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AND OTHER BUILDING SECTORS

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# Management, Quality and Economics in Building



EDITED BY

**Artur Bezelga**

*Professor of Civil Engineering  
Instituto Superior Técnico  
Lisbon.*

**Peter Brandon**

*Professor of Quantity and Building Surveying  
University of Salford  
Manchester*

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the salt-laden atmosphere... The two Hilton Head... failed in many ways due to... concept of "Standard of Care" at the... All of the failed... prevented if management... and accountability had been employed.

Proactive management techniques are not only desired but have become necessary in today's complex and... attention to even... sealant material... most suitable, can head off costly failures and possible law suits. The dynamic shifts in specialized roles of those that produce our buildings and the continued development of new and exciting building materials and systems must be coupled with innovative management control approaches if tomorrow's buildings are to be totally successful.

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Post-occupative quality evaluation of school buildings, a case of study

M.A. ESPOSITO

Abstract:

The goal of the project promoted by the Regione Toscana-Giunta Regionale (Region Authority) is to investigate the conformity to usage of school buildings existing in the region. The purpose is to measure the quality of location, function and structure of school buildings. A data structure is proposed for the direct collection of relevant data. The data collected from the entire region will be used to create an information system for school buildings. The information system shows the user any changes made on the territory. This helps in making future planning decision for the region. In particular this system shows school buildings whose usage conforms to the new program and those that are below acceptable quality standards. This allows the uses to make a ranking based on quality and establish priorities.

Keywords: Geographical Information System, Public Schools, Existing Buildings, Quality Evaluation, Management of Financing, Planning.

1. The context: schooling in Italy

The problem of quality and effectiveness of the school system in Italy is currently being studied, above all, in view of Europe after 1992.

A recent research project<sup>1</sup> shows that in spite of a very large annual budget for schooling (about 3 million liras per student with an increase of 52% on the budget for 1980) the quality level is very uneven around the country.

The main problem of Italian situation with respect to other countries is based on three issues:

- Existence of dropouts in middle school.
- Presence of inequality among different regions of the country.
- Lack of national standards for quality control of schooling and the support system of instruction in Italy.<sup>2</sup>

<sup>1</sup> Gen.s.i.s. (nov. 1990)

<sup>2</sup> Gen.s.i.s. (nov. 1990)

Studying and solving these issues is of great importance for our country. There is a need not only to check and program the public money for schooling but also to guarantee a system for training teachers up to international standards.

A rising issue in the control of reforms since we observe a tendency of the system to divide up. These may increase geographic differences mentioned above.

Locally, efforts are made to increase the understanding of the problem of the territory, focussing on the structure and organization of the school. In contrast with the delay (registered in 80's) of national reforms mentioned above, great dynamism is observed locally where schools change rapidly with society.

This phenomenon has allowed scholars to introduce experimental programs. Such programs have started in varying proportion at different places.

It is hard to monitor the effectiveness of such programs due of a lack of a national standards; a lack of flexibility of the norms and a lack of information regarding existing programs.

Innovations have been registered in 31.2% of the high schools nation wide. The Piano Nazionale Informatico (National Computer science plan) has reported that programs were started in 41.6% of the schools in central Italy, compared to only 25.4% in the north of Italy and 22.9% in south.

Studies conducted by specialized institutes have found different approaches to school reform in Italy. Different situations are focused on local realities and geographic location. As shown by studies done in different areas of the country, innovations (also regarding national reforms) have proceeded unevenly. As a result some areas have excelled and others have not. The situation appears to be best in the central of Italy where the social issues are less conflictive and more dynamic social reality exists. (see table 1)

Table 1. Innovation in Italian school (Cen.s.i.s.p. data 1990)

	low innovation rate	high innovation rate
South	20.4%	4.5%
Centre	3.5%	20.4%
North	5.3%	19.0%

2. Objective of the project

The census of school facilities in Tuscany was started in

<sup>3</sup> see the norms of the law n°148, 5/6/90

with a research on a model for data collection on the territory. The model should allow a fair collection of data to be used in the region to budget financial resources for facilities. Before the census apportioning of money was not based precisely on technical consideration, unless in emergency (natural calamity, etc.), because there are no data available or data were kept by different public board, institution or agency (like: Commune, Civil Engineers, Land Registry Office, etc.). In any case even if available data could not have been used by the Regione to operate a systematic planning activity.

