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Adequate Housing and COVID-19: Assessing the Potential for Value Creation through the Project

Caterina Quaglio [1,*], Elena Todella [2,*] and Isabella M. Lami [2]

[1] Department of Architecture and Design (DAD), Politecnico di Torino, 10125 Torino, Italy
[2] Department of Regional & Urban Studies and Planning (DIST), Politecnico di Torino, 10125 Torino, Italy; isabella.lami@polito.it
* Correspondence: caterina.quaglio@polito.it (C.Q.); elena.todella@polito.it (E.T.)

Abstract: The COVID-19 pandemic has profoundly affected the relationship between people's behaviors and residential spaces, bringing to public and academic attention, on the one hand, the exacerbation of pre-existing problems and, on the other, the potential of spaces, such as communal gardens and apartment-block terraces, to become important resources of sociability or privacy. Overall, this raises the question of how to assess the responsiveness of the existing residential stock to needs that transcend the traditional concept of housing adequacy—e.g., the need for adaptable, open, and livable spaces. This research moves from the assumption that underused spaces in residential neighborhoods represent a crucial asset for creating new economic and social values through architectural and urban projects. Consequently, moving from an in-depth observation of a selection of public housing buildings in Turin as a paradigmatic case study, the aim is to explore the potential for the adaptive reuse of residential spaces at different scales—from the apartment to the neighborhoods—highlighting the implications for design. In doing so, the paper puts forward a methodological approach, which widens the way housing adequacy is normally assessed, by focusing on the possibility of transformation of often neglected spatial resources.

Keywords: adequate housing; COVID-19; underused spaces; adaptive reuse; value creation

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1. Introduction

The distortions that COVID-19 imposed to the functioning of our cities have exacerbated pre-existing inadequacies of residential spaces and brought the problem to public attention. This has resulted, on the one hand, in the accentuation of inequalities [1,2], especially for those who have been forced to spend much more time and to carry out many more activities in an inadequate residential environment. Nevertheless, on the other hand, the health emergency and the consequent lockdown also brought to light underused spaces as viable sources of sociability or privacy [3–5], calling into question the very concept of housing adequacy and the parameters commonly used to measure it. In particular, places such as communal gardens and apartment-block terraces, whose use remained legally undetermined in the quarantine, became unexpected resources for social interactions [6–10]. Drawing on the literature investigating the relationship between residential spaces and people's behaviors during the pandemic to highlight a number of compelling issues, our assumption is that underused spaces in residential neighborhoods can represent an important asset for addressing unmet housing needs. Given this context, in the present paper, we deepen the concept of adequate housing, focusing on the possibilities for transformation of such spaces, with the aim to assess the potential for value creation through architectural and urban projects. In doing so, the concept of adaptive reuse is employed as a frame to investigate how the project, by intervening on the underused spaces of existing housing stock, can produce new economic and social value, not only in the context of the pandemic, but also to address the issue of housing adequacy more generally.

To this end, we focused on public housing as an exemplary and particularly convenient case to test the research hypotheses for three main reasons. First, as a matter of fact, public housing estates represent an example of "ordinary construction" with features recurring both nationally and internationally [11–13]. Second, although affected by frequent spatial problems, such as decay and lack of maintenance, they also have morphological, proprietary, and management features that are particularly well suited to an adaptive reuse approach based on design strategies. In this sense, from a design perspective, the public and unitary ownership of buildings and land in public districts allows a significant simplification of processes and reasoning, favoring the development of experiments which can then be adapted to more complex contexts. From this standpoint, public housing estates often have underused spatial assets, even in those (frequent) cases where the existing supply does not fulfill the demand for social housing [14,15]. Finally, in Italy, as in many other countries, the emergency caused by COVID-19 and the subsequent quarantine affected particularly markedly the social housing market [16]. Indeed, the pandemic challenged further the ability of the social housing system to respond satisfactorily to old and new needs, both in terms of affordability and quality of the spatial offer for tenants and in terms of economic and social sustainability for the administrating bodies [17]. Moreover, the economic support measures planned to respond to the pandemic crisis lay the foundations for enhancing the potential of existing neighborhoods. Exceptional resources have, in fact, been earmarked for interventions aimed at the rehabilitation of the existing building stock and, in particular, public housing—see, for example, [18] (p. 87). In light of this, it becomes even more relevant to question the possibility of creating added value through design projects on the basis of the problems and opportunities arising from the COVID-19 pandemic.

In the research development, we therefore adopt a microscopic outlook on a specific neighborhood, focusing our analysis on a selection of buildings owned by the City of Turin and managed by the Territorial Household Agency (ATC) as a case study. This choice is due, first of all, to the possibility of accessing a wide variety of direct and indirect sources. Moreover, from a methodological point of view, the research is based on the assumption that micro-observations on peculiar objects of study are not only illustrative in themselves, but can also provide important interpretive insights into much broader phenomena [19,20]. Accordingly, Turin would not represent the only possible case study. Rather, it is one of the many significant cases that, analyzed with particular tools and objectives, may raise questions that transcend the specificity of the site [21]. We can, thus, expect to find conditions similar to those observed locally in other residential neighborhoods and units, both publicly and privately owned. Starting from the analysis of a specific place, the present study intends, therefore, to explore the potential of residential neighborhoods to offer adequate housing conditions within a strategy of adaptive and sustainable reuse.

The main findings of the paper are related to: (i) the kinds of values that can be created through the adaptive reuse of underused residential spaces and how (e.g., increased uses and demand produce new economic and social values); (ii) in methodological terms, the importance of a multiscale perspective and the relationships between different scales of observation; (iii) the main implications for the project that can be inferred from the analysis of the potential of underused spaces.

