Assessment of Quality of Built Environment. A Case Study in North of Italy

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ABSTRACT

The paper describes results of a Preliminary Study for the Plan of Quality of Living (PSPQL) of a town in the hinterland of Milan, conducted by an interdisciplinary group of researchers, involving also facilitators, town councillors, administrators, technicians and citizens. Main aim of the work is the evaluation of the most sustainable actions to be taken for improving conditions of living. A bottom-up and participative approach has been followed. A deep analysis has been carried out, elaborating a set of 27 indicators, defined with the help of the town councillors, administrators and technicians. Indicators investigated 6 different systems: environment, territory, mobility, society, economy and health. In topic environment, also energy consumption in public and private buildings has been evaluated; a rough survey of energy performance of existing buildings and a protocol for improving it have been carried out. Results of different indicators have been represented and communicated by graphs, images and maps, with the help of GIS-based model. The study represents an important experience for developing actions for the sustainable development of communities.

KEYWORDS

Urban quality, urban sustainability, indicators, energy consumption, participation

INTRODUCTION

The paper describes results of a Preliminary Study for the Plan of Quality of Living (PSPQL) of Senago, a town of about 20000 inhabitants, located in the hinterland of Milan. Senago is a small town in which some signs of ancient traditions of Lombardy Region cohabit with new trends of living. Agriculture was the main activity in the past; shift to crafts and service have affected also urban planning and buildings realization, abandonment, conversion and refurbishment.

The study started in summer 2005 and ended in spring 2006, but his concept has been developed during many years, in which, the governance try to shift his interests and resources in actions aimed to improve urban sustainability. The study has been commissioned by the municipality and has been carried out by an interdisciplinary group of young researchers (architects and engineers), involving also facilitators, town councillors, administrators, technicians and citizens.

Framework and aims

The measurement of sustainability and quality of life has been identified as a strategic goal during the Rio Summit in 1992. In 1994, Aalborg Charter confirms these needs, by committing the signatory local authorities to the use of indicators as a supporting tool for long-term policy-making. Responding to these calls, a lot of measurement initiatives in Europe tried to describe and monitor the level of sustainability and quality of life by different set of indicators concerning environmental, social d economic issues. The PSPQL sources in this framework and follows a bottom-up approach.

An important aim of the study is to render a vision of the town, investigating the actual conditions of living within each part of citizen (children, teenagers, young people, adults, and old people) and prioritizing the needs in which actions by governance could have relevant effects. Further, there is the intention of putting on trial a new tool, finalized to create a clear base of common knowledge, an interchange platform supporting actors involved in urban planning and management in taking actions in order to promote sustainable development.

METHODOLOGY

The concept of the study has been promoted and discussed during several occasions of interaction among researchers, councillors and technicians. The study was challenged starting from the concept that not only what is mandatory has to be done, but also what is actually feasible in order to improve living conditions. In fact, the so called Plan of Quality of Living is not a defined or mandatory plan; it is an optional plan, not defined before. For this reason, since the beginning, it was very important to define the methodology of the study, including different phases, aims, contents, sources, dissemination tools and scheduling.

Overall analysis

The collection and analysis of the available information about urban environment was one of the most important phases of the work. Some difficulties were encountered because of the different data base supports and reference offices; further, often data were referred to different years and not homogeneous. Further more, it was very hard to acquire and collect updated plans and programs and to blend them for having an effective view of the territory and considering it as a body. Firstly, data was ordered by theme: environment, including energy, waste management and water cycle; territory, including contaminated soils; mobility; utilities, including library, nurseries, schools, green areas, sport facilities, other services for handicapped and old people; economy; society and health. Because some information about territory and environment were lacking or out of time, several survey “in situ” have been carried out for rendering the actual living conditions and for verifying the different exiting plans and programs. After that, measures, observations and remarks were transferred from papery to information support, based on Geographic Information System (GIS). The improvement in quality and availability of information has allowed decision-making process to build-on a cross-sectoral vision and the use of GIS

technology have also made easier communication between different sectors by integrating spatial and statistical data in the same format, structure and map.

The overall analysis permitted to investigate, discuss and underline the strong and week points of living standards and to study in depth the actual meaning of the uninspired numbers, usually called standards of living in plans and programs.