The models provided by the bureaucratic sources are rigid compared with the actual increasing variety of the problems Authority is facing. Furthermore the need of verifying how suitable different schools are, implementation of the new programs is added to already existing problems especially in the case of less innovative schools (guardianship area). In such cases schools are totally inadequate to the education needs and often to the habitability standards.

The model should allow optimization for schools in the excellence area, as well as show inadequacy of schools in the guardianship area.

The lack of facilities in schools varies largely. The excellence area schools mostly need advanced tools like computers or sophisticated improvements of the school buildings (like acoustic improvements). On the other hand the guardianship area schools are in need of basic facilities (like classrooms or labs).

Lately in Italy great stress has been given to environment problems. Many project have started to create a centralized information system. Such information could be used by our model and made available later if necessary also in case of school buildings used differently from schools (as directed by the government thru a Ministry: "Ministero dell'Ambiente", "Ministero dei Beni Culturali", etc.).

On the other hand in Italy, particularly Tuscany, historical buildings are often used as schools so that financing and restoration are not managed by the "Ministero della Pubblica Istruzione" (Ministry of Education).

Financing from the Government does not agree with the local policy of innovation and it is often discontinuous and focused on totally marginal issues. The model of the information system should be flexible for different technical programs in the region.

It seemed necessary to use advanced tools for collection and analysis of data. On such technical goals is based our information system for data collection on the territory.

<sup>4</sup> C.I.P.E. (Comitato Interministeriale per la Programmazione Economica) (1990)

<sup>5</sup> Ministero della Funzione Pubblica (1990)



### 3. Technical goals of the project: the model

The objective of the model is to come up with a complete description of structure and usage of school buildings. The description should allow qualitative evaluation of schools buildings and allow collection of data to be compared with others infrastructure's data bases interactive with the school model. Besides that all data must be geographically related and referred to regional base cartography.

Comparison and evaluation are made between data collected and the standards imposed by law for public buildings as well as for school buildings?

New standards are introduced to evaluate the comfort of the interior of the school buildings. This way the satisfaction of users is measured using parameters not taken into account by any norm?

Technical goals, determined jointly with the "Dipartimento Istruzione e Cultura" of the Regione Toscana, defines the inputs for the information system. The model was developed in two phases:

1. macroanalysis
2. microanalysis

From the analysis of possible areas of improvement made by the Regione Toscana and the relative data we found three levels referred to phase 1:

- 1.1 Territory to refer to
- 1.2 School infrastructure
- 1.3 System interacting on the territory.

Phase 2. includes two steps:

- 2.1 Entities analysis
- 2.2 Individuation of data classes

The first step of the project is the definition, collection and validation of data concerning school infrastructures (1.2); such data are to be collected using tools from the orderer. (see fig.1)

For this purpose the individuation of data classes was referred to a meaningful zoning of the territory (Italy divided into provinces).

In phase 1 of the project the data record format has been established according to the following four modules concluded from microanalysis:

- a) Spatial location
- b) Functionality of the space
- c) Interior comfort
- d) Technical level

The peculiarity of data required specific training of the technical personnel responsible for data collection in each

<sup>6</sup> see the norms of the DM 27/04/78, n°384

<sup>7</sup> Ministero dei Lavori Pubblici, DM 18/12/75

<sup>8</sup> This topic is developed in a parallel degree thesis: De Santis M. (AA. 89/90) *Controllo di qualità in fase di gestione: analisi di un campione di scuole medie nella Regione Toscana*, Università di Firenze

