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METHODS, TOOLS AND BEST PRACTICES

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## THE CITY CHALLENGES AND EXTERNAL AGENTS. METHODS, TOOLS AND BEST PRACTICES

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The cover image shows the Irpinia hills at sunset, highlighting the enhancement of two renewable energy sources: sun and wind.  
The photo was taken by Giuseppe Mazzeo in August 2022, in S. Andrea di Conza, Avellino, Italy.

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## Circular living. A resilient housing proposal

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### Abstract

The current climate change consequences, the migration phenomena, the pandemic, and the war affect the already unstable housing system situation. Implementing resilience is as necessary as ever to solve the existing housing crisis. In particular, a little number of housing units, lack of maintenance, the inadequacy of the heritage to the new housing needs, and weak attention to social aspects, characterize the Italian social housing system. Considering the possible powerful relationships between resilience, circular economy, and housing, this paper is aimed at determining whether and how CE principles can be applied in the social housing system to make it more resilient, adopting a qualitative research method. To this end, a model for Circular Living (CL) is proposed: it includes strategies at the building, neighbourhood/city, and territorial scales. It is extrapolated from the existing bibliography on housing system, resilience and circular economy; the analysis of the case study of south Salento together with its critical housing system and some emerging best practices. The use case of a 70s public building in Lecce is also presented. Although the CL Model is for the resilience of the social housing system in peripheral territories, future research could implement and validate the model in different contexts and systems.

### Keywords

Resilience; Circular economy; Social housing; Flexibility; Housing distress.

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## 1. Introduction

Strategies to implement resilience are an increasingly urgent demand. This nowadays is crucial, considering the constant and new natural catastrophes and climate change consequences – which are expected to worsen in the following years (Micalella, 2014) – migration phenomena, the effects of the pandemic, and the more unstable economic and social situation. All these aspects have a great impact on housing issues.

In detail, the Italian housing system is characterized by several inefficient aspects: these include the numerical lack of housing units, the inadequacy of heritage (Mielis, 2011), and the weak attention to social aspects (Guarino, 2010). The need of modifying the actual housing system to fight the housing access problem has already been pointed out (Federcasa, 2020). Moreover, a lack of strategic view in management choices characterizes the system, which has rarely been reinterpreted in a resilient way.

Some definitional clarifications are necessary. The European interpretation of the term "social housing" refers to the set of services and housing, actions and tools needed to allocate suitable units to families who, due to financial or other problems, have difficulty in finding housing at the market conditions (Czyschke & Pittini, 2007). In this sense, "social housing" includes all other forms and models of housing (public housing, cooperative, affordable private housing, etc.). Social housing is not only a provision of houses but also a complex system (Kraatz, 219) that interferes with and can change many layers and systems making up a city (Porter et al., 2018).

In some studies, housing and resilience are closely related. All UN-Making cities resilient<sup>1</sup>, City Resilience Profiling Program<sup>2</sup>, and 100 Resilient Cities<sup>3</sup> consider social housing as a system in which resilience can and must be implemented, representing an occasion for multiple levels. It is worth mentioning the reference contained in the Sustainable Development Goals of the Agenda 2030, where housing is one of the strategies to obtain Goal 11 "Sustainable cities and communities"<sup>4</sup>. Indeed, some achievements are not a novelty in public housing history. Social housing was conceived in the immediate post-war period through a strong centralist intervention plan. During the INA Casa<sup>5</sup> period, it achieved social cohesion and led to the construction of new and more sustainable buildings, new relationships between the city and the user, new public spaces, and new urban fabrics connected to the rest of the city (Di Biagi, 2001). Moreover, nowadays, social housing has allowed starting urban regeneration processes (Guarino, 2010), as it has modified the social infrastructure, empowering people, and giving them the tools to operate to become active citizens and workers (Holz, 2016). Experimentations on social housing sites can be a strategy to regenerate cities and provide them with quality and efficiency, in addition to a way to recover from the pandemic crisis. In this way, social housing can also become a tool to experiment and set new standards, as done in the past. So, social housing experimentations can define a new paradigm of spaces, in adaption to economic, social, and environmental external agents.

