

Conservation and Regeneration for a Sustainable and Circular City

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Abstract. Conservation and regeneration approaches on existing buildings are the result of a system of attributes and values recognized by the human culture, which results in a framework of rules and practices that differ in different contexts. In the contemporary condition marked by the paradigm of sustainability, conservation planning is required to face the challenges of climate change, through the promotion of circular development and social inclusion, as well as the protection of ecosystems and biodiversity. The circular economy, which is based on the principles of recovery, recycling, reuse and sharing, in line with the sustainable development goals of the 2030 Agenda, offers the opportunity to rethink development models, in urban areas and beyond. Within this framework, the study proposes a systematization of the literature review which classifies taxonomies of values and methods to assess sustainability and circularity in urban planning and design at different urban scales. The proposed conceptual scheme is the first step for the definition of a new system of values of the existing building stock, which prove to be fundamental to guide urban transformations in the Green New Deal.

Keywords: Conservation Planning · Urban Regeneration · Circular City

1 Introduction

Urban conservation and regeneration play a fundamental role in pursuing the sustainable development goals [1]. According to the Circularity Gap Report 2021, the building sector is responsible for about 39% of carbon dioxide emissions dispersed in the environment [2]. Nowadays, the need that represents the largest resource and emissions footprint is for construction and maintenance of residential houses, especially in lower income nations [3]. The construction sector represents a significant component of the national GDP, especially in Italy, where the investment in real estate, in terms of redevelopment and energy efficiency, is still considered one of the main levers for re-launching the economy.

Although the first definition of sustainable development dates to several decades ago, and many initiatives and policies have been promoted to implement this international strategy, an effective integration of sustainability in contemporary society has not yet been achieved. In Italy, for example, the sustainable management of existing buildings

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is threatened by complete demolition, often preferred to a comprehensive renovation based on additions, stratifications, or partial demolitions.

Several categories of existing buildings are in danger of being in Italy:

- residential housing built after the Second World War, especially during the 60s and 70s of the Italian economic boom [4–6] (Fig. 1), often characterized by poor architectural quality: although not the oldest in Europe, the Italian residential building stock needs interventions aimed at responding to the new standards, improving its environmental performance (Fig. 2);
- brownfield sites and all the buildings falling within "transformation areas", where the urban design should define a new physical and value dimension;
- ancient cores and historic urban areas protected by conservation planning tools which sometimes allows the demolition of certain buildings in favor of a restoration in harmony with the characteristics of the landscape, without paying enough attention to the ecological value of the building stock.

In this sense, the integration of a sustainability and circularity paradigm in urban governance and spatial planning requires updating the system of values recognized to the built environment, which should guide any decision-making process [7, 8] and affirm a sustainable conservation and regeneration of existing buildings, understood as a resource and social, environmental, and economic capital.

However, the integration of sustainable development goals in urban conservation still represents an important challenge for contemporary society [9, 10]. The need to update architectural and urban conservation approaches is expressed in the UNESCO Recommendation on the Historic Urban Landscape [11], which states: «The historic urban landscape is the urban area understood as the result of a historic layering of cultural and natural values and attributes, extending beyond the notion of "historic centre" or "ensemble" to include the broader urban context and its geographical setting»

According to this perspective, historical urban areas are dynamic organisms, the result of a stratification of values and attributes. This particular attention to the intangible component (values) provides the base to conserve the city as a palimpsest, where the ancient core is only a part [12]. The "landscape approach" introduced by the UNESCO Recommendation is a holistic and multidisciplinary approach to recognize, conserve, and manage historic urban areas [13] within a more complex strategy of sustainable urban development [14]. This involves a new approach to conservation. The action on the built environment (reuse, restoration, renovation, demolition) derives from an analysis of a renewed system of values, which should consider the possibility of recovering, reusing, and recycling building materials, in line with the pillars of the circular economy [15].

At the same time, the landscape dimension, which consider urban areas as the result of a stratification process still ongoing, a direct testimony of the past and, at the same time, a palimpsest for future generations, defines the conceptual framework to ensure better integration between contemporary architectures and the pre-existing one [46]. However, significant difficulties persist today in assessing the level of sustainability and circularity of interventions on the built environment.