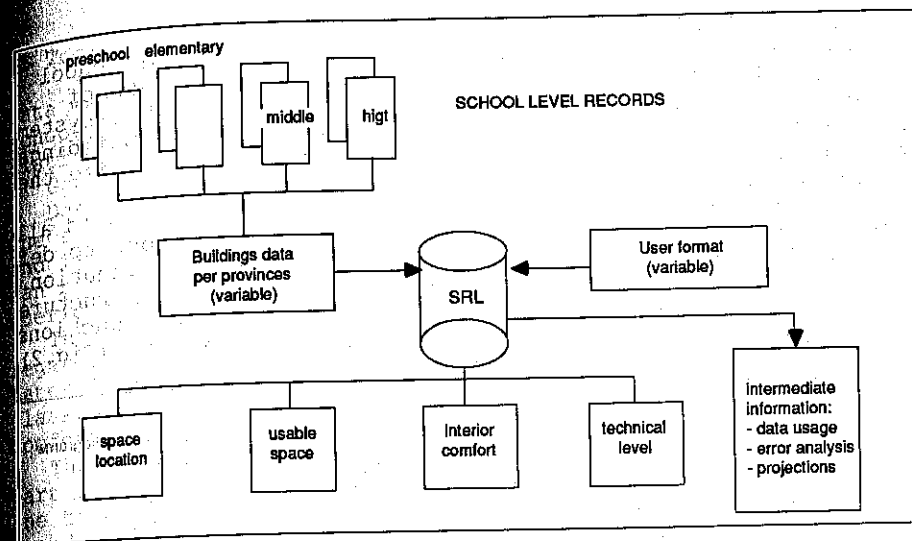


Fig.1. Phase 1 of the project

province. This made the data collected homogenous, simplifying the task of the official data owners ( Commune, Civil Engineers, Land Registry Office, Region Authority).

Through the SRL program it is possible to check the usage of data in real time. One can also perform error analysis using intermediate information and forecast data.

Data collection, one year from the beginning of the census, has covered 50% of the total region and has already been completed for some provinces.

Later we plan to acquire the regional base cartography through a GIS (Geographical Information System) referring to other projects started by the Regione. The geographical reference of the data, collected on school infrastructures in Phase 1, allows one to set up maps.

During the last phase of the project, different information on systems interacting with school infrastructures, is integrated with our system.

In the micoanalysis step information modules, function and data of interest for the macrolevel of systems interacting on the territory are pointed out. The goal is to merge into the GIS other data bases: regional national or external sources. We distinguish classes of data concerning:

- Administrative boundaries (Town General Planning, etc..)
- Transportation infrastructure
- Infrastructural network (roads, highways, railways, etc.)
- Antropic social and economic data
- Environment.

Availability of data in the classes mentioned above leads to a more complete analysis and better planning. For instance priorities can be established on action to be taken on

historical buildings based on environmental data. The system supports studies on optimization of school location in relation to school age population, rate of population growth and transportation facilities. The system can be used to forecast future usage of existing buildings that plans can be made to build extra space or utilize the existing one differently.

By providing a relational data base, the GIS should allow one to monitor the system of schools in the region: to develop priorities and to stimulate and control complex situations in the territory involving schools and related infrastructure.

The system can be used to integrate different functions and computer technologies of the region Authority. (Fig.2)