Instruments to obtain a resilient housing system could be various. Among them, one of the most significant could be the application of the circular economy (CE) approach, as it allows operating on both physical and human dimensions. According to the European Parliament (2022), CE is defined as "a model of production and consumption, which involves sharing, leasing, reusing, repairing, refurbishing, and recycling existing materials and products as long as possible. In this way, the life cycle of products is extended". Although the approach has been deeply studied because of the huge resource consumption caused by the construction sector, the interaction between social housing and circular economy is an emerging theme. A few studies, such as the ones by Marchesi & Tweed (2021), Cetin et al. (2021) and Bolici et al. (2020), apply circular and

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<sup>1</sup> Available at: [www.unisdr.org/campaign/resilientcities/](http://www.unisdr.org/campaign/resilientcities/)

<sup>2</sup> Available at: [unhabitat.org/programme/city-resilience-profiling-programme](http://unhabitat.org/programme/city-resilience-profiling-programme)

<sup>3</sup> Available at: [resilientcitiesnetwork.org/](http://resilientcitiesnetwork.org/)

<sup>4</sup> Available at: [ec.europa.eu/international-partnerships/sustainable-development-goals\\_en](http://ec.europa.eu/international-partnerships/sustainable-development-goals_en)

<sup>5</sup> INA Casa was an intervention plan by the Italian government. The plan was in effect between 1949 and 1963, implemented Italian public housing, and generated work. It was managed by a specific branch of INA (Istituto Nazionale per le Assicurazioni), the national authority for insurance.





*Residenziale Pubblica* (ERP)<sup>10</sup>. Some of the aspects, which make ERS an innovative model, compared to the ERP system, are the partnership between the public and private sector, the strong attention to social actions and services, and, as mentioned, the presence of different targets. At the same time, working on ERS is a great opportunity to operate on the communitarian level of the system. Anyway, ERS experimentations are not so frequent and are mainly located in Northern Italy. It should also be noted that the reuse of existing buildings in a state of neglect as a means of responding to housing problems is not a common practice. ERS interventions have often implied the construction of new buildings; this has led to more soil consumption, the absence of new value, and new territorial resources to trigger urban regeneration processes (Martinelli et al., 2020).

Despite the presented tools for fighting housing exclusion, as previously stated, the Italian social housing system is characterized by a defective offer – just 3% of the total housing units are social (Pittini, 2019) – lack of maintenance of the heritage and weak attention to the social aspect. The rising in poverty and extension of the “grey target” has produced a high, unfulfilled housing demand (Palvarini, 2006). Consequently, 9% of Italian families are in a condition of housing poverty (Palvarini, 2010), hence leading to the current housing crisis.

These critical conditions lead to the need for specific interventions and funding, not as spot actions, but instead organized in a complex and organic frame, to properly modify and improve the housing system.

### 3. Research method

Considering the possible powerful relationships between resilience, circular economy, and housing, this paper is aimed at determining whether and how CE principles can be applied in the social housing system to make it more resilient, adopting a qualitative research method (Creswell & Creswell, 2017). The research aims at exploring possible new governance solutions to overcome the current limits in the management of housing supply, functionally and typologically adapting the existing public heritage to the new needs. The goal is to protect and extend the lifetime of the public heritage, modifying uses and shapes and responding to growing housing needs, using resources circularity. To this end, the research consists of three consequential main phases, hereafter briefly recalled and represented in Fig.1: Phase 1) Literature review; Phase 2) Case study exploration; Phase 3) Model definition.

In the first phase, the literature review about CE, resilience, and social housing has been explored to create a common knowledge base on a previously unexplored topic useful to guide the entire study. So, by adopting a snowball sampling technique, the explorative literature review process stopped when qualitative information collected was considered complete and clear (saturation) (Bell et al., 2018). From the review, the theoretical matrix based on resilience adjectives and CE pillars has been extrapolated, and literature gaps have been underlined. The main contents emerging from this first phase were proposed in section 4.

In the second phase “Case study exploration”, South Salento is chosen as the area of investigation. The South Salento housing system is selected as a case study (Yin, 1994) because of its territorial peculiarities, unexplored social housing issues, and suitability for wide-area strategies. It is peripheral, characterized by medium-small strongly interconnected municipalities, housing distress, and landscape values, together with social phenomena, such as aging of the population and internal area depopulation (Puglia, 2015). Therefore, the selected case study involves a case that is somehow unique and specific, as well as unexplored. Two main data collection methods are adopted, namely the analysis of existing documentation and data (secondary data) and field observation.

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<sup>10</sup> Within the document, ERS is defined as the system of “real estate units with residential and general interest function that safeguard social cohesion and reduce the housing problems of disadvantaged individuals and families, who are unable to access the rental of housing in the free market. It is accompanied by the set of housing services aimed at satisfying primary needs”.

