the similarity values are greater than γ (=0.741) . Therefore, the corresponding $GSDQ_{\gamma}$ is zero, which is less than the threshold value of 0.1 , which is suggested by Bryson (1996) for $GSDQ_{\gamma}$. Based on the test results given above, the hypothesis $\underline{w}^{PE} = \underline{w}^{SE} = \underline{w}^{EE} = \underline{w}^{TC} = \underline{w}^{AGR}$ is accepted. The aggregated importance weights can be assumed as common importance weights for all the respondents and they are $\underline{w}^{AGR}$=(0.198, 0.200, 0.381, 0.221). This weight vector shows that the highest priority is given to economic environment (0.381) with an importance weight approximately twice of the other constructs.

8.2. Conjoint Analysis Results

As was explained above, the study involves 4 independent conjoint analyses, one for each higher construct. As EE and TC constructs are based on full factorial designs, it is possible to analyse both the main and the interaction effects for these constructs. For PE and SE constructs, however, only the main effects are investigated, due to the use of the orthogonal design. The relative impact of each attribute level on the preference score of the respondents is estimated through CA.

8.2.1. Physical Environment

Table 3 shows the CA results for PE, for which an orthogonal design is used. As can be seen, the individuals do not prefer complexes and apartments. They prefer large green areas around the city, rather than green areas within the city, no matter how many and how large they are. Extensive recreational areas, adequate infrastructure and municipal services are preferred. Infrastructure is the most important attribute followed by recreational areas with an importance level of half of the former. Green areas and house type are ranked third with approximately the same level of importance. Building arrangement, on the other hand, is not important for the individuals.

Table 3. Contribution of Attributes to the Physical Environment Construct

Attribute	Level	Utility	t-value	Averaged Importance
Building Arrangement	Complex	-.1199	1.025	3.29
	Individual	.1199		
House Type	Detached	.9303	-3.337	10.70
	Apartment	-.9303		
Green Areas	Few number of large parks in the city	-.2959	3.116	12.31
	Large number of small parks in the city	-.3010	-0.018	
	Large green areas around the city	.5969		
Recreational Areas	Extensive	.8801	-7.525	24.13
	Limited	-.8801		
Infrastructure& Municipal Services	Adequate	1.8087	-15.465	49.58
	Inadequate	-1.8087		
Constant		4.9643		

Goodness of fit, measured by Pearson's R^2, is 0.994, which is very high. The predictive performance of the model is measured by Kendall's Tau in the holdout cards and is found to be 1. The consistency of the respondents measured by the match ratio is 93.9%, which is very high.

8.2.2. Social Environment

Table 4 shows the results of the CA for SE. Individuals prefer extensive, easy to use and free of charge education and health services with low-crime-rate city. Although those results are normally expected, the differences in terms of their relative importance levels have to be emphasized. As an ideal social environment, the individuals describe a city with low crime rate and give more importance to education services than health services. In fact, the priority given to the cultural and entertainment services is more than that of health. Individuals give the least relative importance to the price of educational services, which is less than that of price of health services. Goodness of fit measured by Pearson's R^2 is very high (0.991). The predictive power of the model is measured by Kendall's tau in the holdout cards and is found to be 1. The consistency of the respondents measured by the match ratio is 94.2%, which is very high.

Table 4. Contribution of Attributes to the Social Environment Construct

Attribute	Level	Utility	t-value	Averaged Importance
Extent of educational services	Extensive and easy to access	1.041	-10.054	19.88
	Limited and difficult to access	-1.041		
Price of educational services	Free of charge	.291	-2.809	5.56
	With charge	-.291		
Extent of health services	Extensive and easy to access	.699	-6.757	13.36
	Limited and difficult to access	-.699		
Price of health services	Free of charge	.426	-4.110	8.13
	With charge	-.426		
Cultural activities and entertainment	Extensive and easy to access	1.041	-10.054	19.88
	Limited and difficult to access	-1.041		
Safety	Low crime rate	1.738	-16.788	33.20
	High crime rate	-1.738		
Constant				

8.2.3. Economic Environment

EE is defined by the cost of living, satisfactory job availability and accommodation cost. As this module is described as a full factorial design, both the main and the interaction effects can be estimated at aggregate level. The adjusted R^2 of the main-plus-interaction-effects model is 0.621 and that of the main-effects-only model is 0.617. The superiority of the former model can be tested using the variance analysis. The F-test indicates that interaction effects are not significant at the 5% level of significance (F=2.0245, Pr.=0.0875). Table 5 shows the results of the main-effects-only model. In EE, the availability of satisfactory jobs is found to be the most important attribute, while the cost of living and house prices have almost the same level of importance. Goodness of fit measured by Pearson's R^2 is very high (0.994). There are no holdout cards due to the application of the full factorial design. The match ratio is 95.8%, implying that the respondents are highly consistent. As a result, an ideal EE is the one with great opportunity of satisfactory jobs, and low cost of living and house prices.

