

Portugal SB07

Sustainable Construction

Materials and Practices

Challenge of the Industry for the New Millennium

edited by

Luis Bragança

Manuel Pinheiro

Said Jalali

Ricardo Mateus

Rogério Amoêda

Manuel Correia Guedes

Part 1



Universidade do Minho



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PORTUGAL SB07
SUSTAINABLE CONSTRUCTION,
MATERIALS AND PRACTICES
Challenge of the Industry for the New Millennium

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and

Manuel Correia Guedes

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Foreword

The international conference “Portugal SB07: Sustainable Construction, Materials and Practices - Challenge of the Industry for the New Millennium” is organised in the scope of the International Initiative for Sustainable Built Environment (iiSBE). This event is supported by the Portuguese Presidency of the European Union during the second half of 2007 and by a range of international organisations such as CIB, UNEP, SD-MED and COST / European Science Foundation.

This international conference is part of the SB07 regional/national event series and as such constitutes also a preparation for the 2008 World Sustainable Building Conference to be held in September 2008 in Melbourne, Australia. The venue of this conference is also relevant, as it is the first international conference on this topic to be held in Portugal. The organisers hope that this initiative will promote further the sustainability of construction industry and the built environment, consequently, contributing to further sustainable development of Portugal and the other participating countries.

The construction industry is a vibrant and active industry representing approximately 10% of Portuguese GDP. The building sector is responsible for creating, modifying and improving the living environment of humanity. On the other hand, construction and buildings have considerable environmental impacts, consuming a significant proportion of limited resources of the planet including energy, raw material, water and land. Therefore, the sustainability of the built environment, the construction industry and the related activities is a pressing issue facing all stakeholders in order to promote Sustainable Development.

The new millennium is challenging practitioners and researchers with the sustainability of the built environment and the construction industry. Hence, the main purpose of this conference is to discuss these challenges and look for solutions that actively facilitate and promote the adoption of policies, methods and tools to accelerate the movement towards a global sustainable built environment.

The intention of the organizers is to give an opportunity to practitioners, academics, scientists, engineers, architects, contractors, manufacturers, owners and users from all over the world to come together in a pleasant location to discuss recent developments in the field of sustainable construction, materials, practices and construction sustainability assessment.

The conference main topics cover a wide range of up-to-date issues and the contributions received from the delegates reflect critical research and the best available practices in the Sustainable Construction field. The issues presented include:

- Building sustainability assessment tools
- Indoor environment quality and benchmarks
- Sustainable resources and materials use
- Use of non-conventional materials
- Use of industrial waste
- Eco-materials and technologies
- Sustainable management of existing building stock
- Innovative sustainable construction systems
- Design for climate change
- Design and technologies for energy efficiency and conservation
- Design for minimizing and using construction and demolition waste
- Design for service-life
- Design for deconstruction

- Design for flexibility
- Use of IT in design
- Closing the loop
- Actions and policies to implement sustainable construction
- Designing the sustainable city of tomorrow and Urban Sustainability
- Planning aspects for sustainable construction (construction site, procurement and commissioning)
- Integrated decision making process
- Biomimicry and design with nature
- Teaching sustainable construction
- Case Studies

All the papers selected for presentation at the conference and published in these Proceedings, went through a refereed review process and were evaluated by, at least, two reviewers.

We want to thank all the authors who have contributed papers for publication in the proceedings. We are also grateful to the reviewers, whose effort and hard work secured the high quality of papers expected for this conference. Their efforts reflect their commitment and dedication to Science and Sustainable Construction.

We want to thank the support given by InCI (Instituto da Construção e do Imobiliário) that sponsored and made possible the international edition of these Proceedings.

Finally, we want to address a special thank to iiSBE, CIB, UNEP, Ordem dos Engenheiros and SD-MED and wish great success for all the other SB07 events that are taking place all over the world.