As to documentation, the plans at the regional (PPTR<sup>11</sup>), provincial (PTCP<sup>12</sup>) and municipal levels (e.g. Lecce PRG<sup>13</sup>), and sectorial studies (South Salento Internal Area<sup>14</sup>) were studied. In addition, all data found online and at the relevant administrations related to housing needs and public assets were collected. Data collected were integrated with those collected by direct observations of the work carried out within the public administrations (Apulia Region, ARCA Sud Salento). Direct observation was particularly useful to better understand the recurrent problems, ongoing projects, and emerging strategies. This phase of the South Salento scenario corresponds to paragraph 5.

The last step, as reported in paragraph 6, has been the definition of the CL Model, an innovative tool for improving the resilience of the social housing system in peripheral territories, operating on different scales and dimensions.

The model consists of a frame that derives from the overlapping of the concepts of CE, social housing, and resilience, and a set of strategies that are specific for the analysed territorial context. Its infrastructure is, in fact, the direct consequence of the first phase whereas the specific actions that are presented in the model are the consequence of the second phase. Finally, a use case assessment (Kart & Spece, 2003) is provided. The selected use case is a '70s building located in Piazzale Cuneo (Lecce) because it represents one of the most frequent conditions of South Salento's public housing heritage. The example also represents a way to show a possible and real application of the model.

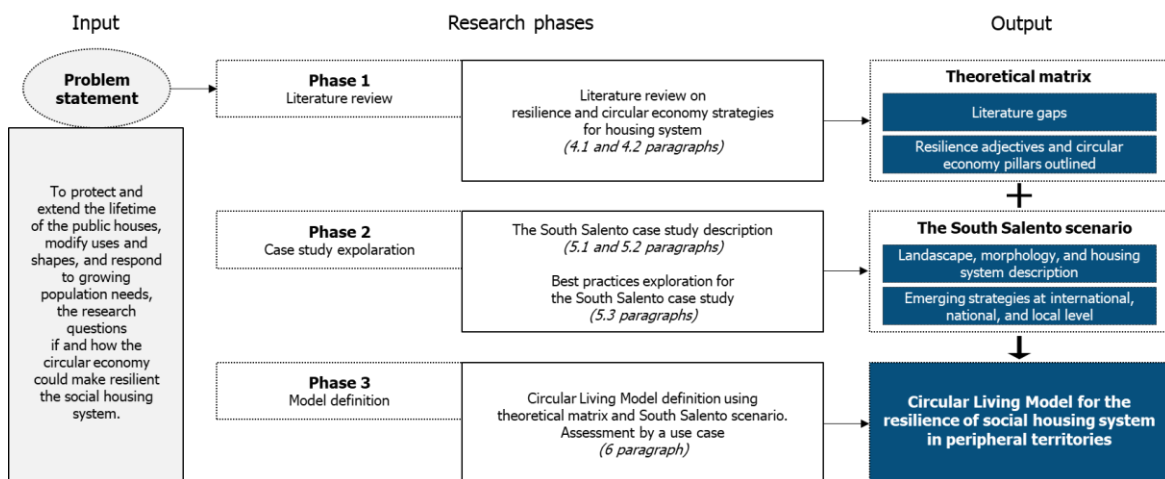


Fig.1 Research design

<sup>11</sup> Regional Territorial Landscape Plan is a landscape plan which has been introduced in Apulia in 2015. The plan is supposed to give a deep knowledge of Apulian territory, to protect and enhance landscape values and to give directions for a sustainable and harmonic territorial development. Further information is available at: [http://www.sit.puglia.it/portal/portale\\_pianificazione\\_regionale/Piano%20Paesaggistico%20Territoriale](http://www.sit.puglia.it/portal/portale_pianificazione_regionale/Piano%20Paesaggistico%20Territoriale)

<sup>12</sup> Provincial Territorial Coordinament Plan is a territorial plan which has been introduced with Law 1150/42. The plan gives instructions for more detailed local plans. The PTCP for Lecce Province has been approved in 2008 and is available at <http://www3.provincia.le.it/ptcp/ptcp/index.htm>

