ACTA SCIENTIFIC AGRICULTURE (ISSN: 2581-365X)

Volume 3 Issue 1 January 2019

Review Article

The Italian Response to Sustainability in Built Environment: The Match between Law and Technical Assessment

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Received: October 24, 2018; **Published:** December 20, 2018

Abstract

During these last years, increasing consideration has been given to the concept of sustainability seen in a broad perspective, including several fields of the human activity. The construction industry represents one of the most important sectors to focus on in terms of sustainability; therefore, its main challenge nowadays has shift from a quantitative to a qualitative aspect of the production. This happens at both international and national levels; still sustainability is an issue that has a relative weight, depending on the specific needs of the area, the political choices of the country and its socio-economical background. The paper analyzes the Italian framework both in terms of law and technical assessment of built environment sustainability. Section 1 shows how nowadays the inner political line and membership in the European Union lead Italy to focus on improving the quality of the buildings: such quality concept could be called "sustainability", since this word includes various dimensions. Section 2 technically explains the environmental, social, and economical dimensions of sustainability and the attempt to balance them in a holistic perspective. Section 3 depicts the legislative approach to enhance sustainability. Section 4 focuses on the Italian background with its recent regulatory changes, which have introduced the mandatory application of the MEC (Minimum Environmental Criteria) in public buildings construction.

Keywords: Minimum Environmental Criteria; Sustainability; BIM Approach

Introduction

The construction industry represents one of the most important sectors to focus on in terms of sustainability, since it is responsible for 50% of the resources that humans take from nature and for 25-40% of the overall energy employed [15]. Therefore, contrary to the trend of the 50s, when, in the after war, the main pulling action of the construction market was the need of rebuilding and providing essential facilities to population, discarding "ornamental" issues as sustainability, nowadays the main challenge the construction industry must deal with has shift from a quantitative to a qualitative aspect. The inner political line and membership in the European Union lead Italy to focus on improving the quality of the buildings: such quality concept could be called "sustainability", since this word includes various dimensions: environmental, social, and economical. The concept of sustainability itself has been the subject of a shift of meaning: from the simple environmental protection concept to a guarantee of general quality including - besides the traditional environmental impact - the concepts of "economy" and "social well-being". Another improvement of the concept of sustainability has been done from the legislative point of view, thanks to "the switch from reactive, national, single-issue and government driven environmental protection approaches based on end-of-the-pipe solutions towards an active, international, multi-criteria and stakeholder driven sustainability approach based on integrated solutions" [7]. Then, achieving a sustainable built environment is a technical and a legislative matter; both the aspects should meet each other in a link of reciprocal communication and input-output relation. Law and technical assessment must proceed in a parallel way: therefore, in this document is given a first feel of what sustainability means and how it is translated in law and assessment tools. Nowadays - by means of a combined action of the law and the technical tools - the main scope in sustainability thinking is to provide a system useful to collect, organize, quantify, and report information and to develop a decision-making process intended to make the building sustainable at each phase of its life cycle: design, construction, operation life, and end of life (reuse, recycling, or demolition). In this perspective, it is possible to observe

two different trends: on one hand, it is registered a great number of indicators from different operators of the built environment, making the matter complex and diverse; on the other hand, they are working to simplify and organize the matter in order to achieve a common understanding and usability [3].

The technical approach to sustainability parameters

The concept of sustainability includes different dimensions; nowadays, the literature agrees on defining three mains of them: environmental, social, and economic. This complicates the decision-making process, especially when it comes to adopting a ho-

Environmental Dimension	
Traditional concept of sustainability, focusing on the natural environment	
Peculiarity	Qualitative assessments (descriptive) o Affected by boundary conditions o Results lacking an objective scale o Useful for preliminary assessment o Modelled considering the construction process as broken down into a sum of energy and material flows Quantitative assessments (calculative) o Computer-based tools o Many information and well-defined boundary conditions required o Life Cycle Assessment (LCA): it should assure a holistic approach (all the phases, input output)
Issues	o Climate change o Emissions to the air, water, and soil o Water efficiency o Resources depletion
Economic Dimension	
Total costs of a system or product produced over a defined life time. In construction context: overall assessment of the economic efficiency of building investments	
Peculiarity	o Life cycle costing: assessment of all costs covered by any actors in any phase o Complimentary inclusion of externalities o Database: cost comparisons relating to the specific type of building and target values
Issues	o Costs before building o Use operational costs o Maintenance costs o Costs after building use (residual value)
Social Dimension	
Impact of an organization, product, or process on society	
Peculiarity	Inside the building o Hydrothermal comfort: relative humidity, winter thermal performance, summer thermal performance; o Indoor air quality: suspension of particles; carbon; ozone; formaldehyde; organic volatile compounds. o Acoustic comfort: sound insulation; reverberation time. o Visual comfort: natural lighting use; illumination. o Outside the building o good integration of the building in the surrounding areas o during all the phases and in relation to all the stakeholders o Italy focuses on the recovery of degraded urban areas and the safety of work.