The article is structured as follows. In the next section, we explore the concept of the right to adequate housing through the main guidelines and assessment parameters developed in recent years at the national and international level, pointing out how the COVID-19 pandemic has further challenged the way official documents usually look at the adequacy of residential spaces. What emerges is that the officially developed guidelines and principles do not fully capture some important resources since they overlook the transformative potential of residential spaces. So, through an in-depth analysis of the literature on the secondary impacts of COVID-19, in the third section, the article synthesizes some emerging trends and needs in the use of living spaces according to three significant scales—the apartment, the building, and the neighborhood. In doing so, the

aim is to highlight them as possible key factors to be considered for developing urban and architectural projects. The fourth section then turns, in practice, to the microscopic dimension to assess the potential of adaptability of a specific case—namely, a public housing estate in Turin. To this end, the analysis is supported by visual materials aimed at underlying and measuring the scope for adaptive reuse of underused spaces. Conclusions and future developments are discussed in the fifth section.

2. Background: The Right to Adequate Housing and COVID-19

The right to adequate housing [22] is tightly linked to sustainable development, for which organizations under the mantle of the United Nations are active promoters. Adequate housing is recognized as fundamental in achieving public health and social justice, in terms of both housing quality and access to basic services [23]. According to officially developed international and European guidelines, the key principles to implement adequate and sustainable housing, as defined by the United Nations Economic Commission for Europe, are basically four [24,25]: environmental protection, economic effectiveness, social inclusion and participation, and cultural adequacy. Consequently, besides guaranteeing structural safety and physical protection, an adequate house must also respond to a variety of social and economic criteria [26]. All these aspects have important implications for this research, namely, in relation to those spatial issues through which housing should be designed and used [24]. First, from an environmental point of view, strategies can be directed to resiliency and enhancement of existing housing stock through retrofitting and redesigning, and, at the same time, to green spaces around and within housing areas integrated into sustainable urban policies, particularly for disadvantaged people. Secondly, on an economic point of view, again, housing stock retrofitting and renovation can contribute to allowing people living in low-income settlements to have access to adequate housing, also supporting adaptation as a sustainable approach. Thirdly, with a focus on social issues, promoting healthy living and increasing the usability of private and communal areas enhances inclusion and participation for all people across various divides. Finally, cultural integration can be improved too by emphasizing the development of social and cultural activities in public spaces and neighborhoods actively redesigned and maintained to properly host them [24]. Housing spatial improvement, therefore, plays an important role in achieving sustainability and adequacy, both in terms of improvement in social sustainability and of increasing the functioning of the real estate sector [27]. The pandemic emerges as a wakeup call to improve adequate housing and as an opportunity for new housing policies, heightening the visibility and scope of the problem before public, political, and academic opinion. COVID-19 spread and the subsequent control measures developed in cities and urban areas have impacted on housing adequacy in many respects, highlighting the need to question existing indicators in order to implement evidence-based and sustainable housing policies [25]. As a matter of fact, the pandemic exacerbated an already existent lack of adequate and affordable housing, as a global and longstanding crisis [23,26–30]. Indeed, the fundamental requirements of adequate housing—sufficient living space, basic service provisions, thermal comfort, accessibility, etc.—help to reduce exposure to the virus of people already suffering from health inequities. Moreover, social distancing measures due to COVID-19 have changed the use of space, with the closure of workplaces, learning, leisure, consumption, and restrictions on the use of public space as key policy measures to protect public health [4,31]. However, these measures have produced secondary effects, including drastic changes in people's lifestyle [32]. In many neighborhoods, for example, social distancing is generating a new social space, reclaiming neighborhood spaces for public life, with changes in their use, perceptions, and, potentially, design [32–34].

As a consequence, the concept of sustainable housing and its adequacy has recently started to be analyzed by different perspectives. In this sense, broader questions emerged in the public debate about how housing could be better designed and resourced to respond to evolving needs [1,35,36]. Due to this trend, academic literature has started to investigate

this issue, paying particular attention to what could be the future of our homes, based on the lessons learned from the analysis of people's behaviors during the pandemic and the importance of designing healthy and sustainable spaces [37]. Moreover, the literature highlights how some measures taken in housing space during the emergency could become part of daily life and of long-term reasoning about sustainability [1,4,37–39] in terms of density, flexibility, and adaptability of spaces, both indoor—e.g., to accommodate workspaces—and outdoor—e.g., the use of terraces, balconies, and courtyards.

If, on one hand, discourses generally referring to housing and COVID-19 have overall appeared ever more frequently not only in the academic literature, but also in the news, e.g., [6–10]; on other hand, structured reflections considering such dimensions as potentially inter-related to the concept of adequate housing are nonetheless lacking. Starting from this assumption, this research moves from the hypothesis that an in-depth analysis of residential spaces in light of the observation of people's behaviors during the pandemic can provide new insights from a design perspective on the potential of underused spaces for housing adequacy. Accordingly, this paper aims to highlight the spatial implications of reasoning on adequate housing from a perspective that draws on lessons learned from the pandemic, but that is not intended to be solely limited to such contingency. In doing so, we put forward a methodological framework to assess the potential for adaptive reuse of underused spaces, with the aim of outlining the main implications for the project.