The Organizing Committee and Proceedings Editors

Luis Bragança (University of Minho)
Manuel Pinheiro (Instituto Superior Técnico)
Said Jalali (University of Minho)
Ricardo Mateus (University of Minho)
Rogério Amoêda (University of Minho)
Manuel Correia Guedes (Instituto Superior Técnico)



Welcome

The strategy defined by the Portuguese Government for construction and real estate is based in sustainable concepts, optimizing the State regulatory functions in view to reduce bureaucracy, improve processes transparency, strengthening cooperation and guarantying an effective co-ordination in the definition and implementation of Government Program policies.

As a result of the above mentioned strategy, the Portuguese Government recently assigned a new mission and new challenges to InCI - Instituto da Construção e do Imobiliário, I.P. (Institute of Construction and Real Estate).

The mission of InCI, I.P. comprehends the regulation of the construction and real estate markets being the new challenges the promotion and implementation of solutions that achieve sustainability priorities, reduce environmental impact, enable energy efficiency in buildings, contribute to energy and environment certification, improve the rational use of materials and the construction waste management in Portugal. Summarizing, InCI, I.P. has an ambitious and challenging aim that is the modernization of the Portuguese construction sector contributing to the efficiency and sustainability of construction in general and of buildings in particular.

The aims of InCI, I.P. are fully in line with the scope of the conference “Portugal SB07: Sustainable Construction, Materials and Practices - Challenge of the Industry for the New Millennium” and, therefore, participating in the edition of these Proceedings is a contribution to positively changing the construction industry towards the adoption of sustainable and efficient building practices.

InCI’s support will also promote the opportunity to increase awareness and interest among the economic operators to the issues related to sustainable construction, through the exchange of practices, experiences and information.

It is with a great pleasure that InCI, I.P. warmly welcomes all the participants and wishes a great success to the Conference Portugal SB07.

The Executive Board

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Sustainable recovery approach to the existing housing stock in Italy

P. Civiero

Ph.D, CITERA - Centro "Interdisciplinare Territorio Edilizia Restauro Architettura", University of Rome "La Sapienza", Rome, Italy

ABSTRACT: The current Italian situation in the pre-existing building sector and the forecasts for its future lead to reflections on aspects of the wider European picture that might help us better understand future patterns in our national context. The theme of adapting residential buildings, which have been built using non-traditional methods, demands in particular both an overall vision of the strategies to use to carry out intelligent interventions, and a methodology that leads to the achievement of aims that are coherent with the concepts of sustainability.

1 INTRODUCTION

The priority in the next few years, or the next few decades, is confirmed by the way the construction market is shaping up: a more rational use of urban resources in the pre-existing residential sector.

Of particular interest from this point of view is the recovery of materials used in building that were made with industrial and prefabricated technologies that, despite their comparative newness, demonstrate an advanced degree of deterioration, and which require not only serious remedial work at the level of the buildings themselves, but also the cleaning up of whole urban areas, along with the development of infrastructures and related services.

This is recognised as a prevailing aspect in different European contexts, where it is possible to carry out a meaningful comparison with the situation in Italy with regard to the conditions, spread and reasoning that led in the 30-year post-war period, with slight variations on this time-scale, to the creation of the majority of the residential property that exists today. The indications, both theoretical and practical, for interventions stem above all from a number of phenomena which appeared over the last few decades and which can be summed up as follows:

- the movement from a culture of expansion to a culture of redevelopment, especially in Italy, caused by a lack of demographic pressure and by the substantial dimensions of the building stock which benefited from maintenance work: in synthesis, the normal procedures for planning and operating should be in line with the notion that the spaces that, in the future, are going to house a large part of residential property and workspaces already exist;
- the appearance of serious signs of deterioration in the building stock from only a few decades ago, which led to the term "architecture of deterioration" being coined, has already become an emergency which imposes the need to carry out enormous building redevelopment and salvage operations, which pose technical, planning and methodological problems which are quite different from those that had to be confronted when dealing with historic town centres or buildings of historical importance;
- the substantial distance which, in the past, has separated the planner from the resident, along with the misunderstanding of the freedom of expression and to experiment of the former, and

- the results of this on the latter, the inhabitants, who didn't have the same freedoms and whose background, cultural roots and needs were ignored;
- the possibility of analysing the building that's to be redeveloped in a profound way that's not destructive, and so to intervene on the same with appropriate means, also employing highly innovative planning techniques, which are thus able to find their points of reference not so much in the expansion of a building or in replacing old with new, as in a more considered re-reading of what's already there, in the ongoing work of the functional adaptation of a physical reality.