<sup>13</sup> General Regulator Plan, introduced with Law 1150/1942, is a municipal plan which established the territorial development of the area. In Apulia Region this planning tool has been replaced by the more innovative General Urbanistic Plan with Regional Law 20/2001. Anyway, many Municipalities, such as Lecce, still use their ancient PRG. Lecce PRG, which was approved in 1983, is available at: <https://www.comune.lecce.it/amministrazione/settori/pianificazione-e-sviluppo-del-territorio/progetti/p.r.g.-vigente-tavole-centro-storico---1-2000---1-5000>

<sup>14</sup> More information and studies over the area can be found at <https://politichecoesione.governo.it/it/strategie-tematiche-e-territoriali/strategie-territoriali/strategia-nazionale-aree-interne-snai/strategie-darea/regioni-del-sud/regione-puglia/sud-salento/>

## 4. Background

### 4.1 Housing resilience

Resilience is the ability of a system, community, or society exposed to hazards to resist, absorb, accommodate, and recover from the effects of a hazard in a timely and efficient manner, including the preservation and restoration of its essential basic structures and functions (UNISDR & WMO, 2012).

Since 2008, resilience is one of the main themes of urban studies (Jong et al., 2015). The concept comes from biological studies, where it refers to the idea of a system that recovers from shocks (Talia, 2021) and comes back to the past or a new condition (Mehaffy & Salingaros, 2014). When referring to urban studies (Esopi, 2018), it would be more appropriate to consider resilience as the ability to reach a new state of equilibrium. This idea comes from the consideration that urban systems are not stable but change constantly (Porter et al., 2018).

Although resilience from natural catastrophes is well defined and quantifiable (Khazai, et al., 2015), the term, especially when referring to social and economic events, is quite vague. This has sometimes led to different interpretations and political uses of the term (Porter et al., 2018). Commonly, when talking about resilience, the focus is not only to the shock action, but also to the response to continuous stresses in urban systems (Micalella, 2014).

Resilience has become more relevant in the post-pandemic urban scenario. According to the *City Resilience Framework* (Silva, 2015) the adjectives of a resilient city (Tab.1) are reflective, robust, redundant, flexible, resourceful, inclusive, and integrated, and they refer to the interaction of physical and human dimensions (Micalella, 2014). All these adjectives and their definitions are significant to the scientific community for various reasons. They allow better defining resilience and widening the scope of this term; they are qualitative elements of resilient systems evaluation; they represent the input of actions to implement resilience and define urban planning strategies.

Adjective	Definition
Reflective	Reflective systems accept ever-increasing uncertainty and change, have mechanisms to continuously evolve, and will modify based on emerging evidence; they systematically learn from their past experiences to inform future decision-making.
Robust	Robust systems include well-conceived, constructed, and managed physical assets so that they can withstand the impacts of hazard events without significant damage or loss of function. Robust design anticipates potential failures in systems and ensures failure is predictable.
Redundant	Redundancy refers to spare capacity purposely created within systems so that they can accommodate disruption, extreme pressures, or surges in demand. It implies the presence of multiple ways to achieve a given need or fulfill a particular function. Redundancies should be intentional, cost-effective, and prioritized at a city-wide scale.
Flexible	A flexible system can change, evolve and adapt in response to changing circumstances. This may favour decentralized and modular approaches and can be achieved through the introduction of new knowledge and technologies.
Resourceful	Resourceful systems can rapidly find different ways to achieve their goals or meet their needs during a shock or when under stress, so they can anticipate future conditions, set priorities, and respond, for example, by mobilizing and coordinating wider human, financial and physical resources.
Inclusive	Inclusion emphasises the need for broad consultation and engagement of communities, including the most vulnerable groups. Inclusive systems can address both shocks and stress through the diminution of the isolation of sectors, locations, and communities. An inclusive approach contributes to a sense of shared ownership or a joint vision to build city resilience.
Integrated	Integration between city systems promotes consistency in decision-making. Integration should be evident within and between resilient systems, and across different scales. Exchange of information between systems enables them to function collectively and respond rapidly through shorter feedback loops throughout the city.

**Tab.1 Qualities of resilient city system and definitions**

The relationship between social housing and resilience has been mostly explored in the last few years. The first works in this field mainly consider the environmental aspect of both housing and resilience. For instance, one study monitors the overheating of social housing units to implement its resilience (Marvogianni et al., 2015) and others consider the building aspects of the housing system and the reduction of its vulnerability (Garrefa et al., 2021). Another study describes how to improve resilience through the implementation of a management system (Blackwell & Bengtsson, 2021). Some of them specifically analyze risk management of the housing system as a way to improve resilience (Gibb et al., 2016). One of the most complex and complete articles is the one by Kraatz (2019): considering housing as a complex system, he uses both its physical and socio-economic aspects to improve its flexibility and resilience. However, no one investigates the resilience strategies for the social housing system on a multi-scalar basis, and even less adopting circular visions of house reuse, as discussed more specifically in the next section. This paper, instead, tries to fill this literature gap.

