Indicators for urban quality evaluation at district scale and relationships with health and wellness perception

Abstract:

The paper is related with a research that was aimed to better define urban quality and sustainability at a district scale (4000-10000 inhabitants), specifically referred to European towns and settlements. An innovative set of indicators (72) has been developed, starting from and taking into consideration also existing literature, both in terms of indicators and sets of indicators (OECD, UN, Agenda 21, and existing European databases as CRISP), four "thematic" areas have been defined dealing with architectural quality, accessibility, environment and services. Within each of these areas some macro-indicators and micro-indicators have been defined. The aim is to translate something that is usually considered subjective into something "objective" and finally defined with a number (0-100). Micro-indicators and macro-indicators are weighted thanks to a mathematical method based on symmetrical matrixes, so that there is a correct balance between different areas. Indicators are both qualitative and quantitative, so they are not just referred to urban planning procedures. The research has been already successfully applied to some Italian districts in towns as Lodi, Genova and Milano. The set of indicators was needed also to work within a multi disciplinary team that has already included engineers, architects, planners as well as doctors and physicians. As a matter of fact the results in terms of urban quality have been compared with medical results concerning health and wellness perception (using SF-36 international recognized questionnaires) by users (inhabitants), finding (non linear) relationships between urban quality and well being perception by inhabitants. The results of this research can be used to: better define design strategies (by designers) accordingly to users wellness, or evaluate ex-post the results of design activities (by municipalities or public authorities).

Key words: urban quality, quality indicators, health, wellness perception, pre-post quality assessment

Introduction: the meaning of urban quality and the call for sustainability

The paper is the result of a research that deals with an innovative idea of urban quality, that integrates different ways on interpreting "quality" already existing and referred to environment, landscape or specifically to urban landscape. The research takes into consideration the very actual and specific normative and laws references that are set at European level as: the European Convention on Landscape, the Resolution of the European Council "Architectural Quality of Urban and Rural Environment", the Environmental normative referring to the European Directive 2001/42/CEE, the Development Scheme of the European Space (SDEC), etc. Moreover the study takes into deep consideration the existing normative and the call for a sustainable development: one of the outcome of the research is expected to be a methodology (design guide lines) to intervene in built environments, both the existing settlements and the new ones.

Approaches to quality evaluation

It is possible to refer to quantitative and qualitative systems of evaluation, where quantitative research is usually more general, is built on the base of the researcher forecasts and does not start from one specific case study, while Qualitative research, is "multi method in focus", "study things in their natural settings", involves the studied use and collection of a variety of empirical materials" (Denzin, Lincoln). In particular, concerning the qualitative approaches, a focus importance is set in the evaluation of landscape, accordingly to some experiences held in the UK in the sixties (Hampshire County Council, 1968 and others). These experiences are based on direct observation and perception of the sites made by experts. But the state of the art concerning evaluation systems can be also referred

to various recent experiences, like the research called "Living places: caring for quality" that is referred mainly to public spaces. It defines in a qualitative way some features of the urban space like accessibility, comfort, vitality, safety, attractiveness, etc. The evaluation is based on "quality" and it is expressed through interpretative categories that are set also through the places' perception. Starting from these references it is evident that, together with the more consolidated vision of the planning and urban design disciplines (historically based upon quantitative factors and indicator) there are innovative methods and ways to qualitative analyze the territory and the projects.