2 SUSTAINABLE APPROACH

That which might have represented a critical reflection on the means of constructing quarters and buildings in the past instead comes to constitute the starting point for focusing on the problem of sustainable redevelopment.

In reality, as borne out by the valid results of a number of projects both at a national and European level, refurbishment interventions have to be the consequence of synergy and collaboration between various sectors, sciences and fields of knowledge: sociology, economy, urban planning, engineering and law have to be managed and made to work with each other. All the same, the increasing degradation of these buildings demands – both for how widespread it is and for the seriously obsolescent conditions in which they find themselves – a rapid reaction followed by action, and the identification of a tried and tested strategy able to limit as far as possible an eventual loss of control that would render future events unmanageable.

Contemporary renovation experiences in Italy underline both the problems encountered in other countries as well as the shared need for a sustainable approach to what already exists. The principal difficulties that will be encountered can doubtless be blamed on the deterioration of the buildings, but, there are also problems in the management and financing of interventions.

A number of organisations in Italy, such as ATER (Azienda Territoriale per l'Edilizia Residenziale – Regional Residential Buildings Company) of Rome, are only now launching new strategies for carrying out redevelopment programmes, and turning to Project Financing – as allowed for in Legislative Decree 163/2006 (Code for public contracts relating to works, services and supplies in carrying out EU directives 2004/17/CE e 2004/18/CE) – making the most of the potential benefits that would come from the running of the production of renewable energy sources, especially solar power.

Management represents, therefore, faced with projects and existing plans for recovery, one of the essential conditions for the activation of a process of renewal of building stock which has been long-awaited and hoped for in our country, but which up to now has not taken off.

If, on the one hand, many experiences favour turning to the external upgrading principally of building envelopes using add-on or substitution strategies, and with modifying internal living spaces, the lack of a consolidated redevelopment culture reveals itself. Interventions, mostly carried out on time, are still lacking at the level of correct planning both nationally and locally.

This incapacity is doubtless exacerbated by the greater percentage of owned rather than rented property, which is largely down to previous policies for running the public housing stock, which were subsequently revealed to be mistaken and which, in some way, limit the possibility of planning new interventions, even important ones, to demolish or redevelop for a different use, as instead happens in other European situations. A consolidated culture which aims more at conservation rather than renewal such as we find in Italy still lacks the inclination and experience to be able to confront in a decisive and knowledgeable manner an overall modification in residential buildings.

2.1 *Sustainability or energy efficiency*

Before looking further at the theme of sustainability in recovery interventions, it's useful to clarify a number of differences inherent in the concepts, which are often used incorrectly, of sus-

tainability and energy efficiency, and which might create misunderstandings even among those who work in the field.

In the original concept of sustainable development, from which was born in 1992 Agenda 21, the environment was placed at one of the corners of an ideal square, whose other corners were occupied by the economy, social background and culture. Such a concept, expanding its areas of concern, led to an interchange ability among applied research sectors, underlining the need for an ever more integrated and complex approach to the project. Thus the notion of the environment as oppositional force and a brake on economic and social development was overcome, but it placed itself as an essential element which had to be the starting point for long-term progress that won't compromise the survival of the planet and the life of future generations.

This definition of sustainability constitutes the starting point, the reference, the framework and the expression of the principles within which the international community, nations and local authorities are moving, taking it on as a fundamental aspect in the process of governance and in the decision-making processes for the development of a given area.

Energy efficiency, on the other hand, is a specific aspect of sustainability and therefore has to be considered as a prerogative for interventions but not as the single all-inclusive element to be aimed for. With the Legislative Decree 192/2005, the EC directive 2002/91/CE was introduced into Italy, which controls the production of energy in buildings. The provision establishes, among other things, the criteria, conditions and means to improve energy performances in buildings with the aim of favouring development, increased value and integration of renewable resources and energy diversification.