Table 5. Contribution of Attributes to the Economical Environment Construct

Attribute	Level	Utility	t-value	Averaged Importance
Cost of living	Low	.9870	-8.909	22.79
	High	-.9870		
Opportunity of finding a satisfactory job	High	2.3932	-21.602	55.26
	Limited	-2.3932		
Accommodation cost	Low home prices and rents	.9505	-8.579	21.95
	High home prices and rents	-.9505		

8.2.4. Transportation-Communication Facilities

The attributes corresponding to TC are means of communication, availability and means of public transportation, and traffic flow. As this module is described as a full factorial design, both the main and interaction effects can be estimated. As in EE, first of all, the main effects are estimated and then the significance of the interaction terms is tested at aggregate level. The adjusted R^2 of the main-plus-interaction-effects model is 0.681 and that of the main-effects-only model is 0.646. The variance analysis is used to test the significance of all the interaction terms together. According to the results of the F-test, all the interaction terms are significant at the 5% level of significance (F=11.865, Pr=0.00001). Table 6 shows the results of the main-plus-interaction-effects model. When the interaction terms are significant, the effect of one attribute depends on the level of all other attributes. Therefore, a single attribute does not have a unique effect. Table 7 shows the effects of the attributes depending on other attributes. For example, the effect of traffic flow varies from 2.883 to 1.343 with an average of 1.899, which is also the estimated main effect of the traffic flow in the main-effects-only model, due to the orthogonality of the attributes. Thus, use of the average main effects in the presence of interactions can be seriously misleading. In other words, the effect of a change from a congested and slow traffic flow to a comfortable and rapid one is 2,8825 when communication is extensive and easy to use, and public transportation is well-developed, but this effect becomes 1,343 when communication is limited and difficult to use, and public transportation is undeveloped. The ease of traffic flow is found to be the most important attribute of the transportation-communication facilities. This is followed by public transportation opportunities and means of communication. Goodness of fit is measured by Pearson's R^2. Although it is very high (0.974), it is lower than that of the other three modules. Since full design is used, there are no holdout cards. The respondents are consistent as seen in the match ratio of 100%.

According to the transportation and communication activities, the ideal city is the one with an easy and fast traffic flow, with extensive communication and transportation opportunities, and with easily accessible public transportation.

Table 6. Contribution of Attributes to the Transportation-Communication Construct

Attribute	Level	Utility	t-value
Means of communication	Extensive and easy to access	1.4926	-12.448
	Limited and difficult to access	-1.4926	
Means of public transportation	Well developed public transportation	1.2672	-11.466
	Inadequate public transportation	-1.2672	
Traffic flow	Comfortable and rapid	1.8995	-15.185
	Congested and slow	-1.8995	
Communication X Transportation	Extensive and easy to access & Well developed public transportation	-1.0098	3.762
	Limited and difficult to access and /or Inadequate public transportation	1.0098	
Communication X Traffic flow	Extensive and easy to access and/or Comfortable and rapid	-1.1570	4.309
	Limited and difficult to access and/or Congested and slow	1.1570	
Transportation X Traffic flow	Well developed public transportation and/or Comfortable and rapid	-1.2353	4.602
	Inadequate public transportation and/or Congested and slow	1.2353	
Communication X Transportation X Traffic flow	Extensive and easy to access & Well developed public transportation & Comfortable and rapid	0.8529	-2.247
	Limited and difficult to access and/or Inadequate public transportation and/or Congested and slow	-0.8529	

Table 7.Utilities of Attributes with Changing Levels of the Other Attributes

Attribute	Communication	Transportation	Traffic flow	Utility	Main Effect	Importance
Communication	Extensive and easy to access	Well-developed public transportation	Rapid	2.3625	1.492	32.04
		Undeveloped public transportation	Rapid	1.3530		
		Well-developed public transportation	Congested	1.2055		
		Undeveloped public transportation	Congested	1.0490		
Transportation	Extensive and easy to use	Well-developed Public Transportation	Rapid	2.1765	1.267	27.20
	Limited and difficult to use		Rapid	1.1670		
	Extensive and easy to use		Congested	0.9410		
	Limited and difficult to use		Congested	0.7845		
Traffic Flow	Extensive and easy to use	Well-developed public transportation	Comfortable and rapid	2.8825	1.899	40.77
	Limited and difficult to use	Well-developed public transportation		1.7255		
	Extensive and easy to use	Undeveloped public transportation		1.6470		
	Limited and difficult to use	Undeveloped public transportation		1.3430		

8.3. Integrated Results

The relative importances of the attributes are computed as the multiplication of the relative importance of that attribute within its higher construct by the relative importance of the higher construct calculated in the bridging stage. As seen in Table 8, the most important attribute for a city is the opportunity of finding a satisfactory job, followed by infrastructure & municipal services and traffic flow which have relative importances approximately half of the first attribute. Cost of living, accommodation cost and means of public transportation are the subsequent attributes. As seen, 3 of the top 6 attributes belong to the EE construct. Price of health and educational services and building arrangement are the least important attributes. Thus, inhabitants of Istanbul portray an ideal city as one with a high opportunity of finding a satisfactory job, adequate infrastructure & municipal services, comfortable and rapid traffic flow, low cost of living, low home prices and rents and with well-developed means of public transportation.