Table 1: Sustainability dimensions.

listic perspective and weight the indicators belonging to the different dimensions. Regarding the environmental dimensions, the established practice is the use of various Life Cycle Assessment (LCA) tools, the performance of which is regulated at international level by the standard ISO 14040 and 14044. The first defines the LCA as "compilation and evaluation of the inputs, outputs and the potential environmental impacts of a product system throughout its life cycle" [5]. Regarding the economic and social dimension, indicators and methods are easily detectable in qualitative way, but there are difficulties in defining them in quantitative way. Below are described and summarized (Table 1) the typical dimensions of sustainability.

Environmental dimension

The ecological assessment of sustainability has both qualitative (descriptive) and quantitative (calculative) methods. The qualitative assessments are often affected by some boundary conditions and limitations connected to the background; moreover, their results, lacking an objective scale, cannot be put in comparison. Despite the risk to get a non-meaningful system, qualitative methods are useful as a preliminary assessment of the project in the early design phases of the construction process, when the necessary input data for a quantified assessment are not yet fully available. However, such assessments are often modelled by considering the construction process as broken down into a sum of energy and material flows. This could imply the risk of breaking down the quality assessment as well, reducing it in a sum (maybe incoherent) of some planning aids like quality control seals, labels, recommendations, positive and negative lists, etc. [7].

Quantitative (ecological in-depth) assessment are possible only by means of computer-based tools, which require many information and well-defined boundary conditions. Nowadays, the main tools to assess the environmental dimension of sustainability fall within the Life Cycle Assessment (LCA), which evaluates the sustainability with some criteria and parameters, especially with regard to products and processes. In fact, these tools have been developed with a bottom-up approach, which means that the building is meant as a combination of materials and components. The positive aspect of the LCA-based tools is that they are thought to address the building as a whole and for this reason they represent a powerful support for decision-making [3].

Economic Dimension

The typical issues related to the economic dimension of sustainability concern the life-cycle costs, meant as the total costs of a system or product produced over a defined life time. In the construction case, costs before building use; operational costs, maintenance costs; and costs after building use should be considered; also the residual value should be included in the analysis [3]. Viewed the involvement of several stakeholders, the trend is to create databases updated by the government, the engineering/architecture associations, and other advisory bodies, so that the cost assessment phases can be based on cost comparisons relating to the specific type of building and the target values, useful to detect the typical consumption-related costs of water/sewage, heating/cooling and electricity [6].

Social Dimension

By social dimension of sustainability, it is meant "the impact of an organization, product or process on society" [7]. In the construction context, this is realised at two levels: inside and outside the building. Indoor items like the hydrothermal comfort, the indoor air quality, the acoustic comfort, and the visual comfort contribute to the wellness of the occupants [3]. However, the social sustainability has also an outdoor dimension, as good integration of the building in the surrounding areas, which means integration in the urban context, including the related needs and dynamics. The social issues relate to all the phases and all the stakeholders involved in the construction process: e.g. during the construction phase, attention should be given to forced labour, working hours, or existence of trade unions [7]. The selection of social criteria and their quantification is still one of the major challenges, since a variety of social objectives and indicators address many different topics, always changing depending on the specific case; for example, Italy focuses on the recovery of deprived urban areas and the safety of work, according to the peculiarity of its background.

Balance and integration of the sustainability dimensions

Ecological, economic, and social aspects can be assessed independently of each other, by using the established criteria; however, weighting the different criteria is a difficult task that requires considerable expertise (by employing simulation tools or database processing, by hearing experts' opinion, and so on). The task becomes even more complicated when the results of the three separate assessments must be integrated into the overall assessment of sustainability [6]. Moreover, the criteria not only must be weighted by themselves - within their own dimension - but must be weighted in relations to the ones belonging to the other dimensions. The main challenge is to develop and implement a systematic methodology supporting the design process of a building, while achieving appropriate balance between the different sustainability dimensions.