European directives and national laws are intended therefore to increase energy efficiency and improve its availability, defining measures aimed at promoting and developing, including at an environmental level, the generation of high levels of heat and energy, based on the demand for useful heat and on the saving of primary energy, with particular reference to national weather conditions. Apart from the new element foreseen by the Italian Law no. 296 of December 27th 2006 (Budget 2007), on February 2nd 2007 the Legislative Decree 311/2006 came into force which alter the Legislative Decree 192/2005 and extends, starting from July 1st 2007, the obligation for energy certification to existing buildings of over 1,000 sq.m and further increasing a number of regulatory values.

It's in this sense that the adopting of European Directives at national level with the Circular of 31/05/2007 no. 36 which fixes at 55% the tax relief for energy redevelopment interventions on existing buildings (from which stems the Decree of February 19th 2007 which modifies article 1, subsection 344, of the Law of December 27th 2006, no. 296), aimed at obtaining an index of energy use in the winter at least 20% lower than previous values. Particular attention was again paid to interventions on the envelopes of existing buildings with regard to opaque horizontal and vertical structures, frames, delimiting heated volume, towards the exterior and towards unheated spaces, defined in respect of new thermal transmission values U , expressed in $W/m^2 K$, relative to the six climatic zones Italy is subdivided into.

The buildings involved have to be pre-existing, and the incentive is aimed at strengthening those procedures which seek to preserve the building heritage, raising the tax relief and reducing the number of years it has to be divided over. The European advice of spring (OR. EN 7224/07 of March 8th 2007) gave a further push to the European policy against climate change, underlining the close interdependence between energy policy and the leading role of the European Union in international climate protection, in view as well of the system that will replace the Kyoto Protocol in 2012. In this sense, in both the European advice and the application of the recent decree granting incentives for photovoltaic activities, the aim of growth in renewable energies is made explicit and requires 20% of total EU energy consumption to be renewable by the year 2020.

With the launch of this programme, a number of provincial and local organisations, including Rome City Council, have already set in motion significant works in the field of energy redevelopment in existing buildings and in new builds, introducing variations and integrations to the Provincial and Council Building Regulations with laws for saving energy, the use of renewable energy sources and the saving and recovery of water resources.

The picture is made even more complex by the specific intervention programmes for energy redevelopment which control and define the granting of funding on the part of the European Community. Among these, Jessica (Joint European Support for Sustainable Investment in City Areas) constitutes the recent European support for sustainable investments in urban areas. This programme foresees the gathering together of grants aimed at programmes of urban redevelopment and development (including the social housing sector), with loans and financing that stem from a partnership between the Commission, BEI and the European Council Development Bank.

Against this background, recovery activities underline the relevance of the redevelopment of external closures (envelope) even with the knowledge that, despite the value of its planning characteristics – as much in respect of requirements linked to image and communication of the buildings as of those connected with environmental comfort and energy consumption – the specific intervention on the envelope has to be the result of synergies and actions of greater depth than those described above.

There's no doubt in fact that it's not sufficient to redevelop merely the envelope without reorganising the internal spaces on the basis of new needs, without reordering or projecting the viability, the running and the use of the external spaces and the balance of the whole set-up. The recovery of residential buildings cannot however remain a problem whose solution is to be found only at a planning-technological level, but it has to start to bear in mind social dynamics, changes of use and variables in scale (from the surrounding area to the building), which has implications for the architectural and construction impact of buildings, for environmental resources (space, materials and energy), for the image and on the social structure of an area.

The testing ground is therefore an intervention on an existing building capable of combining both the typological-distributive aspects as well as those of building technology: in many Italian cities, but especially abroad, experiments have been carried out which, with varying results, have involved public and private bodies working together with a common aim. In the context of building redevelopment, what is emerging is the need to identify means and operational instruments aimed at the tightening up of the physical, technical and user efficiency of the building organism and/or some of its parts, and the integration of any missing functions. Results so far, although often very interesting, cannot be reliably reproduced in different contexts.

The search for coherence between the need for the recovery of buildings and the sustainability of interventions on buildings highlights the theme of correct technical information and of methods aimed at choosing the most suitable strategies and instruments for the task in hand.