Within this framework, starting from an analysis of housing regeneration schemes aimed at improving the performance of buildings and relative living conditions, the paper proposes a systematization of the literature review which classifies methods to assess

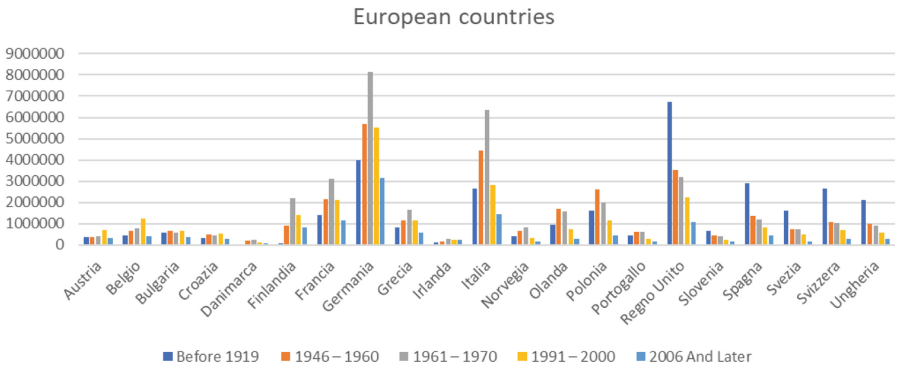

Fig. 1. Age categorization of housing stock in Europe. The EU countries with the oldest housing stock are the United Kingdom and France. Source: [4].

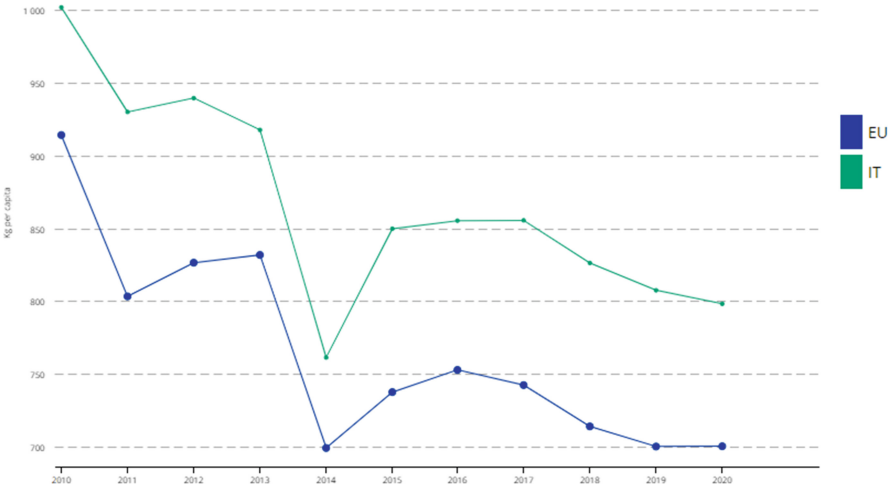

Fig. 2. Greenhouse gas emissions by households for heating and cooling in the EU in 2020 (in kg per capita). Source: [4].

the level of circularity at different urban scales. The circularity matrix is the first step for the definition of a new system of values of the existing building stock, which prove to be fundamental to update the paradigm of architectural and urban conservation in line with the Sustainable Development Goals (SDGs) of the UN Agenda 2030 [16] and the new vision of the European Green Deal [17].

After the introduction, the paper is organized as follows:

- Sect. 2: Materials, which focuses on conservation and regeneration strategies, according to the Historic Urban Landscape approach.
- Sect. 3: Case Study, where two housing regeneration schemes in Europe are analyzed.

- Sect. 4: Methodology, which proposes a conceptual scheme to assess sustainability and circularity in urban planning and design at different urban scales, as codified by the disciplinary debate.
- Sect. 5: dedicated to the discussion and conclusions, together with the future developments of the research.

2 Conservation and Regeneration Strategies

The sustainable development goals have progressively informed approaches and methods of all the research fields, including those of urban conservation and regeneration. The primary aim to pursue sustainable development objectives in a spatial dimension, represented by the model of the compact city, has led to test actions on existing buildings oriented towards the architecture stratification [18]. Several studies investigate innovative design solutions ascribable to the stratification model, understood as a third way between integral conservation and tout court demolition.