Definition of the set of indicators

Many efforts were made in order to define an effective set of indicators for representing the state of the art, but also for simulating and predicting effects of different choices on living conditions in the future. The set has been established by specifying a number of selected issues identified between local priorities and strategies, with the help of the town councillors, administrators and technicians. After that, a deep analysis has been carried out, elaborating a set of 27 indicators. Some of these belong to defined and consolidated database (i.e. European Common Indicators, National and Local Planning Strategies); others, called user defined (UD), have been thought up, defined “ad hoc” and elaborated for the first time for Senago. Indicators investigated 6 different systems: environment, territory, mobility, society, economy and health (see Figure 1). More specifically the indicators selected, ordered by systems, are (see also Table 1):

- ENVIRONMENT: 1. air quality, 2. energy consumption, 3. waste production, 4. waste collection, 5. waste management and disposal, 6. environmental accounting
- TERRITORY: 7. proportion of woodland, 8. sustainable land use, 9. availability of local public open areas and services
- MOBILITY: 10. availability of pedestrian street, 11. local mobility, 12. children’s journeys to and from school
- SOCIETY: 13. citizens' satisfaction with the local community, 14. education degree of population, 15. proportion of 19 year olds with secondary school qualifications, 16. availability of childcare places, 17. leisure and cultural services, 18. crimes committed, 19. proportion of strangers, 20. computer knowledge
- ECONOMY: 21. affordable housing, 22. proportion of people of working age in employment, 23. poverty rate, 24. local businesses e jobs
- HEALTH: 25. death rate by cause, 26. people with disabilities e demand for social assistance services, 27. public health services.

Each indicator is identified by a code and is supplemented by a methodological sheet that specifies object of measurement, data collecting and elaborating methodology, data sources, references and outputs.

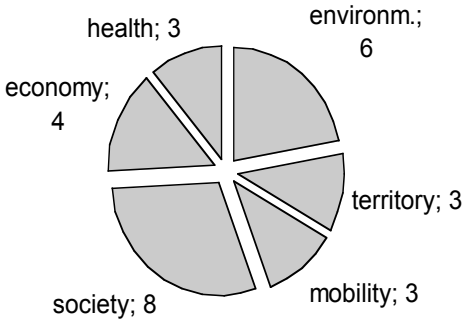

Figure 1: repartition of the 27 indicators in the 6 systems

Participative approach

Local involvement in the planning and management of the environment allows strategies to be tested and refined before adoption, ensuring built environment that satisfy both individual and community needs. Nowadays, there is a growing range of methods that has been developed in different experiences from many countries. They include different ways of listening to what local people have to say about their surroundings corresponding at different level of participation.
The approach adopted rises from the principles of Local Agenda 21 processes and includes, in particular, three different stages of community involvement: surveying citizens' satisfaction with the municipality as a place to live and work and the modes of transport of children travelling between home and school, according to European Common Indicators recommendations; inquiring visitors of the local trade exhibition about quality of public spaces by interactive displays; awakening people to environmental issues by public conferences and graphic materials shown during the same exhibition to capture the views of a large number of citizens.

CALCULATION OF THE INDICATORS, RESULTS AND CONSIDERATIONS

Despite the lacks of data and the non homogeneity of them, the 27 indicators (previously described) were calculated. Full information about procedure of calculation, proxy indicators used and quantitative results are reported in the official deliverables. An overall and qualitative view of the results is available in Table 1. Results of different indicators have been represented and communicated with graphs, images and maps.

TABLE 1
Overview of the evaluation through indicators; results were translated in a qualitative score
(*: bad; **: medium; ***: good; user defined – UD – indicators in bold)

indic.	Score	indic.	Score	indic.	score	indic.	score	indic.	score	Indic.	score
1.	*	6.	**	**11.**	*	**16.**	**	**21.**	**	**26.**	**
2.	*	7.	**	12.	*	**17.**	***	22.	**	**27.**	**
3.	***	8.	*	13.	***	18.	***	**23.**	**		
4.	***	9.	***	**14.**	*	19.	***	**24.**	*		
5.	**	**10.**	*	**15.**	*	20.	***	25.	**		

Energy performance of built environment

The calculation of the 27 indicators gave important result about the built environment (i.e. buildings performance and energy consumption in buildings and transportation). For calculating indicator “2. Energy consumption” (one of the six indicators of system ENVIRONMENT), a rough survey of energy performance of existing buildings has been carried out. On the basis of the collected data, it is possible to adfirm that main residential conditions are quite adequated and the availability of spaces is quite good (see Table 2).