Recovery activities for existing building stock necessarily move from the starting conditions of the object to be worked on and from a structural organisation of the architectural organism according to the subdivision of subsystems, technical elements and materials.

What's necessary, therefore, is an approach to the project based on a needs-planning approach that permits the analysis of the level of deterioration and obsolescence of the existing building and which justifies and guides what to do next: a complete diagnosis that permits the identification of residual performances, of pre-existing obligations and of the picture of the new needs, so as to clarify the requirements, priorities and objectives of the project.

The principle prerogative for a coherent carrying out of redevelopment interventions is therefore the use of a methodological-operational set of instruments by which the activities to be carried out can be aimed, encouraged and controlled, and, in particular, a:

- definition of the technological units and technical elements which, inside the technological system of residential buildings, constitute the envelope of the building system under analysis;
- definition of qualitative parameters aimed at guiding the recovery project for residential buildings, and the formulation of a means of control and evaluation of the quality of the pre-existing and of the final quality achieved through the project on the building;
- initial evaluation of a picture of needs which will be used to define the priorities and aims of the project;
- definition, establishing and valuation of the needs related to the external envelope where the interventions will be carried out;

- identification and organisation of the technologies available on the market that are best suited to the redevelopment of the external envelope.

What this means, specifically, is the elaboration for each intervention on a pre-existing building of a “knowledge project”, a system of information closely connected to the context under analysis and capable of confronting it in all its complexity: in this way a planned project is imposed, one that is articulate, open, and multidisciplinary, with the aim of being able to determine its own reorganisation as further information is acquired.

In the light of recent experiences in redevelopment, the success and difficulty of an intervention consist in the capacity of the project to link with the qualities which the extant building already offers and which, on a case by case basis, will be preserved, improved or integrated.

Given the relevance and complexity of the concept of quality – an indispensable given for any project on a pre-existing building – it’s opportune to investigate the attributes that distinguish it within of the entire useful life of a building, both in relation to the process that characterises redevelopment, as well as the final verification of the end result of the recovery and its relation to the original stated aims. The principal of responsibility, in light of the transformations that are of interest to contemporary society, contributes to amplify the content and forms of the planning reflection and encourages the reconsideration of local situations which lessen the dependence on standardised technical solutions and housing models, but which continue to look for coherent solutions in technological potentialities and the living cultures of the areas.

A complete approach to the theme of redevelopment involves a complex approach to the aspects which contribute to the satisfaction of expressed or unexpressed needs; the capacity of planners will therefore be that of identifying the correct solution that’s able to resolve the instances linked to the themes of quality that are raised by all those who come to be involved in the recovery process. Alongside the identification of elements on which to intervene we therefore have to place the need to make explicit and fully satisfy the qualitative aspects that have to be observed. The concept of quality is intended in a very wide sense and includes all those aspects that make a building work suitable for the needs and activities of those who use it. This complexity leads to the search for a multi-criteria method which has the aim of confronting together factors of a different, multidimensional and not always measurable nature. It follows that the requirements be classified according to a complex scheme, in relation to and in order of quality, attributes or properties, by means of the performances offered, and able to satisfy any requirements that emerge.

The qualitative parameters, although they may come to assume variable levels of importance and weight, represent the fundamental decision-making input of the project which can be translated into different solutions for different environmental realities. If all this is evident in a new build, the problem is even more present in the process of recovery, where the inter-relations between pre-existing technologies and new requirements underlie different intervention strategies that are capable of leading to integrated and durable building projects. The aim of the initial diagnosis is therefore to direct the decision-making process and to provide elements of information aimed at motivating and guiding the choices to be made. The correct predisposition of the diagnosis furthermore allows the reading of recurring interventions, of a spontaneous nature, produced by the users over time, which represent both the highlighting of a number of problems that are linked to obsolescence and also a powerful push which shouldn’t be overlooked in the planning phase because it demonstrates the true “*Habitus Habitandi*”.