3. Adaptive Reuse of Underused Spaces

Adaptive reuse approaches address the increasing amount of abandoned or underused assets in cities [39,40], considering buildings—but also urban areas, districts, and sites in general—as non-static entities during their life cycle [41]. According to this view, underused or unused spaces are conceived as resources to be activated [42] by introducing new contents in existing containers [39,43]. Extensive literature considers adaptive reuse as a valuable approach to pay attention to the needs of society in pursuing current sustainability standards [30,44–48] by implementing new projects aimed at generating extra values in existing buildings.

With the aim of assessing the potential of underused spaces in residential neighborhoods, we frame our interest in a kind of strategic approach—as opposed to the typological and the technical ones [49]. Accordingly, in the paper, we intend adaptive reuse as a way of detecting spatial resources and maximizing, through the project, economic and social benefits in our responses to emerging needs [50]—as, among others, the ones that have emerged in relation to COVID-19. More specifically, we address housing adaptability in design terms [42] by focusing on those spaces to be rediscovered and reorganized at different scales.

Research Setting: Going Micro

The consequences of the pandemic highlight the need to rethink the concepts of adequate and sustainable housing, both in relation to indoor and outdoor spaces. The factors that have emerged as secondary impacts of COVID-19 are, therefore, investigated here, building forward a methodological approach aimed at widening the way housing adequacy is normally assessed. In this sense, the study moves from an analysis of the literature addressing the relationship between spaces and uses triggered by the pandemic and reviews the main lessons learned by highlighting some emerging requirements of residential buildings as a starting point for developing adaptive reuse strategies. To this end, an attempt is made to compile a list of key factors (see Table 1), based mainly on sources such as academic journals and government reports on the inter-relations among living space conditions and COVID-19, to identify those issues of relevance to the research questions.

Table 1 reviews some emerging implications of COVID-19 in the spatial realm according to three significant scales—the apartment, the building, and the neighborhood—as the above-mentioned key factors to be considered for developing urban and architectural

projects. Accordingly, these aspects have been indicated in the text, highlighting them with italics.

Table 1. Emerging requirements of residential buildings during the pandemic as key factors to be considered.

Scale of Observation	Emerging Key Factors	References
Apartment	Adaptability of home spaces	[1,5,35,37,51]
	Livability of spaces for different uses	[1,2,5,35,37,51,52]
	Accessibility to outdoor/green spaces	[35,37]
	Thermal comfort and indoor air quality	[5,35,37]
Building	Adaptability of shared space	[1,35,38,53,54]
	Rediscovery of shared outdoor/green spaces	[1,5,31,35,37,53–55]
Neighborhood	Adaptability of public areas as a new sociable space	[4,37,56,57]
	Self-sufficient neighborhoods/functional mix	[1,2,35,37,57,58]
	Outdoor spaces and shared environments	[4,37,53,58]

Numerous studies have documented the secondary impacts of COVID-19, focusing on the scale of the *apartment*. Indeed, confinement at home has entailed an inevitable increase in the demand for *adaptable and flexible spaces* to easily arrange to different functions throughout the day [1,51], particularly for working in domestic living spaces. It is, therefore, necessary to ensure the adaptability to changes, both in the distribution and the uses of the different spaces of a house, to make housing more "sustainable". Moreover, future building will be approached and projected considering the possibility of efficient adaptive reuse of existing structure in order to adapt to changing needs [5]. Similarly, a matter of the *livability of those spaces to different uses* is reported as being related to the above-mentioned concept of adaptability, related, in this case, to comfort and privacy possibilities as an essential dynamic in living space uses [51]. In order to meet the needs of the residents, living spaces must respond to overcrowding problems related to the emerging need to work from home [2,5] to comfortably guarantee both enough space and adequate privacy for each family member [52]. The lockdown period has also strongly underlined the importance of *outdoor and green spaces for inhabitants* [55], at least visible from home, though even better when available and accessible, as terraces, balconies, and surrounding garden spaces. Finally, a basic principle to reconsider sustainability requirements for homes has been reaffirmed in terms of both *thermal comfort and indoor air quality* of living spaces. In this sense, the housing units should provide adequate, healthy, safe, and comfortable living spaces for residents, but with no significant harm to the climate and the environment [5].

In addition, the quarantine policies have brought about a series of emerging issues at the scale of the *building*. Moreover, in this case, the lockdown emphasized the need for *adaptability of shared spaces*, in particular, when underused areas are available for inhabitants and easily adaptable for a specific and temporary need, even in the case of multi-story residential buildings [35]. To this extent, ground floors, basements, and free floors, but also terraces and courtyards—and shared spaces in general—can be treated as semi-private and collective environments to be flexibly rethought and reused by multiple families [38]. One of the most widespread effects of COVID-19 relates to the *rediscovery of shared outdoor/green spaces that* offered—when available—a precious opportunity for outdoor daily time for residents, helping meet physiological and psychological needs, and decreasing stress and anxiety during lockdowns through the access to vegetation and daylight [31]. On the other hand, the lack of outside spaces results in a challenge, especially for residents in overcrowded and small houses. In this respect, significant changes are needed in buildings' design to include common gardens, green roofs, terraces, and walls as functional outdoor spaces [54], with multiple advantages, even in terms of sustainability.