Addition to an existing building and partial transformation of the pre-existing structure contribute to shaping the urban layout of the city. In many cases, the addition, which transforms the material fabric of the city with zero soil consumption, becomes an opportunity to promote the energy requalification of the building stock.

The most widespread operations in Europe can be summarized as follows:

- physical elevation of an existing structure to increase the living area, which often modifies or replaces the roofs.
- addition of an existing structure to improve the energy efficiency of buildings, which often modifies the envelope through suspended floating facades.

All these strategies can add unique and aesthetic elements to the project but also to the urban setting, thus shaping urban morphology.

Angi, B. [19] proposes adaptive, interdisciplinary, and integrated modifications, i.e., architectural, structural and performance design strategies. Some of these are also defined as retrofit actions, which refer to addition of components or accessories to an existing building to meet new performance standards, first those relating to environmental performance. These operations, especially if carried out on large real estate complexes such as those of social housing, usually adopt prefabricated and pre-assembled elements [20] also to reduce the costs and times of the intervention, as well as the additional load on the structure.

The stratification models involve design solutions that may require partial demolition of existing buildings to improve their intrinsic and extrinsic characteristics, respectively in terms of a new flexibility of the living space and of a greater accessibility. In this sense, these strategies shape the dynamic nature of the city image [21], with its tangible and intangible values.

Considering this assumption, a critical reflection on the possible forms of demolition is needed, within a more general framework which assesses both the creative role and the possible environmental, economic, and social impacts. In this regard, Bracchi P. [22] proposes a conceptual framework for three types of demolition: “Measuring distances” (separate, reduce, insert); “Design absences” (subtract, include, connect); “Recompose memories” (stratify, recompose).

These design solutions, that lie between integral conservation and complete demolition, inform conservation and regeneration processes to respond to the needs of contemporary society.

3 Case Study

The literature review highlights how the action on the built environment significantly affects the development of sustainable and circular cities [3]. In particular, the architectural and energy renovation of "big size architectures", such as social housing districts, could prove to be strategic for achieving the objectives of environmental, economic, and social sustainability.

Significant regeneration schemes of this type of architecture, based on adaptive solutions, have been implemented in European countries and beyond [19].

Park Hill, a housing estate in Sheffield, South Yorkshire, England, is one of the most emblematic social housing schemes built between the 1950s and 1960s, a true urban landmark of the city (Fig. 3).

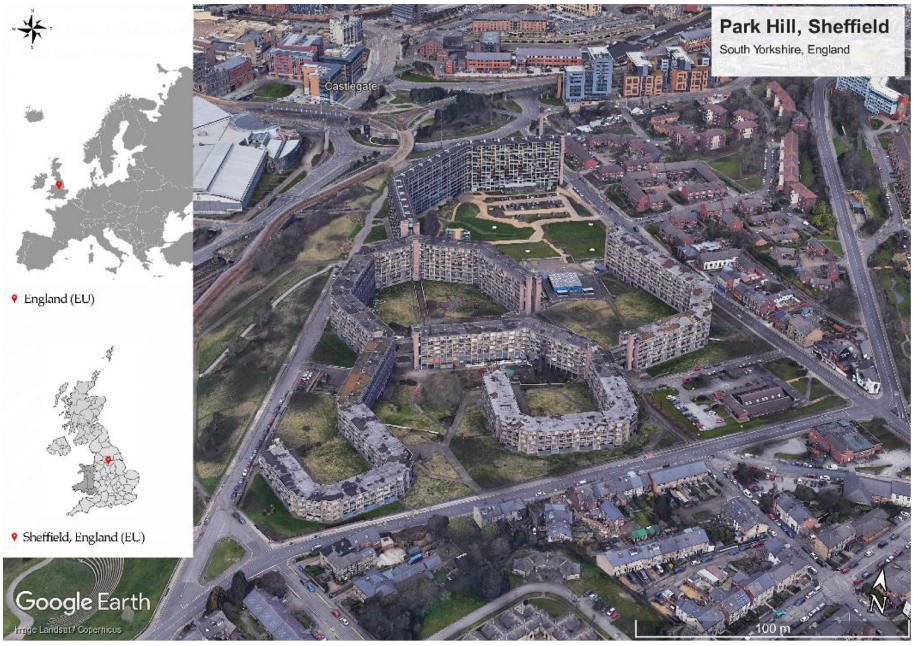

Fig. 3. Park Hill, housing estate in Sheffield, South Yorkshire, England. Form listing to renovation. Source: Google Earth.