This holistic performance analysis of the built environment including the "soft indicators", i.e. the economic and social impacts, could be called Building Sustainability Assessment (BSA) [3].

The legislative approach to sustainability

After giving an overview about what the sustainability means technically, it is clear that the main principle of sustainable development is a matter of integrated decisionmaking, with the inclusion of the environmental, social, and economic spheres. Therefore, it is important to focus on the governance for sustainability realised through a "law for sustainability" able to provide essential tools and institutions for a structured sustainably plan. This means to include a wide variety of professional, academic, and geographic perspectives. The law and the governance mean to integrate the conceptual ideals and the practical procedures: "environmental, health, and safety regulation together with industrial, trade, and employment policies" [1].

Integration across levels of government is also important. In many cases, the laws issued for a specific sustainability objective at a higher level of government are completely separated from the actual needs at a lower level of government. The legislature should issue framework-laws encouraging plans that provide for local autonomy in matter of sustainability. "Across the world, subnational units of government-such as provinces and local governmental units - have substantial, if not primary, legal responsibility for issues central to sustainable development" [4]. These issues are very diverse and belong to several spheres: education, provision of water, land use control and many more. "The more granular scale of decision making at more local levels corresponds to the more granular scale of the problem. Better local land use and sustainability planning and decision-making can make communities significantly more liveable" [4].

However, "there seems to be very little understanding or coherent thought about what exactly sustainable development means and its role in governance" [13]. Nowadays, across the world, three main models for sustainability legislation can be recognised: a procedural model (requiring, for example, the development of a strategy but not necessarily requiring adherence to the strategy), a law that explicitly establishes a sustainable development strategy as the point of reference for all decision-making (or, at a minimum, environmental decision-making), and a law that makes sustainable the organizing principle for national governance [13]. Within these three models, specific policies and procedures for sustainable procurement (green procurement standards) are to be especially sought in order to enhance - since the very early stage - an improvement on the environmental impact and the well-being of people within the construction market.

Within the law-framework, it is important to underline how soft law (declaration and conferences) is important against the hard law (formal pacts) [6]. In this sense, the approach closer to the construction industry is represented by sustainable building rating and certification systems. This assessment tools cannot withstand by their own; instead, they need an institutional framework and a legislative structure, often provided by mechanisms and entities as judicial review and nongovernmental organizations [14]. Each rating system is based on regulations or standards issued by governmental or non-governmental authorities at different levels, and on local conventional building solutions. The main benefit of the rating and certification systems is that they transform the sustainable conceptual goal into specific performance objectives, providing a tool to evaluate the overall performance [3].

Three major building rating and certification systems exist nowadays: The Building Research Establishment Environmental Assessment Method (BREEAM), which was developed in the U.K., the Sustainable Building Challenge Framework (SBTool), which was developed by the collaborative work of 20 countries, and the Leadership in Energy and Environmental design (LEED), U.S.A. [2]. These certification systems are meant as voluntary guarantee of quality that give the companies a label of good performance in sustainability at 360 degrees: this way the rated companies obtain rewards, even in terms of future economic value. This topic has recently entered the world of public works, by means of some prescriptions and criteria adopted in the procurement process of the bidders; specifically, it has happened in the Italian context with the legislative decree on the environmental criteria [9].

The Italian law on sustainable procurement in construction process

Considering the importance of law for buildings sustainability, nowadays the European Union has legislated to provide the national authorities with organizing principle for governing the sustainable development, highlighting the importance of the soft law with international conference and programs; by doing so, each government should perceive the sustainability matter into its own laws. In fact, the matter of sustainability, with the building technologies and the indoor environmental quality standards, strongly depends on the environmental, economic, and socio-cultural constraints typical and different for each county/geographical area. This normally hinders the use of foreign decision support and sustainability assessment methodologies without prior adaptation [3].

In Italy, the European COM 397-2008 (Communications on Consumption and Sustainable Production) and COM 400-2008 (Green Public Procurement (GPP)) have been transposed into the L. D. 24/12/2015 "Adoption of minimum environmental criteria for design and construction services for new construction, restoration, and maintenance of buildings for the management of the construction sites of the public authorities and basic environmental criteria for supplies of aids for incontinence" and then in the new Code on Public Contracts, L.D. no. 50/2016 [9,12].