The lockdown measures have also brought about a series of behavioral consequences and habits at the scale of the *neighborhood*. Indeed, in terms of social proximity and interaction, even if constrained, a trend emerged for neighbors, families, and residents in

general to experience more frequent contact [57], reusing and *adapting public areas as a new sociable space* [4]. Neighborhood spaces assumed a somewhat public character, since spaces such as residential streets, parks, play areas, and other nonprivate spaces have become gathering spaces for everyday activities. Moreover, as a result of the pandemic, a focus on proximity and availability has made evident the potential of *self-sufficient neighborhoods*, not so much in traditional terms of energy efficiency, water supply, and food production, but more in relation to further functions that help promote wellbeing and social relationships, such as sport and recreational activities. Self-sufficient lifestyles imply strategies to provide both physical and visual benefits, for the production of food, for playgrounds, or resting and reading places. An adequate quality of life should imply planning the neighborhood functional mix, adapting both the outdoor spaces at a short distance and near the building and the ground floors themselves to essential urban social functions more and more centralized in the residential neighborhoods in parallel with work and education. Finally, the lack of *outdoor spaces and shared environments* that emerged at the scale of buildings is even more crucial at the neighborhood level, where people spent most of their time, modifying both the use of space and the kind of interactions [53], and highlighting the need for a decentralized network of smaller green spaces in the city as a source, in this sense, to improve health and quality of life [37,58]. On the one hand, people living in medium- or low-density neighborhoods are transforming and reusing them for active living, playing, and socializing; on the other hand, residents with limited access to outdoor spaces due to inadequate public spaces or unsafe conditions have been hard hit by the lockdown.

The key factors listed in Table 1 allowed us to outline a number of emerging issues (already present and emphasized by the pandemic) relevant to the adaptive reuse of residential neighborhoods.

4. Assessing the Potential for Value Creation through Adaptive Reuse

Drawing from the literature, we develop a methodology that is both qualitative and quantitative to identify, redraw, and quantify underused spaces in our case study, whose spatial characteristics reveal their propensity for adaptability. Through a simplified visual analysis, we focus here on a real public housing neighborhood, located in Turin, known as "Via Artom", which shows highly recognizable architectural and urban traits similar to those of many other public "ordinary" neighborhoods not only in Italy, but also in Europe (Figure 1). Between the 1990s and 2000s Via Artom was the subject of a major urban regeneration project that partially changed the morphology of the area due to the demolition of two buildings.

Figure 1. Via Artom public district, aerial view from Google Maps.

Summarizing the findings of the analysis developed in the previous paragraph, Table 1 reveals some recurring pandemic-related issues that are often overlooked by existing indicators on adequate housing, which can be synthetically gathered within some common specific features with direct socio-spatial implications at the three scales analyzed: (i) the role of open spaces and the relation among indoor and outdoor spaces; (ii) the livability of spaces, in terms of private or common uses; (iii) the level of spatial adaptability, with respect to rigid or adaptable spaces and uses. Accordingly, a set of suggestions of potential spaces for action is identified and visualized, then also redrawn and quantified, without claiming to be an exhaustive framework, but instead as a meaningful selection of aspects to be deepened. Consequently, taking the emerging key factors (Table 1) as a source to define the context for the empirical research, the spatial analysis starts from the potential for adaptability of spaces to improve existing conditions—and to answer to emergent and unpredictable needs—focusing on the proximity and availability of spaces with a transformative potential inside and outside the buildings. In the analysis of the case study, a graphical method is proposed for highlighting and quantifying the above-mentioned dimensions, ascribed to synthetic labels, such as: (i) indoor/outdoor, (ii) private/common, and (iii) rigid/adaptable (Table 2). In particular, adaptability is the spatial characteristic we are going to quantitatively assess in the case study; nevertheless, since we consider all three of these factors critical to any analysis, spaces are also visually classified according to the other two features, thus as private or communal, and indoor or outdoor.

Table 2. A synthesis of the dimensions to which the key factors are related.

Key Factor Dimensions	Labels
(i) the role of open spaces and the relation among indoor and outdoor spaces	indoor outdoor
(ii) the livability of spaces, in terms of private or common uses	private common
(iii) the level of spatial adaptability, with respect to rigid or adaptable spaces and uses	rigid adaptable

Research Outlooks: The Potential for Action

For the purposes of this study, the adaptability of a typical public neighborhood is assumed, as that of the Via Artom, in terms of modifiability and polyvalence of uses [50] at different scales. Starting from [59,60], we consider the capability of arranging different configurations of uses within and between available spaces, and the hypothesis that this depends on the spatial organization of those spaces. In doing so, we consider the inalterability and rigidity of some "permanent" elements in the space that define the frame in which change can occur [60], such as the kitchens and the bathrooms, since moving them is usually a major operation, both in terms of cost and complexity of the intervention. In addition, another criterion we have taken into account when assessing the rigidity of both indoor and outdoor spaces was whether it housed a nonreplaceable and legally binding function for the analyzed unit—e.g., each flat needs at least one bathroom and one kitchen, and each building needs its own parking spaces. So, in Leupen's research, the results evidence the relations among certain spatial configurations and the quantity of possible functional arrangements. Similarly, we propose a method in which, considering some spaces as rigid, both indoor or outdoor, and both private or common, adaptability is intended as investing minor resources in the transformation of space at the three different scales (see Table 3). In this sense, it will be sought to assess and quantify the degree of adaptability—then the transformative potential through the project—that such spaces may have.

Table 3. A view of the features and the related graphic code used in the analysis.