Designed by Ivor Smith and Jack Lynn, in 1998 it received the status of Grande II* listed building for its architectural interest and for its historical value: Park Hill is the first demolition project of post-war slum clearance to have been completed in Great

Britain, as well as one of the most ambitious programs launched in the context of urban policies focused on the inner cities renaissance.

The typological and morphological redevelopment scheme of the Northern Block of the complex started in 2008. The first aim of preserving the original architectural qualities and adapting buildings to the new standards of livability and design, consisted of various interventions [23]: partial demolition, particularly on the fronts; rehabilitation of the load-bearing structure; reorganization of living spaces in line with the principles of energy efficiency.

Switching to the French context, the redevelopment scheme of 530 social housing apartments in the Grand Parc district of Bordeaux (2017), designed by the famous architects Anne Lacaton and Jean-Philippe Vassal, in collaboration with Christophe Hutin and Frédéric Druot [24], implements some of the main goals and targets of the sustainable regeneration of the built environment (Fig. 4).

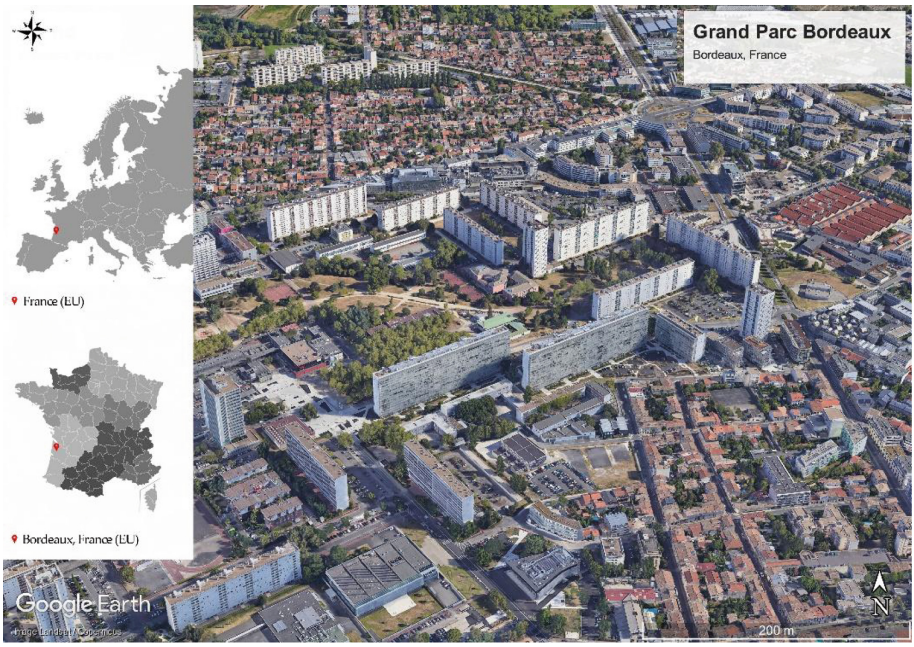

Fig. 4. Quartier du Gran d Parc - Lacaton & Vassal, Druot, Hutin. Transformation of 530 dwellings (2017). Bordeaux, France. Source: Google Earth.

It is a large housing estate developed in the 1960s, in a modernist style. In recent years, the building obsolescence had made it eligible for demolition. However, this scenario was never implemented, in favor of the redevelopment scheme which applies the principles proper of the professional activity of Lacaton & Vassal, winners of the Pritzker Prize 2021 [25]. Firstly, the systemic approach to sustainability [26], which led to test technological innovation in response to environmental and social needs and adopt a design able to shape a concept that incorporates ideals of democracy and social

justice. This approach is reflected in the primary choice to renovate the social housing district also by the addition of o architectural elements [27]: better living conditions are achieved through the addition of external to internal structural connections such as balconies in each apartment, which improves the use of natural light and, consequently, reduces energy consumption and costs.