Evaluation methods and set of indicators

Taking into consideration the diffusion of environmental evaluations, initially referred just to infrastructures (roads, highways, bridges, etc), many other methods were born starting approx from the '80. The research takes also into consideration European policies to find evaluation methods and indicator sets already adopted, like the OECD system of indicators: they were developed taking into consideration the DPS (Pression – State – Answer) Model (by Friend) elaborated in the '70 and more recently evolved in the DPSIR model. Also the Agenda 21 process, stated in 1992, is referred to this general situation: it involves 5 different categories of indicators like the urban and building structure, the urban green, the landscape, risk factors, net infrastructures. Planning (urban, architectural and infrastructural) disciplines are more recently using different sets of indicators: each of them is referred to particular context or works, so that it is difficult to harmonize between them. Making specific reference to indicator sets, it is to remark the "Core set for environmental performance reviews" by the OECD (1993), the "Monitoring Human Settlements with Urban Indicators" by the United Nation Centre for Human Settlements (1997), the "Indicators of Sustainable Development" by United Nations (2001). International recognized database are also present like the CRISP (Construction and City Related Sustainability Indicators), with the aim to collect the state of the art and different set of indicators that are grouped by subject, so to create an international network of experiences. Moreover, a research from Politecnico of Torino (Italy) developed in 2002 a specific urban quality index referred to the "housing urban space", including basic services close to housing like playground and green areas. The dimension of the case study sites is determined on the base of visual perception and main infrastructures. This research uses a specific mathematical model based on the method of matrix comparison by pairs.

State of the art: Health status perception

The scientific results of recent researches show relationships between urban and environmental quality and perception of health status. These effects of reduction or improving of the health status' perception is discreet and, most of all, measurable. The differences (health status perception) that have been observed (through an international recognized validated questionnaire called Short Form SF-36) are not random but statistically meaningful. Usually, when we refer to environment and relationships with health, the comparison data are referred to economic, social, services fruition or pollution features (for example pollution can be referred to air pollution with chemical or physical substances - PM10, PM5 e PM 2,5, or to acoustic pollution as noise level - Leq, dB(A)). These environmental data are usually compared with "heavy" indicators like increasing in dead percentage or hospital admissions, medicinal use, days of disease, etc. These indicators have the benefit of being easily accessible in literature but they have the drawback of making evidence of just "heavy" environmental situations, with evident risks for men health. A more flexible tool is needed to put in evidence first symptoms of disease, discomfort and illness, and to check with more accuracy health diseases and health alterations. The research, accordingly with the group leaded by prof. Orlando and prof. Cristina – Univ. Genova, already used the Short Form 36 test, that can analyze and give quantitative response on the health

status perception, on the mental-physical well being and on the changes that are caused by the "context", referred to life and social issues. The Short form SF-36 is internationally recognized and validated (unique meaning and comparison). It finally finds out summary measures, one for physical health (ISF) and one for mental health (ISM). The SF-36 is a multi-purpose, short-form health survey with only 36 questions. It yields an 8-scale profile of functional health and well-being scores as well as psychometrically-based physical and mental health summary measures and a preference-based health utility index. It is a generic measure, as opposed to one that targets a specific age, disease, or treatment group. Accordingly, the SF-36 has proven useful in surveys of general and specific populations, comparing the relative burden of diseases, and in differentiating the health benefits produced by a wide range of different treatments.

The research can be summarized in finding a new and innovative methodology that can be applied to:

- Give indications on the results (as the improving of health status) of urban renewal processes;
- Evaluate (quantitative way) the interference between urban environment and health status;
- Evaluate the correspondence between urban and environmental features and population's health.

Scientifically validated relationships between urban environments and health status perception of people, both in positive or negative way, could strongly improve the urban planning and design activity and the urban regeneration processes. The expected scientific results are to determine if and how much it is possible to translate the capacity of urban settlement of modifying and interfering with the health and the health perception of people that live in that environment.