Features	Graphic Code
adaptable indoor private	
adaptable indoor common	
rigid indoor private	
adaptable outdoor private	
adaptable outdoor common	
rigid outdoor common	

On the basis of these considerations, in developing the analysis on the case study, we have adopted some preliminary assumptions, which need to be made explicit in advance. First of all, since assessments of housing adequacy usually refer solely to the residential unit, we took this scale as the starting point of empirical research in our study. Secondly, by investigating the level of potential adaptability of the housing stock—and not yet the possibilities of transformation through actual projects—the arrangement and subdivision of the spaces that were the object of the analysis correspond to the ones existing at the moment the research was conducted (Figure 2a,b). Thirdly, given the focus on the issue of adaptability in relation to the possibility of having spaces for shared use also, we adopt as the minimum observation unit the two-flats unit located on the same floor of a stairwell (Figure 2c). Although this condition is not generalizable to every building, it is in fact the typical spatial configuration present in the case study, replicable for any other apartment of the same public housing estate. The aim, in this way, is to make the approach generalizable, while paying particular attention to the specificities of each place. Finally, the point of view adopted for assessing underused spaces is the same at all three scales and always refers to the minimum unit in an additional logic—that is, the two-flats unit (Figure 2c). Accordingly, the different conditions of use of a private space compared to a common one are described qualitatively with the subdivision of the private/common categories and not through a quantification.

At the first scale (Figure 3), all rooms are classified according to the previously mentioned categories (see Table 2). As shown, we exclude corridors and stairwells/elevators from calculation—a further step would be to take into account potential design transformations that modify the distribution system, but this does not reflect the objectives of this paper. The rooms that have been assessed as "rigid" are those with configurations specific to accommodate a particular function—e.g., bathrooms (T) and kitchens (L), as in [59]. On the contrary, we consider as "adaptable" those spaces that have such dimensions and comfort conditions that they can easily accommodate functions other than the current ones—e.g., living rooms (L) and bedrooms (B).

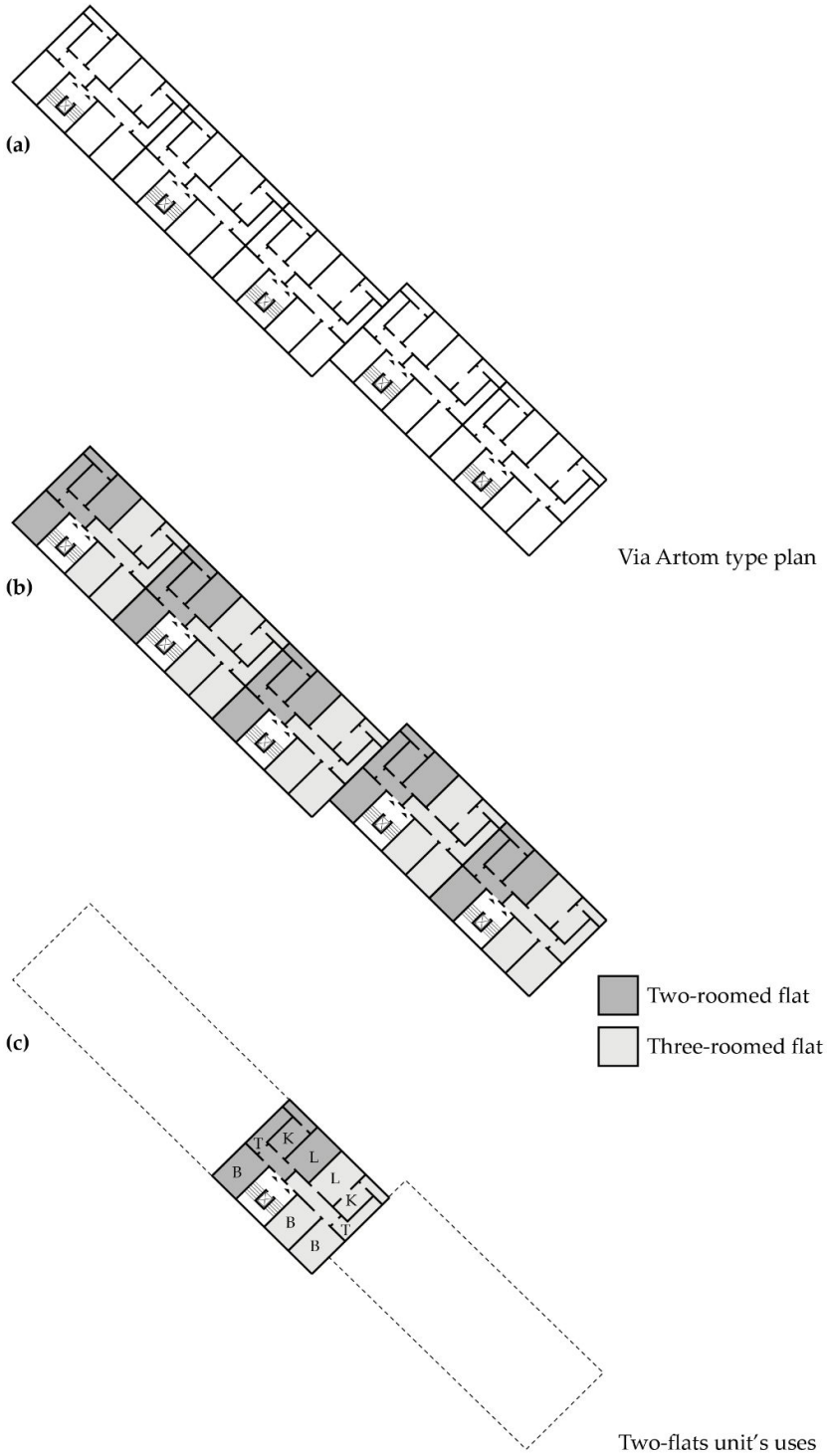


Figure 2. Via Artom building's type plan, flat type, and flats uses.