In this sense *habitus* represents, on the one hand, the clear frame of reference to identify and, on the other, the solid scientific basis which, taking into account all the environmental, technical, social, economic, management, legal, historical and cultural related aspects, renders itself necessary to look more closely at the state and conditions of the technological, physical and economic obsolescence of buildings. The finely balanced debate on the need, on the one hand, to evaluate and, on the other, to translate the notion of quality into terms that are never less than objective and legitimate, can only be achieved by a systematic approach and a continuous and gradual movement towards actions that are particular to each transformation, seeking out, nonetheless, the minimum common denominator in the process of the experiences.

2.2 *Instruments for a project of sustainable redevelopment*

The definition and evaluation of recovery interventions to be carried out are two extremely delicate activities because a construction and the environment in which it is to be found form a complex system where all the subsystems influence the total efficiency systems and where the interdependence between subsystems has an important role.

A great deal of research and study has been carried out in recent years in an attempt to focus and control redevelopment interventions in order to guarantee acceptable levels of quality that are in line with the various disciplinary requirements.

The first recovery programmes based on a sustainable approach of this type were born in France in 1972 and promoted by HVS (Habitat et Vie Social) availing themselves of a decision-making system (DSS) and network systems to enable global functioning. The *neural network* is a further method of evaluation which, following the function of the human brain, is able to receive data and, at the same time, the previously available and recognised connections between the elements.

It was on this basis that in Europe the first methodologies for evaluating redevelopment interventions were born – like that used for assigning the NPR (National Prjis Renovatie) – which makes use of a methodology of multi-parametric analysis. Defining recovery as an integrated system, it's very evident that there are many neural routes that can be identified and analysed, but what still hasn't been completely attained today is the global recognition of the elements to observe and of the network of connections between them.

The results that were provided in the WG2 research – in the recently finished Action COST C16 - reinforced the judgment on the individuality of every redevelopment project while pointing out that there are recognisable strategies of intervention that can be adopted. In the research, the problems related to needs were analysed, taking further the multi-parametric analysis that was applied to the themes of redevelopment in the different countries taking part. The research, furthermore, confirmed the difficulty of identifying a single planning solution that would, on the one hand, be capable of answering all the observed indicators, and, on the other, reach a degree of quality that would prove satisfactory to all the countries involved.

The theme of control and leading a project is further supported by a number of instruments of particular interest that derive from the latest research at a European and national level. Among these we find EPIQR (Energy Performance Indoor Environment Quality Retrofit) and TOBUS (Decision-making Tool for selecting office Building Upgrading Solution) – which are two research projects of the JOULE programme of the European Commission which have provided the basis for a new generation of instruments to assist in sustainable redevelopment interventions. The principal aim of this research was the development of an instrument – whose EPIQR software is the most evident example – aimed at evaluating retrofitting strategies, costs, and the activities aimed at satisfying those needs whether from the point of view of optimising energy consumption, the use of renewable (solar) energy and the improvement of the internal environment (Indoor Environment Quality). This instrument also permits the analysis of the physical deterioration of the building, the cost of the recovery intervention, the technical feasibility, the energy costs, the indoor environment quality and the predicted development of the deterioration, placing the emphasis principally on the energy question which is set at the centre of the decision-making process right from the start of the project, and therefore before the definition of the initial investment budget.

Still in a European context we recall the HQE²R Project financed by the European Union within its Energy, Environment and Sustainable Development Programme of the V Programme R&D and coordinated by the CSTB. This project involved 7 European countries – including Italy – with the objective of defining a method to direct recovery projects towards solutions that aim towards an improvement in the quality of urban life: in other words, redeveloping the city from an environmentally sustainable point of view. HQE²R, which was launched in 2001, has supplied, to public administrators and workers in the sector, suitable instruments for evaluating the possibilities of recovering the built environment, starting in terms of sustainability of existing buildings, which have to be well-integrated into their area and which will contribute in time

to forming its identity. The peculiarity of the approach suggested by HQE²R lies in the four principle phases that make it up:

1. Decisions: preliminary identification of the problems and initial strategic decisions;
2. Analysis: gathering data (inventory) and diagnosis of possibility for sustainable development;
3. Study of the action plan: creation and evaluation of alternative scenarios;
4. Action and evaluation: implementation, monitoring and evaluation of the action plan for the sustainable recovery of the area.