Methodology for evaluating urban quality

It consist of a procedure adaptable to different urban settlements by using both quantitative and qualitative features translated into indicators. The kind of indicators are not just the ones referred to the history of planning (like urban standards as density, green surface, etc) but they involves also qualitative features like maintenance, homogeneous distribution of services, quality (public spaces, furniture, lighting, etc). The research define indicators of quality accordingly to the international state of the art. Accordingly to recent researches (CRISP database, C.Socco – Politecnico of Torino) a set of indicators for evaluating in complete way urban sites is needed. The set of indicators should include also the reference to housing, social and collective services at the neighbourhood scale, landscape and environmental features. Clear and objective evaluation guide lines are provided, by expressing for each indicator the required features and how to express a qualitative evaluation (not sufficient, sufficient, good, excellent). The research provides a set of 72 indicators that can be referred to urban settled environments (that could be historical centre, '800 and '900 century settlements' extension: context with clear morphological and aesthetic rules so that they can be more easily recognized). As a consequence of urban and functional analyses the site should have a number of inhabitants between 4000 and 10000. This has been considered the right dimension which the set can be referred to as it can present both housing, collective spaces and services. Referring to the 72 indicators (in the evaluation procedure called micro indicators as they correspond to the most detailed element of the evaluation), each of them is defined with specific qualitative and quantitative features, and accurately described into a form with text description, features, references to projects and sites. Some of these indicators are already existing in Literature (Agenda 21, CRISP - Construction and City Related Sustainability Indicators Network funded by EU in FP5, Living Places: Caring for quality (UK),

OECD indicators, etc) while some of them are new and just indirectly referred to the ones already existing.

The indicators are grouped in four categories:

- the Architecture group is related to architectural values, identity and recognizable features;
- the Fruition group is in relationship with quality and presence of services, infrastructures, mobility;
- the Environment group is linked to the quality and presence of landscape, environmental systems, etc;
- the Social group is related to public and collective functions and services.

As an example, into the Environmental group there are 5 macro indicator as follows: visual issues, green spaces and vegetation, topographical and morphological elements, natural areas, sensorial quality and environmental risks. Finally, 20 micro indicators belongs to these 5 macro indicators. Particular attention was provided in giving a precise description of each indicator, so that subjectivity is reduced as much as possible. It is possible to adapting the set of indicators to different urban settlements, by pondering the importance of specific micro – indicators. One of the expected research output is to adapt the set of indicators to different sites and settlements. In fact the set of indicators can fit all urban settlements of the European town. Anyway it is flexible and can be easily modified without interfering with the methodology. The base matrix of evaluation is as follow:

Base Matrix of evaluation

Index	excellent	good	sufficient	Not suff.	**I**
excellent	50	52	70	80	**100**
good	48	50	65	75	**84**
sufficient	30	35	50	60	**60**
Not sufficient	20	25	40	50	**27**

Figure 1

The Urban Quality index is based on a series of matrixes that include the evaluation as from the following procedure:

- micro indicators are defined, grouped into macro indicators;
- a general layout (structure of the procedure) of micro indicators, macro indicators and categories (architectural, social, fruition, environmental) is created (figure 2).

As the indicators (micro and macro) are mathematical variables, four level of evaluation are recognized: not sufficient, sufficient, good and excellent. These evaluation is linked to a brief description of features required, and it is translated into a value between 0 and +100. Each of the four categories and of the macro indicators are function of the pondering weighted sum of the micro indicator evaluations, each of them is expressed with a numeric value; When all the evaluation of

micro indicators is completed, the weighted sum of values bring to a final result that is Urban Quality value.

The global index of Urban Quality (Qu) is the result of the following weighted sum: Qu = f(Qarch, Qfruib, Qamb, Qsoc), where: Qarch = architectural quality; Qfruib = fruition quality; Qamb = environmental quality; Qsoc = social quality.

More in detail the following formula is valid: Qu = karch Qarch + kfruib Qfruib + kamb Qamb + ksoc Qsoc, where karch = coeff. of pondering for architectural quality; kfruib = coeff. of pondering for fruition quality; kamb = coeff. of pondering for environmental quality; ksoc = coeff. of pondering for social quality.