TABLE 2
Statistical data about built environment of Senago (year 2001)

Num. of families	7238	Aver. residential surface per person	32 m^2
Average num. of person per family	2.6	Average num. units per buildings	3.9
Average surface of residential units	84 m^2	Average num. rooms/Unit	3.6

But, looking at the actual characteristics of built environment and buildings system, it is possible to find out that a scheduled and adequate program for refurbishment is needed. In fact, more than 50% of buildings were built more than 30 years ago and the most part of them were built during years 1946–1961, period in which no performance requirements were considered nor fixed by law (see figure 2, on the left, in which reported data represent a situation that is very popular in Italy). Looking at the shape of buildings and considering surface/volume ratio (S/V), it is possible to suppose a bad thermal behaviour of buildings and high thermal losses (see Figure 2, on the right).

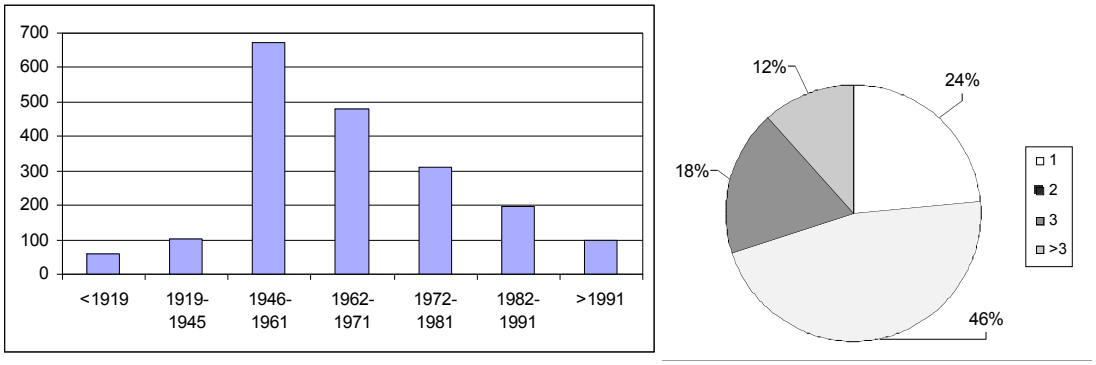

Figure 2: number of buildings ordered by age (left) and percentage of buildings with 1, 2, 3 or more than 3 floor above the ground (right)

All these considerations are confirmed by data about energy consumption in buildings for heating, cooling and appliances. It was very difficult to find homogeneous and correct data about natural gas (most used source for hating) and electricity and to define the reference built surface and lived space, but at the end it is possible to assert following data:

- natural gas consumption in buildings (all, public and private): about 750 m^3/inhabitant, otherwise more than 200 kWh/m^2 per year, in term of primary energy; analogous results were obtained considering natural gas consumption

in public buildings that represent about 3-4% of total consumption; worst performance in term of natural gas consumption was observed in a nursery
- electricity consumption in buildings (all, public and private): about 26 kWh/m^2 per year
- electricity consumption in public buildings: about 40 kWh/m^2 per year.

On the basis of a rough analysis carried out in few public building, these high consumptions do not correspond to good comfort conditions. Further, considering results of a campaign for monitoring air pollution in 2004, it is possible to find out that heating systems and plants contribute for half of the total CO_2 and NO_x emissions. Therefore, despite final result of indicator "2. Energy consumption" represents an average situation if compare with the national Italian one, a wide potential for reducing energy consumptions and, as consequence, CO_2-eq emissions has been pointed; and this information is more important if considered in the framework of new European Directive on Energy Performance in Buildings and following national and local laws and regulations.

DEVELOPMENTS AND CONCLUSIONS

On the basis of the results of the indicators, thorough fields of intervention for each topic have been indicated, in order to improve built environment performances and quality of living within different sources and time steps (i.e. definition of procedure for maintenance and refurbishment of existing buildings, integration of low energy and renewable in new buildings, promotion of slow modes and public transportation, improvement of public lighting efficiency, development of environmental monitoring campaigns, soil reclamation etc).
Further, because one of the aims of the PSPQL was to give an overview and to put in communication existing plans and programs for optimizing their effects and evolution, relationships among PQL and the most important defined by law plans and programs have been underlined, as development of the study. For all these reasons, the study can be considered as a promising, interdisciplinary and experimental start for developing actions for the sustainable development of communities.

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