Starting from the two-flats unit, in developing the graphical analysis and calculations, we assumed one of the rooms—the most convenient in terms of location near the stairwell and characteristics—as a potentially shareable space for the occupants of the two flats—e.g., as a workroom. As shown in Figure 3, the rate of adaptive spaces in an average public housing project is very significant (see Table 4). This is also related to the high level of standardization in the design of spaces, which becomes, in the perspective of adaptive reuse, a potential for transformation. Finally, special attention was paid to private open spaces—e.g., balconies. Although small in the case study, the constraints caused by

the COVID-19 pandemic clearly showed the importance of these spaces, which should, therefore, be central to the concept of housing adequacy.

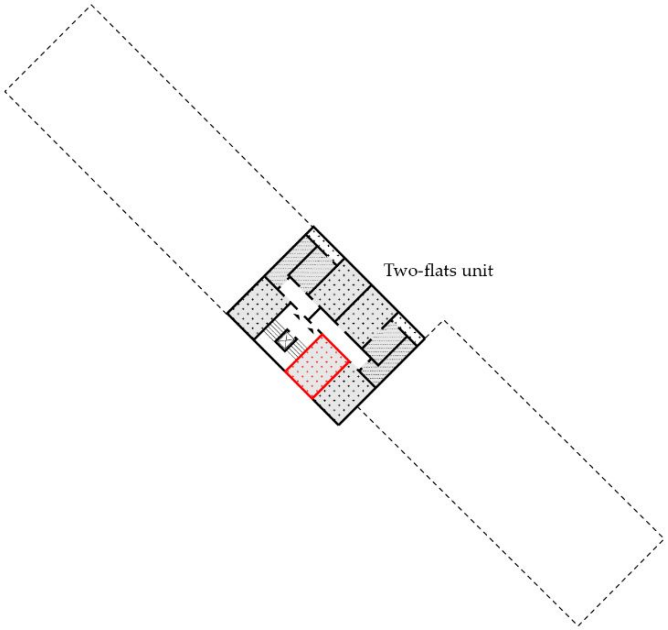


Figure 3. Two-flats-scale classification of spaces, with respect to Table 3.

Table 4. Two-flats-scale calculation of adaptable spaces.

Two-Flats Unit		Square Meters (sqm)	(%)	
	adaptable indoor private	16 sqm * 2 (L) * 2 (B) = 64 sqm	53%	100%
	adaptable indoor common	16 sqm * 1 (B) = 16 sqm	13%	
	rigid indoor private	(8 sqm * 2 (T)) + (9 sqm * 2 (K)) = 34 sqm	28%	
	adaptable outdoor private	7 sqm (balconies)	6%	

In this research, the two-flats unit is then assumed as reference and, accordingly, the 100% in Table 4 is the calculation benchmark for the other scales. At the scale of the building, we expanded the spectrum of observation to the entire stairwell—a set of spaces that insist on a single distribution system—and to a portion of open space in front of it (Figure 4). In fact, although in the case analyzed—as in many other public complexes—the open space is not divided by fences and has a single public owner, we evidenced an area of relevance that mirrors the internal distribution system and that can be seen as a space adaptable primarily in function of the occupants of the correspondent stairwell. This also corresponds to an increasingly widespread trend towards privatization and "residentialization" [61] in the regeneration of both private and public neighborhoods. Similarly, and in line with the logic used at the previous scale, we assumed ground floor apartments—those of lesser residential value—as adaptable spaces for shared functions. Finally, again, we have subtracted the space allocated to vertical distribution from the calculation (Figure 4).

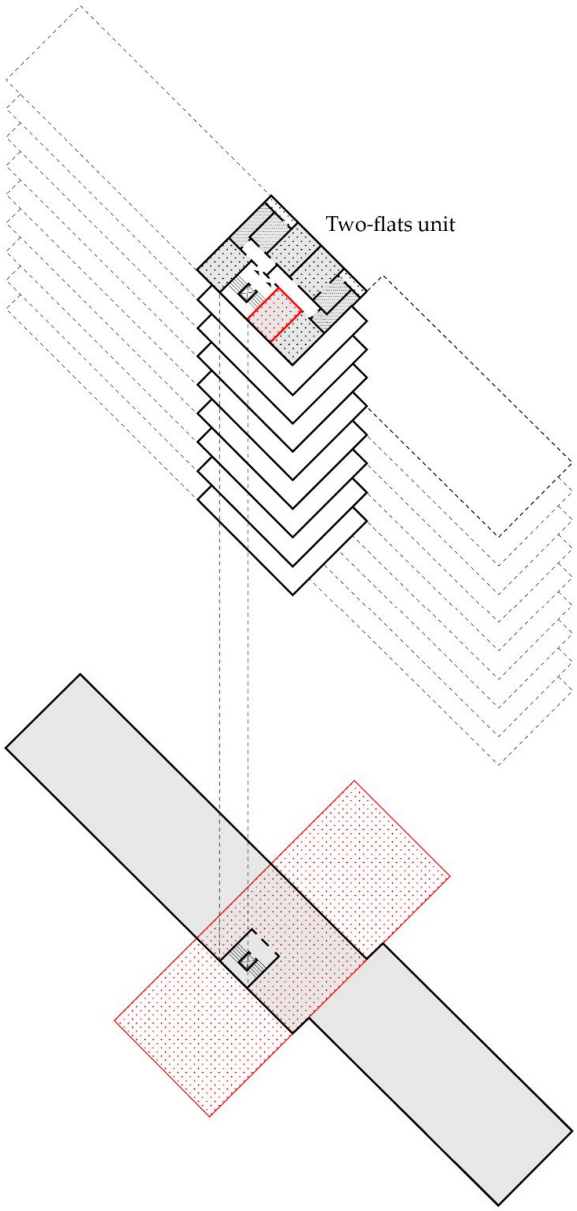


Figure 4. Building-scale classification of spaces, with respect to Table 3.