Evaluation level	MICRO INDICATOR - Evaluation description (just a sample, it changes with the kind of micro indicator)		SCORE
Excellent	*Very high quality (eventually with a value) along the site, with homogeneous distribution and no lack*	100	Final score
Good	*High quality along the site (eventually with a value) , with eventually very few lacks in localized portion of the site that do not influence the overall result*	84	
Sufficient	*Medium quality (eventually with a value) with some spread lacks that do not largely influence the overall quality*	60	
insuff.	*Lack of quality with extended problems that influence the final result*	27	

Figure 2

INDEX OF ENVIRONMENTAL QUALITY (sample) Q AMB = (kV QV + kG QG + kT QT + kN QN + kS QS)						
	Visual issues	*Green spaces and vegetation*	*Land morphology and topography*	*Natural areas*	*Sensorial quality and environmental risks*	
Criterion	V	G	T	N	S	**Q AMB**
k	**kV**	**kG**	**kT**	**kN**	**kS**	**53**
	0,28	0,22	0,09	0,13	0,28	
Q SITE	**QV**	**QG**	**QT**	**QN**	**QS**	
	41	58	43	27	76	

Figure 3

Every quality factor (for example Qarch) is the result of a weighted sum of a defined number of indicators. This method brings to the reduction of subjectivity in the evaluation process and let increase the general coherence of the indicators' set. This proposed criterion is a technical tool to get to a concise evaluation of urban quality expressed with a numeric value. Why to translate the urban quality into a numeric value? It is possible to compare different sites between them, so to create a

statistically meaningful database of experiences. Moreover a concise result expressed with numeric value let us comparing different sites creating a strong reference database. This is an innovative method of evaluation, in fact: the evaluation model can be adapted to the single case study, as the "structure" is flexible and modifiable for future developments. It is a "open" model into which new or updated indicators can be added. As the sum of the four categories evaluation is weighted, the "accuracy" of the result depends on the number of indicators. A few number of indicators provide not sufficient accuracy in evaluation, but we consider that 72 indicators was the right number of indicator to provide an accurate evaluation of urban environments. So if the "structure" and the number of the indicators will need to change in relationship to particular kind of environments, it will be possible to do it very easily. The requisites of the evaluation method have been found with the aim of:

- Selecting issues of interest concerning urban and environmental features, with strong interconnections between them;
- Select a set of indicators as much as possible complete without being useless over dimensioned;
- Defining a methodology of evaluation as much as possible objective, with clear description of indicators features both in qualitative and quantitative way;
- Restricting the possibility of variation (for example, with different context) by using pondering factors, so that the system is fully flexible;
- Work out a more objective evaluation of urban quality to apply to urban settlements with a population between 4000 and 10000 inhabitants.

The final aim is to define in an accurate and flexible procedure for evaluating urban quality in different kind of urban settlements in European towns. The aim is not to express something it is already known as the environmental data, but to express a complex evaluation of urban quality with a concise output that is a mark (numeric value).

Urban quality evaluation and health status perception

Environmental indexes, urban quality evaluation and health status perception are strictly linked: in fact in some case study the menthal health was inverse function of the environmental noise. So if the environmental noise is increasing, the mental health is decreasing (following figure). This result is perfectly aligned to the scientific state of the art concerning the effects of noise on health. The accordance between these last data will confirm the initial hypothesis, as from the image below that shows the correspondence between Global Urban quality (vertical, increasing) and the Short Form 36 evaluations (horizontal, increasing). Scientific researches already confirm the correspondence between urban quality – evaluated with the methodology proposed – and the results of the SF-36 answers by people who lives in the selected sites. Relationships have been found between Fruibility Quality index, Vitality (VT) and most of all the Summary measure of Mental Health. So at increasing values of urban quality there is correspondence of increasing value in health status perception.

Conclusion

The research can also be applied in the near future to eco-districts, by managing the set of indicators through some pilot cases (i.e. through Horizon2020). The final goal is to improve it and find new and better relationships between urban quality and wellness perception, maybe within renewal/retrofitting of existing neighbourhoods (i.e. social housing districts), also in terms of cost-benefits effects.

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