The project is sustainable in environmental terms, considering the reuse and improvement of existing buildings performance, but also in social terms, both for the recognition of the historical values of the buildings and the attention in guaranteeing the permanence of the inhabitants during the renovation stages.

It is in line with the objectives of the *Rénovation énergétique et réhabilitation lourde des logements sociaux* (Energy renovation and major rehabilitation of social housing) [28], an important policy introduced by the French government to finance the major restructuring of social housing (reconfiguration of their typology or even improvement the accessibility) coupled with a global thermal renovation (in terms of energy performance), also supporting a new industrial production chain in these sectors. It means that major restructuring or rehabilitation operations that profoundly transform the asset (retention of only the building envelope; addition of an elevator/modification of the stairwells; modification of housing typologies, etc.) are associated with ambitious renovation to increase the energy performance, in line with policies launched at an international level [29].

Applications can be submitted by subjects closely involved in the management of social housing, in order generate the greatest benefits for the local community: low-rent housing organizations; semi-public companies; other bodies benefiting from project management approval; public establishments of an administrative nature under the supervision of local authorities and housing managers; municipalities managing social rental housing.

This policy has already financed the rehabilitation of 37,501 housing units in 2021, integrating major restructuring or rehabilitation associated with energy renovation. In the same year, the number of beneficiary housing units grew thanks to a further national call for projects of renovation of the social rental stock, *MassiRéno*, which made it possible to finance the renovation of 2,605 housing units.

However, although some experiences may be considered best practice, the definition of indexes and key performance indicators conceived as assessment tools to measure the sustainability of the action on the built environment and the circularity of the previous and post conditions (ex-ante and ex-post intervention), still represents one of the main issues.

4 Framework to Assess Sustainability in Urban Planning and Design

The literature review highlighted that the definition of methods to assess the degree of sustainability and circularity of interventions on the built environment continues to be one of the main issues. The methodology is aimed to develop a conceptual scheme based on a systematization of the literature review which classifies recent studies that develop sets of indicators to assess the sustainability at different urban scales: urban planning, urban regeneration projects and architecture renewal (Fig. 5).

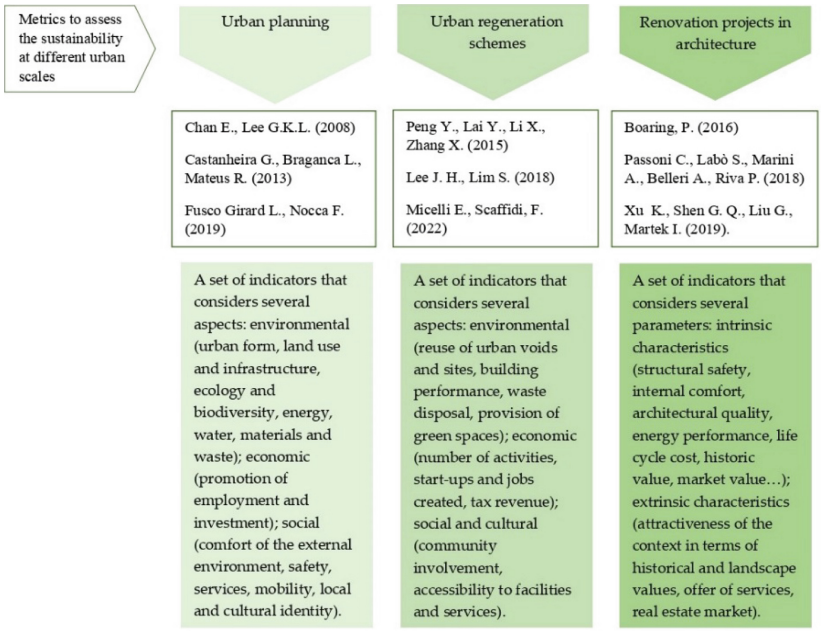

Fig. 5. Conceptual scheme to assess the degree of sustainability of urban regeneration at different urban scales according to the literature review.