This focus on the sustainable procurement in the construction process, is part of a wider plan for the governance of sustainability actions, the so-called "Action Plan for Environmental Sustainability of the Public Authority's Consumptions (PAN GPP)"; in particular, the PAN GPP pursued the national goal to reach the 50% of green procurements by the end of the 2015; the legislative decree facilitates this objective by introducing Minimum Environmental Criteria (MEC) in the "call of tender" and by obliging the contracting authority to communicate the data about their "green" purchases to the authority appointed for monitoring.

The holistic approach of the sustainability with focus on the Italian background

As first step of a sustainable procurement process, the legislative decree stresses the importance for the contracting authority to carry out an analysis of its own needs focusing on the priority of the interventions and following the line - typical of Italy and other densely built - to adapt existing buildings for new uses and to evaluate the life cycle of the facility (including the design, construction, and operation costs and the future savings).

In general, it becomes increasingly important to analyse the intervention in detail before building. At general level, the feasibility studies refer to the protection of the ground and natural habitat by limiting the use of ground and reutilising the neglected urban areas. The rule is to locate the facilities in already urbanized or blighted areas and to use local materials and respect local habitat, enhancing the social and economic aspect too. In this holistic perspective, it is important: to carry out cost-benefits analysis for the whole life cycle; to evaluate the environmental compatibility and the convenience between reuse (or restoration) and demolition; to evaluate the ease of realization of urban services (public transportation, green areas, biking paths, universal design, etc.)

Environmental dimension

The peculiar environmental aspect the legislative decree focus on is the importance to protect the habitat within the area of intervention and to interconnect it with the external one: this could be done by choosing species of plants that are local, do not require too many resources to grow, help the microclimate, and make simple the maintenance. Regarding the energy supply, effort should be made to satisfy part of the demand through: cogeneration/trigeneration, photovoltaics/wind turbines, geothermal systems. Another goal is to reduce the impact on microclimate and atmospheric pollution, on the hydrographic system. At single-building level, the action to be undertaken for the reduction of the energetic demand of the building are: increasing the energetic performance (classes) for both the building system and the services system; reducing the indoor pollution (emission of materials). The attention to the environment concerns also the construction site: all the operations must be carried out with respect to the protection of organic materials and biodiversity; the demolition must be carried out so that the treatment and the recycling of materials are facilitated.

Economic dimension

All the operations in construction industry are weighted according to the economic perspective. The point is to balance all the stakeholders' benefits. Therefore, the focus is on the feasibility studies at early stage, firstly evaluating between either making use of existing facilities or building new ones; secondly, favouring the construction in areas already provided with urban services. Then, during operation, the running cots should be taken under control for their optimisation by means of the so-called building energy management system (BEMS) (energy consumption monitoring system connected to the management system and integrated with all the building's technological functions). The cost should be analysed also with regard to the end of life of the facility, e.g. considering the selective demolition.

Conclusions

The mandatory nature, in Italy, of MEC for new public works has been a difficult modification to accept both in terms of content and procedure. Although the general interest aims are clear to all, it cannot be denied that compliance with the changes complicates standard design processes, as well as offers preparation for tenders, because it is necessary to return, more than before, on the project choices in order to be able to score better evaluations during the selection of participants, for example for used materials and for the standard to be guaranteed.

This increases the time taken to prepare the documentation for participation in the tender and similarly forces the commissioners to keep many more technical aspects of the past under control. Certainly, however, the availability of such well-defined parameters [10] favors the evaluation procedure through the MEAT.

At the moment, the most complex criteria to be verified are those related to the disassembly and recyclability of the work, precisely because they concern design studies that have never previously been standardized and required for the design and construction of public works [11].

The recent regulatory changes in Italy require (slow?) digitization of the public works sector [8]. When this is completed (the obligation will soon apply only to major works), then the BIM will be an important tool for verifying compliance with MEC.

For example, the verification of disassembly and recyclability criteria, both of which are required as a percentage on the weight of the construction, seems to be an extremely immediate step with a BIM software, compared to the use of a traditional drawing software, together with a computational software and so on.

Certainly, for the contracting authorities to design and build according to MEC, it will entail higher economic costs, both for the actual construction and for the fees of the professionals; and this is already the case for the design at BIM, so overall in the next few years the sums committed by the contracting stations for the single works will increase, with the inevitable reduction in the number of interventions given the current need for money. But interoperability is now the easiest way to conduct all the formal checks required by MEC in the three phases of design, execution and management.

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Volume 3 Issue 1 January 2019