In this case, we consider the nine floors of two-flats units on the same stairwell for the purpose of calculation. Assuming this perspective, the share of common adaptable spaces available with respect to the two-flats unit reference grows exponentially (see Table 5), both indoor (+10.4%) and outdoor (+32.4%). Although the possibilities of using these spaces are bound to a logic of common interest—for a restricted group of inhabitants—their high transformation potential suggests that the economic and social value of the single apartment could benefit from a considerable increase through a comprehensive design intervention.

The last scale of the analysis is that of the residential complex, defined, in the case study, both, morphologically, as a block bounded by roads and, managerially, as a set of buildings attributed to the same managing body—i.e., the above-mentioned Territorial Household Agency ATC (Figure 5). In this case, we have first subtracted the pertinence area of all the other buildings and stairwells, which, following the logic used in the previous analysis, would be attributed to the corresponding apartments.

Table 5. Building-scale calculation of adaptable spaces—considering nine two-flats units.

Two-Flats Unit		Square Meters (sqm)	(%)	
	adaptable indoor common	114 sqm/9 two-flats units = 12.7 sqm	+10.4%	+32.4% 100% +10.4%
	adaptable outdoor common	354 sqm/9 two-flats units = 39.3 sqm	+32.4%	

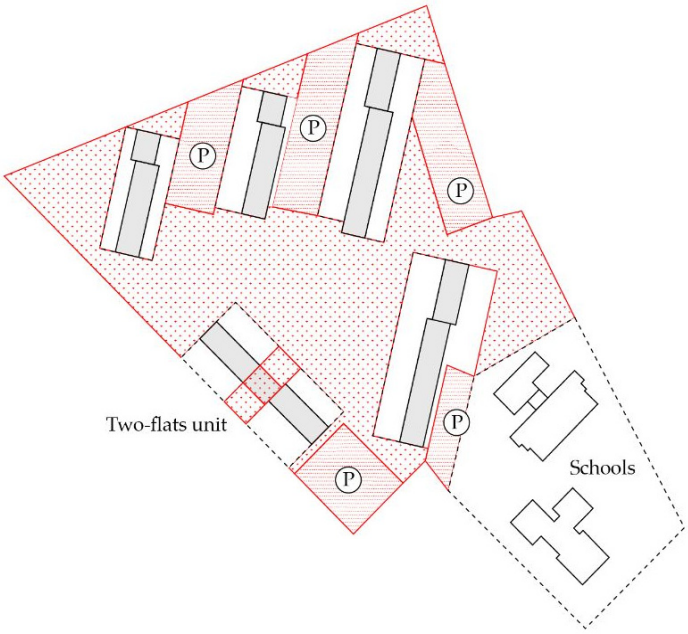


Figure 5. Neighborhood-scale classification of spaces, with respect to Table 3.

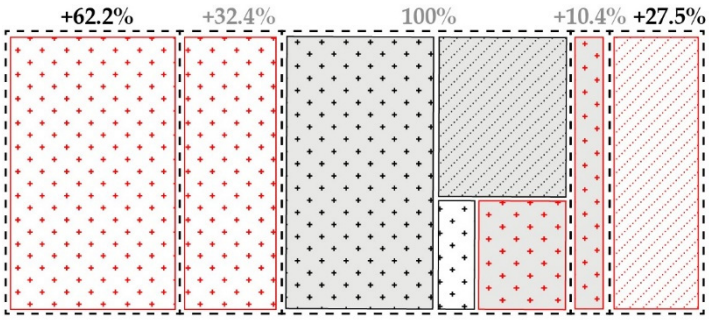
Similarly, we have subtracted the space allocated to specific public functions, such as schools. Finally, we have extended the concept of adaptability by considering "rigid" all spaces characterized by spatially and/or normatively binding functional attributions—e.g., parking lots (P), as standards and building-related, are considered as rigidly located. Even in this case, in fact, the transformation process would be very costly, both in economic terms and due to the complexity of the authorization process. It has to be specified that we are aware that, at the scale of the neighborhood, the implications and the complexity of the process in a perspective of adaptive reuse and transformation of space are different from the two previous scales because they involve further reflections on ownership and management aspects. However, in view of the unity of ownership and management responsibility of Via Artom housing estate—of the City of Turin and the ATC, respectively—and considering the propensity on the part of the residents to use the open spaces as an extension of the residential units—although not fenced off and formally public, these spaces are, therefore, used in the same way as a communal garden in a private complex—we assume the hypothesis that the entire neighborhood can be considered a micro-center related to this specific community. This hypothesis might be more difficult to extend to private housing estates, but is still plausible if a demonstrable increase in the quantity and quality of space available for individual owners is assumed as the driving factor for change.

Accordingly, for the purpose of the calculations, we again refer to the perspective of the unit of two apartments adopted so far. In this case, we consider again the nine

floors of two-flats units on the same stairwell for the purpose of calculation; moreover, we calculate five stairwells for three of the five buildings, and three stairwells for the other two. In doing so, the two-flats units to be considered for this calculation are 189. Assuming this perspective, the share of common adaptable spaces available outdoors at this scale, with respect to the two-flats unit reference, grows again further (+62.2%), increasing the spectrum of possible transformations and, consequently, the potential for increased value (see Table 6).