## 4.2 Circular strategies

A possible solution to generate housing resilience, modernize housing heritage, and resolve the chronic under-sizing of the public housing system could be the adoption of a circular economy approach. The European Union classifies CE as a core strategy. It can inspire restorative and regenerative design, and creates environmental and social benefits, contributing to building long-term resilience (Marchesi et al., 2020). When applying this approach to buildings, CE is defined as "a lifecycle approach that optimizes the buildings' useful lifetime, integrating the end-of-life phase in the design and uses new ownership models where materials are only temporarily stored in the building that acts as a material bank" (Leising et al., 2018). For buildings, circularity includes design for flexibility (Geraedts, 2016), adaptability (Mofatt & Russel, 2001), disassembly (Ciarimboli & Guy, 2007, Cottafava & Ritzen, 2021; Durmisevic et al., 2007), and the evaluation of embodied energy/carbon (Hammond et al., 2008). The construction sector is identified as a priority area to transform the current linear economy into a circular one. The need for regeneration of the European building stock represents a challenge, but also an important opportunity to apply a circular economy to the built environment (Giorgi et al., 2020), and a tool to reuse materials and reduce land consumption. A better use of the existing housing stock and the extension of its life cycle can reduce the construction of new buildings and urban sprawl phenomena, and the consequent use of new soil. (Mirzahosseini, 2022) This problem is particularly evident in national contexts that are often invaded by construction, with loss of natural spaces, and degradation of soil, landscape, and ecosystem services (Torre et al., 2017).

On a larger scale, CE can improve the management of resources in cities to enhance efficiency and thereby reduce demand, enhance accessibility and support local economic growth, job creation, and innovation (Marchesi & Tweed, 2021). Few studies are documenting how CE can be an alternative space of urban policy and praxis (Bassens et al. 2020). It has been noticed that "circular cities" and, consequently, circular territories, offer improved access to housing, goods, and services and better liveability (Marchesi et al., 2020). A circular city is defined as a city that practices CE principles to close resource loops, in partnership with the city's stakeholders, to realize its vision of a future-proof city. Amsterdam, Glasgow, and Barcelona are some of the cities trying to apply CE to their management strategies (Predenville et al., 2017). Specifically, Predenville et al. (2017) use a CE framework called ReSOLVE, applying it to urban studies. ReSOLVE (Tab. 2) is the most widespread framework among several CE models and has been developed for business models based on other sectors. Even though the framework comes from a different discipline, its definition and characteristics, as shown in the table, can be easily applied, with little variations, to urban studies. The method is particularly important because it is both descriptive and practical and focuses on CE activity on a macro-level (Predenville et al., 2017). At the same time, its value is related to the possibility of working on various dimensions: governmental, economic, environmental behavioural, societal, and technological (Marchesi & Tweed, 2021).

Consequently, the framework well adapts to complex systems such as the housing one. The ReSOLVE framework works on the six pillars of circular economy: regenerate, share, optimize, loop, virtualize, and exchange (Murphy & Rosenfield, 2016). These actions all increase the utilization of physical assets, prolong their life, and shift the use of resources from finite to renewable sources. Each action reinforces and accelerates the performance of the other actions, creating a strong compounding effect (McKinsey, 2015).

<b>Circular Economy pillars</b>	<b>Main actions and strategies</b>
Regenerate	Shift to renewable energy and materials Reclaim, retain, and restore health of ecosystems Return recovered biological resources to the biosphere
Share	Share assets Reuse/secondhand Prolong life through maintenance, design for durability, upgradability etc.
Optimise	Increase performance/efficiency of product Remove waste in production and supply chain Leverage big data, automation, remote sensing and steering
Loop	Remanufacture products or components Recycle materials Digest anaerobically Extract biochemicals from organic waste
Virtualise	Dematerialise directly Dematerialise indirectly
Exchange	Replace old with advanced non-renewable materials Apply new technologies Choose new product/service