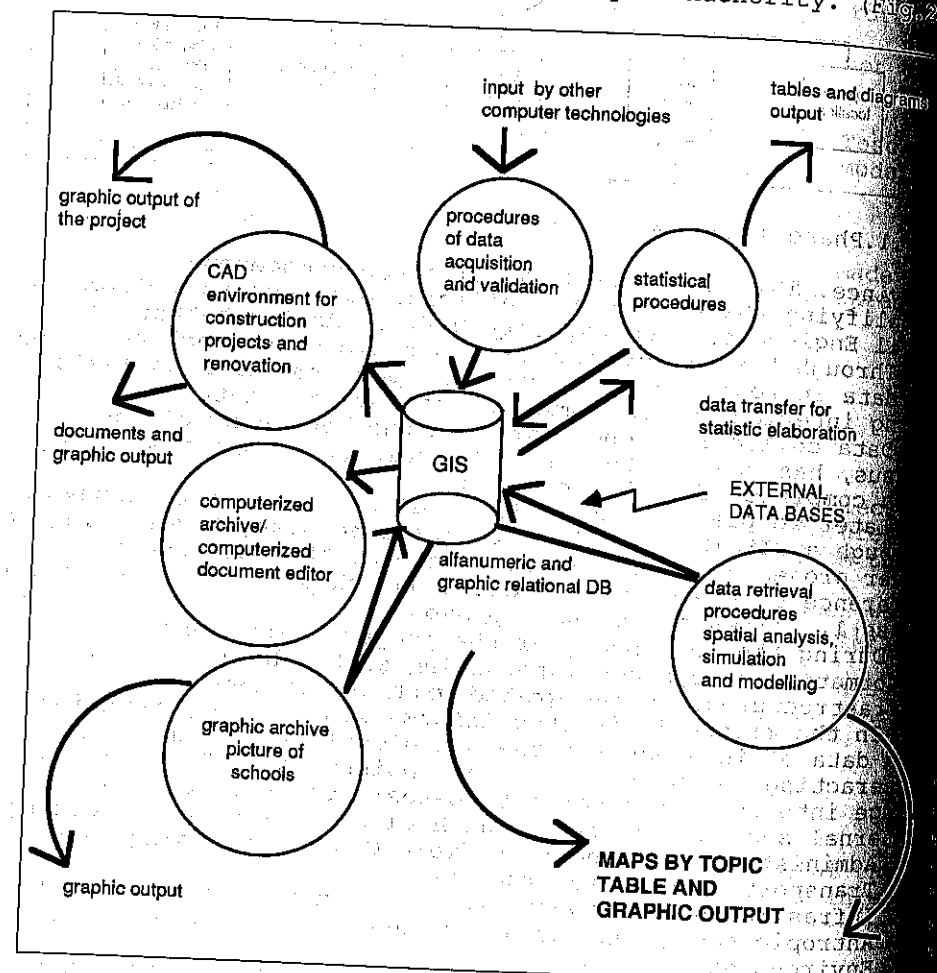


Fig.2. Functional scheme of the final configuration of the system

**Tools used in data collection.**

Data was collected using a different set of records for each school level (preschool, elementary, middle, high). We distinguish two types of data:

- General data of identification and location
- Data specific to a school level.

The first field of the record is common to each school level and is the key to get a specific record. However retrievals can be made using any field of the record through specific procedures.

The first field of the record contains information regarding name, location and age of each school building. Other fields contain information on quantity and quality of classrooms and other facilities. We can also find data on location of such spaces.

The data on location allows use of the data base on the part of thematic map makers. Data on quality of spaces allows to evaluate conformity of each school to national standards, particularly for buildings dated before 1975.

Data on special facilities (gyms, parks, parking lots etc.) allows one to evaluate the quality of school and the area where it is located on the urbanistic point of view.

Data on technology used to build the school and data on its preservation allows one to evaluate the level of maintenance. This data retrieved jointly with data on comfort gives an objective analysis of quality.

Data bases are open and updatable, particularly for data concerning maintenance or update of buildings based on new regulations (e.g. fire security, handicapped access).

**Conclusions**

The system helps evaluations on a global as well as local level. On a global level the system helps production of maps on the relation between schools and territory; for example:

- Ranking of school buildings belonging to the excellence area or to the guardianship area, or to the area not in accordance with norms (i.e. school buildings where living standards are not acceptable);
- Highlights or bad environment for school buildings;
- Visualization of user classes for different school levels;
- Maps of historical buildings used as schools;
- Etc.

On a local level the system helps to come up with project for future construction or update. For example:

- Definition of building profile (made by dimension, functionality, comfort etc.);
- Evaluation of how accessible schools are
- Etc.

Comparison of such data with data concerning experimental

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programs may become a very important factor on decision making.

The data base, as used by an information system geographically related may help law and decision makers at different levels:

- Region Authority for planning and programming
- Provinces and Communes for actual actions;

further the Provincial Education Offices may decide experimental programs on a realistic view of the infrastructural support.

In conclusion the System provides to the community that totally changes the traditional approach. From a posteriori control system to a-priori support system designed in function of projects in the sector and providing quality control on future decisions.

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## Comfort and new strategies for passive solar buildings

E. de OLIVEIRA FERNANDES

**Abstract:** The concept of passive solar buildings has evolved significantly during the last twenty years. In the early 1970s, the focus was placed upon solar energy collection and storage for heating purposes only, and the dominating perspective was the substitution of conventional energy sources and equipments. The main motivation was in residential buildings. While centered on (solar) technologies, that approach to improve indoor environmental conditions was too far from the highly sophisticated technological approach represented by the use of air conditioning for producing comfort.

Today's quick pace of change has however contributed to make those two worlds much closer than one could imagine at first sight. The growing consideration given to different types of passive non-residential buildings, many of which equipped with some type of air conditioning system, and the fact that air conditioning systems are being themselves identified as sources of contamination for both indoors and outdoors, converge to suggest reductions in auxiliary energy systems both in terms of dimension (power) and use (energy).

This paper will discuss the implications of comfort on the strategies for building design along the ideas discussed in the previous paragraphs, with a special emphasis on nonresidential buildings.

**Keywords:** Comfort, Passive Solar Buildings, Building Design, Energy Conservation in Buildings.

#### Introduction

Today's the design of passive solar buildings requires much more than just having the "know how" about solar technologies.

On the one hand, solar technologies, solar components and solar systems cannot be separated from the building itself, i.e., from its architecture; and, on the other hand, the main system to be considered is precisely the