Table 8. Importances of Attributes in Descending Order (%)

No	Attribute	Importance	No	Attribute	Importance
1	Opportunity of finding satisfactory job	21.05	10	Extent of educational services	3.98
2	Infrastructure & municipal services	9.82	11	Cultural activities and entertainment	3.98
3	Traffic flow	9.01	12	Extent of health services	2.67
4	Cost of living	8.68	13	Green areas	2.44
5	Accommodation cost	8.36	14	House type	2.12
6	Means of public transportation	8.22	15	Price of health services	1.63
7	Means of communication	7.08	16	Price of educational services	1.11
8	Safety	6.64	17	Building arrangement	0.65
9	Recreational areas	4.78			

If the higher constructs had equal importance, the top 5 attributes would be opportunity of finding a satisfactory job, infrastructure & municipal services, traffic flow, public transportation and safety.

In the survey, each respondent was asked to evaluate Istanbul on a 0-10 scale with respect to the attributes used in conjoint analysis. The averages of these evaluations indicate that the most problematic attributes are traffic congestion, cost of living and accomodation, while the least problematic attribute is the means of communication. The most problematic attributes are the 2nd, 3rd and 4th in relative importance ranking, while the most important attribute, which is opportunity of finding a satisfactory job, is the 7th problematic attribute. Thus, it is seen that individuals do not give the highest importance to the most problematic attributes.

9. SEGMENTATION

Our results imply some heterogeneity in the respondents' preferences for attributes of QOL. Therefore, it is important to identify groups of respondents with significant differences in QOL preferences. Identification of such segments provides the urban planners and authorities with additional information and understanding of inhabitants' priorities and desires. Such a segmentation is made based on the socioeconomic classes A, B and C.

9.1. Physical Environment

There are significant differences in the preferences of

- class B and class C in terms of infrastructure and municipal services (at 5% significance level),
- class A and class B in terms of house type (at 5% significance level),
- class A and class B in terms of infrastructure and municipal services (at 10% significance level),

9.2. Social Environment

There are significant differences in the preferences of

- class A and class B in terms of the price of educational services (at 5% significance level),
- class A and class B in terms of cultural activities (at 10% significance level),

- class B and class C in terms of the price of educational services (at 10% significance level).

9.3. Economic Environment

There are significant differences (at 5% significance level) in the preferences of

- class A and class B in terms of opportunity of finding a satisfactory job,
- class B and class C in terms of cost of living.

9.4. Transportation-Communication

There are significant differences (at 5% significance level) in the preferences of

- class A and class B in terms of means of communication,
- class B and C in terms of means of communication and transportation.

10. CONCLUSION

The aim of this study is to discuss the results of a decompositional model used in revealing the priorities and needs of the inhabitants of Istanbul. The model is derived from HII, developed to handle complex decision making problems involving large number of attributes like QOL.

The results of the study support the validity of the HII approach. The utilities estimated from each higher construct and the bridging stage are in line with our prior expectations; the economic environment is the dominant construct, the utilities of the best levels of the attributes are all positive and the marginal increase in utilities is lower when all the other attributes are at their worst levels. In addition, the goodness-of-fit of the estimated models are highly satisfactory and the overall consistency of the respondents as a whole, measured by a match ratio, is 96%, which very high.

In this study, two new approaches are integrated to the HII approach. First, at the bridging stage, the pairwise comparison approach of AHP instead of conjoint analysis of the traditional approach is used to find the relative importances of higher constructs with respect to the goal of having the best quality of life in a city. Second, respondents are randomly assigned to only one of the constructs so that they evaluate the cards and attributes of only their own construct, leading to a great reduction in the number of cards evaluated. The equality of the importance vectors of each of the 4 groups with respect to the importance vector of the respondents as a whole is verified through a similarity function suggested by Bryson (1996).

The substantive conclusion of this study is that, on average, respondents prefer a city which has a high opportunity of finding satisfactory jobs, adequate infrastructure and municipal services, rapid traffic flow and low cost of living and accomodation. Thus, the city planners and municipal authorities should place the most emphasis on these areas. Of course, some of the attributes cannot easily be manipulated, but this study indicates the priorities to allocate resources to improve the QOL in Istanbul.

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