Table 6. Neighborhood-scale calculation of adaptable spaces—considering 189 two-flats units.

Two-Flats Unit		Square Meters (sqm)	(%)
	adaptable outdoor common	14.263 sqm/189 two-flats units = 75.46 sqm	+62.2%
	rigid outdoor common	6.310 sqm/189 two-flats units = 33.38 sqm	+27.5%



5. Conclusions and Further Developments

The current COVID-19 pandemic has brought to light the need to call into question the concept of adequate housing and the parameters commonly used to measure it. Indeed, private and communal spaces, such as gardens, apartment-block terraces, and other often underused spaces, which had critical importance during lockdown periods, can become unexpected resources for improving social interactions and spatial quality in existing neighborhoods. The present paper aims to assess the potential for value creation through architectural and urban projects, by drawing on the experience of the COVID-19 pandemic to investigate the relationship between residential spaces and people's behavior to offer a new design perspective on the potential of such latent spaces to respond to emerging housing needs. Our assumption is that adaptive reuse of spaces promoting diverse and evolving uses can produce new economic and social value for housing stock, with implications for both design strategies and the assessment of housing adequacy.

Our analysis focuses on the public housing stock of Turin in Italy, with a selection of buildings under the management of the ATC as a paradigmatic, as well as ordinary, case study [16]. Indeed, the boundary conditions of public housing estates are similar and their specific characteristics—even more so in other countries—simplifies the application of specific processes and design strategies. We then consider the underutilized spatial assets of residential neighborhoods—particularly evident in the case of public housing—with potential for adaptive reuse, questioning the generalizability of what is found at the micro-scale of observation. Accordingly, we analyze such spaces' conditions similar to those observed locally in other residential neighborhoods and units, both publicly and privately owned, suggesting potential for replicability of our findings. By doing so, although it does not aim to present definitive answers, this study provides insights for areas where future research is required.

First of all, the paper highlights the potential of some underused residential spaces for creating extra values that are often overlooked in the assessment of housing adequacy. Increasing values arise firstly from the intensified use of these spaces, which, as highlighted

by the literature on the implications of COVID-19 in the spatial realm, has grown and diversified during the pandemic, with a consequent increase in demand for adaptable spaces. Conversely, the commercial value of extraordinary or common spaces, such as terraces, common gardens, etc., is usually lower than standard. In Italy, for example, the commercial surface area of these spaces is usually weighted with a reductive coefficient in real estate valuation. Although this is not the object of this paper, it is worth asking whether, as demand increases, the market value of residential spaces might also change, and by which criteria. Furthermore, the potential for adaptive reuse of underused residential spaces highlighted in the research has implications for the social value of such spaces. Indeed, an optimization of the use of space in a perspective of circular economy is envisaged, in which the partial reduction in private space is balanced by an increase in the benefit for the individuals in terms of quality and quantity of spaces accessible and adaptable to different functions.

Secondly, the research shows the importance of a multi-scalar approach in assessing housing adequacy. As shown, the results of the analysis change substantially according to the three scales of the apartment, the building, and the neighborhood. Only by considering several scales of observation at the same time and their reciprocal relationship was it possible to properly identify the key factors to be considered for developing urban and architectural projects.

Finally, and most relevantly, the paper provides some important insights for the design of underused residential spaces with a focus on adaptive reuse. Some common and recurring factors are underlined in the research as current trends to be taken into account: (i) the role of open spaces and the relation among indoor and outdoor spaces; (ii) the livability of spaces, in terms of private or common uses; (iii) the level of spatial adaptability, with respect to rigid or adaptable spaces and uses. Accordingly, a set of suggestions of potential spaces for action is identified and visualized, then also redrawn and quantified, by focusing mainly on the potential for adaptability of spaces to improve existing conditions. Without going into the details of specific design solutions, some general design indications emerge from the analysis developed: (i) the quality and accessibility of both private and communal open spaces should be enhanced, identifying appropriate spaces for different functions or target users; (ii) some indoor and outdoor spaces, selected at different scales for their versatility and location, lend themselves to being redesigned for shared use, in line with the increasing openness of a wider spectrum of inhabitants towards various forms of sharing and cohousing; (iii) adaptability to accommodate diverse uses and new functions in the short- and long-term is a key requirement for residential spaces, which must be safeguarded and enhanced. More generally, an adaptive reuse project is called upon to start from an accurate analysis of the potential of existing spaces at different scales in order to propose solutions adapted to the social and spatial specificities of the area and to the valorization of existing resources in a perspective of continuous development.

By addressing the potential for value creation in residential spaces, this study indirectly questions how the adequacy of those spaces is normally measured. In line with this, possible future investigations are envisaged in terms of the evaluation indicators commonly used to assess housing adequacy and the potential for adaptive reuse that becomes evident in a number of unmeasured spatial resources. Despite environmental and economic sustainability consisting of well-developed measures, mainly related to quantitative data, that we can use as indicators in practice, existing frameworks focus on evaluating built structures and fail to take further experiences and wellbeing—such as those that emerged during lockdown—into account. Therefore, a more comprehensive model is needed to reconsider the established evaluation practices and to think about these spaces not only in terms of potential, but focusing on how the project can increase economic and social value while accommodating evolving uses. Indeed, the targets of sustainability assessment are generally used for proposing actions—such as projects, programs, plans, or policies; similarly, the identified key factors can be narrowed down at the project level and employed to practically address the potential for sustainable development through the

adaptive reuse of such underused spaces, also in relation to the specificities of each one, with the identification of functions and specific design devices.

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