The elements of sustainability which have integrated the methodology of evaluation are further:

- the improvement of the quality of the building with regard to the qualitative and quantitative requirements defined by the users and administrators, in particular with regard to improving comfort, a reduction in running costs and the maintenance of residential (and non-residential) buildings – saving energy, reducing water consumption, better use of primary materials
- the improvement in the quality of life thanks to a process of urbanisation that is respectful of the environment (criteria for organising public spaces, play areas, cycle paths, pedestrian and/or green areas, bus lanes) and a correct urban redevelopment of conurbation spaces;
- the control of mobility costs by means of economic and environmental management of the urban space to control urban mobility at different levels (quarter, city, conurbation).

It's in this sector of research and experimentation that we also find the efforts of the Italian Institute ICIE (Istituto Cooperativo per l'Innovazione) which, since the '80s, has been studying the field of conserving the building stock, and which has invented and defined working instruments for the analysis and management of the built stock, intended as a "complex system", as a connected tissue made up of buildings, the spaces between them, equipment and service networks, where it is possible to operate in synergy and in an integrated manner.

2.3 *Multi-criteria analysis*

We've been able to observe how the decision-making system in relation to the transformation is influenced by multiple factors which we can define as level 1 (related to the deterioration and obsolescence of a building and the quality of its internal environment) and level 2 factors (environmental, social, temporal and economic). The distinction between the two levels, however, isn't sufficient to completely define the objectives of every single intervention: the objectives will depend in fact of the starting level of quality that's encountered and on the priorities at the outset for the definitive imposition of action.

Compromise, a fundamental means to identify an efficient solution, is to be sought in the typologies of social, technical, environmental and ecological factors, without overlooking the quality of the internal environment (such as dampness, acoustic isolation, comfortable levels of heating, air and ventilation quality, lighting, security) and of the external environment which should be pointed towards the user in so far as they are the beneficiary. Quantitative and qualitative information, which involves building systems and subsystems (described in units of measurement, value and initial conditions), completely define the reference variables on which to intervene through analysis, methods of verification and criteria for determining their value and importance. The theme of quality, therefore, in the intervention requires a clear carrying out both of all the aspects – measurable or not – and of their relative minimum values of acceptability, as well as a definition of the intervention strategies and the technical elements on which to intervene. The indicators, once they've been identified, form a whole which is able to structure the requisites that will be more able to interpret the needs that emerge and through which it'll be possible to verify the residual performances. Each of these, resulting from the analysis of problems that arise, is made up of subcategories which, in a more detailed and precise manner, define the performance deficits that are encountered, and, at the same time, represent the decision-objective inputs of the intervention.

The methodology described above was analysed and applied – in the context of research for a doctorate in Redevelopment and recovery at the Faculty of Architecture "Valle Giulia" of "La Sapienza" University of Rome – to a redevelopment intervention on a number of buildings in the residential complex "Le Navi" in Florence. The methodological-working instrument used in

the research confirmed the validity both of the multi-parametric approach as well as of the qualitative results obtained through the intervention. Furthermore, the research reinforces the recognition of the coherence that exists between the qualitative aspects asked for and the solutions adopted, underlining the pre-eminence of the economic aspects in achieving the aims, but, at the same time, the knowledge that economic investment represents a fundamental parameter, but not for this reason one that should interfere with the possibility of an intervention. The instrument that's been arrived at, which doubtless needs to be adapted for future applications to other case studies, underlines on the other hand, the necessity, which we referred to above, of that continual and gradual movement towards the reality of actions that are peculiar to each transformation, seeking the common denominator in the approaches adopted, but recognising at the same time the uniqueness of each of these.

Today, but even more in the future, these residential complexes are and will be a part of history and, as such, we are responsible for their potential to a greater or lesser degree. Common needs of the past were faced up to in this way, with no regard for and not giving body to the culture and habits that are part of living somewhere. The relevance of these considerations calls for the need for a planning culture which avoids the possibility of falling again into the same traps as in the past.

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