Studies that define metrics to assess sustainability in urban planning, essential for supporting the idea of sustainable cities [30, 31], consider several aspects: environmental (urban form, land use, infrastructure, ecology and biodiversity, energy, water, materials, and waste); economic (employment promotion and investment); social (comfort of the urban and rural context, safety, services, mobility, local and cultural identity) [32]. Other studies, starting from the results of questionnaires submitted to planners, real estate entrepreneurs and the local communities, identified the main factors underlying the improvement of the social sustainability of urban redevelopment projects [33], which can be summarized as follows: the satisfaction welfare requirements; the conservation of resources and the surrounding environment; the creation of places that respond to the needs of daily life; the urban development model. These assessments, which should inform the strategies and planning choices to implement sustainable and circular cities, are also the base to define actions to conserve and enhance the built environment [34].

The review of international research focused on the definition of metrics to assess the level of sustainability of urban regeneration schemes [41] includes studies concerning several aspects: the social impact of urban regeneration processes [15, 35]; the economic feasibility [36]; the environmental value of the built environment [37, 38].

Other studies adopt a systemic approach to define matrices [39, 40] or circularity indices [42].

Finally, other research focused on the definition of indicators to support decision-making processes aimed at evaluating the opportunity of demolishing the existing buildings in urban renewal projects [43], taking into consideration several parameters, affecting the intrinsic and extrinsic characteristics of the buildings. The first ones include structural safety, internal comfort, architectural quality, energy performance, life cycle cost, historical value, market value, etc. The second ones include the attractiveness of the context, in terms of historical and landscape values, the number and variety of surrounding services and the real estate market [44]. Moreover, the list of sustainable building certifications such as LEED and WELL, testifies to the great attention towards a design capable of reducing environmental impacts in favoring more sustainable and circular production and consumption models. In Italy, one of the most important policies is that of the Minimum Environmental Criteria (MEC), i.e. green criteria designed to prompt public bodies to purchase green goods and services, with the lowest possible environmental impact throughout their life-cycle, in line with the European legislative framework [45].

All these studies offer the opportunity to implement the system of values of the built environment, to assess the sustainability of ex ante and ex post conditions, to guide planning decisions (conservation, transformation, total or partial demolition) according to the life cycle approach.

5 Discussion and Conclusions

The present study proposed three interrelated topics which contribute to the project of the sustainable and circular city: the updating of the system of values of the built environment; the innovation in technique, materials, and design to conserve and regenerate the building stock; the development of metrics to assess the degree of sustainability and circularity in planning decisions, urban design schemes and architectural renewal.

System of values, methods of intervention and metrics should converge to affirm a culture of recovery and transformation in the construction sector.

Recent studies confirm the role of the circular economy paradigm and of spatial energy planning in urban governance. European cities are characterized by specific trends to steer the circular transition, as well as important challenges still outstanding to shift the paradigm from linear to circular systems.

Within this complex scientific-disciplinary debate the methodology proposed a conceptual scheme to assess the degree of sustainability and circularity of urban regeneration plans and projects. The framework is based on a systematization of the literature review which classifies recent studies that develop sets of indicators to assess the sustainability at different urban scales: urban planning, urban regeneration projects and architecture renewal.

Although important goals have been achieved, there are still few codified methods. In Italy, the definition of Minimum Environmental Criteria (MEC) represents an important milestone. However, the definition of metrics to assess all three dimensions of the sustainability of urban regeneration schemes is still a challenge.

Social housing complexes are often threatened by demolition and consequent relocation of various groups of residents, without consider the impact in social, economic,

and environmental terms. Yet, the regeneration of "big size architectures", such as social housing districts, could prove to be strategic for achieving the sustainable development goals. In this sense, the definition of matrices represents a real tool to support urban governance and planning.

Within this framework, the future steps of the research will be dedicated to the implementation of the set of key performance indicators to assess and monitor performance of urban regeneration schemes, with particular attention to those relating to the large public and private real estate complexes, which prove to be fundamental to guide urban transformations and ecological transition in the Green New Deal.

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