**Tab.2 The ReSOLVE Framework**

The interaction between social housing and circular economy is an emerging theme. Marchesi & Tweed (2021) deal with its dimensions exploring the good effect of technological implementation on the building scale. Some recent studies, instead, propose to implement the circular economy within social housing thought operating on the behavioural and societal dimensions of the community, to promote more sustainable consumption practices (Cetin et al., 2021). At the same time, some studies on social housing focus on its relationship with the collaborative economy which does not propose a new consumption model but also an alternative way to move, lend, work, travel, be together, and therefore live (Bolici et al., 2020). Improving the system within a shared logic can improve services, reduce waste, and increase both sustainability and resilience. Whereas these few studies apply circular and collaborative economy principles either to urban planning or to some aspects of the housing system, no study has applied these strategies to the housing system as a whole yet. This dimension is part of the exploration of this paper.

## 5. The South Salento case study

### 5.1 Landscape morphology and inter-urban synergies

The South Salento is a strategic territorial area in several respects. It is a peninsula that can be considered a sub-region: it is the province with the highest number of municipalities in the Region, as well as being the second most populous in Puglia after the Metropolitan City of Bari. The province of Lecce is administratively organized into 96 municipalities and has a total population of over 782,000 inhabitants. With a surface area of almost 2,800 km<sup>2</sup>, it has a density of about 280 inhabitants per km<sup>2</sup>, due to the local morpho-typological characteristics of the area.

The Regional Territorial Landscape Plan (PPTR) identifies two main landscape areas in the South Salento: "Tavoliere Salentino" and "Salento delle Serre". Both are characterized by the widespread presence on the

territory of small and medium-sized urban centres, interconnected by a dense provincial road network and fast-flowing roads, which allow continuous dynamic flow and socio-economic correlations between several towns. In particular, Tavoliere Salentino has a more consolidated urban network, which is denser until merging near the provincial capital Lecce, where the suburban fabric develops almost uninterruptedly along the main arterial routes. The existing road network and the morpho-typological characteristics of the South Salento have thus allowed, over time, the creation of an articulated urban system consisting of a series of interconnected and complementary urban centres, which are characterized by consolidated or ongoing conurbation phenomena and strong synergic socio-economic relations.

A shared identity factor between both landscape areas is the existence of synergic socio-economic and cultural inter-urban relations and dynamics that transcend municipal administrative boundaries. These synergies make up the image of a "widespread Salento city" in the territory, which takes the form of a territorial archipelago of several urban conglomerates; for each inter-municipal archipelago, common identity features and internal flows of exchange and dynamic actions can be identified.

This theory is proven by the current system of local autonomies in Salento. The Unions of Municipalities in the province of Lecce provide for the administrative grouping of 74 municipalities into 15 groups, a significant number if we consider that they are 22 in the whole Puglia Region. Besides, the conurbation of the municipalities of Acquarica del Capo and Presicce has been approved, and the *Area Interna Sud Salento* (South Salento Internal Area) has been established. The latter is a group of 13 municipalities in the Capo di Leuca area to implement strategies to improve the quality of the area to counteract the abandonment of urban centres.

This trend offers the opportunity to experiment with new planning and regeneration strategies in the housing sector to counter the risk of impoverishment and abandonment of smaller urban centres, while responding to the growing housing needs exacerbated by the pandemic.

## 5.2 Housing trends

Public housing in South Salento is characterized by an excessively small number of large apartments, principally built in the GESCAL period, with a scarce maintenance level. The housing heritage is represented by 9,044 public apartments, which is too little considering that the resident population of the area is 797,000 persons; this is also the lowest number of housing units among Apulian provinces (Fig. 2). Total demand data are not available, but as a reference, in Lecce, only 5% of the requesting people have been provided a housing unit (Miglietta et al., 2021). Moreover, on a Provincial level, from the side of supply, just considering ARCA Sud Salento<sup>15</sup> properties, out of the owned apartments almost 50% is for families of 5 or more components (more than 85 square meters according to Apulian regional law) which instead only represent 6.7% of the local population. The apartments for 1 or 2 persons, which represent almost 63% of the population, are instead just 8.8% (Fig.2 and Fig.3). Similar data can be seen when focusing on Lecce, the provincial capital. These data are quite homogenous over the whole analysed area. It is also worth noting that a big problem of the provincial housing system is that no system for collecting data is well working. It is also conceivable that data on the demand side could not be appropriate because many people do not ask for an apartment, as they already know their request will not be fulfilled. These data are also managed on a Municipal level and at different times and so are very difficult to collect and interpret.

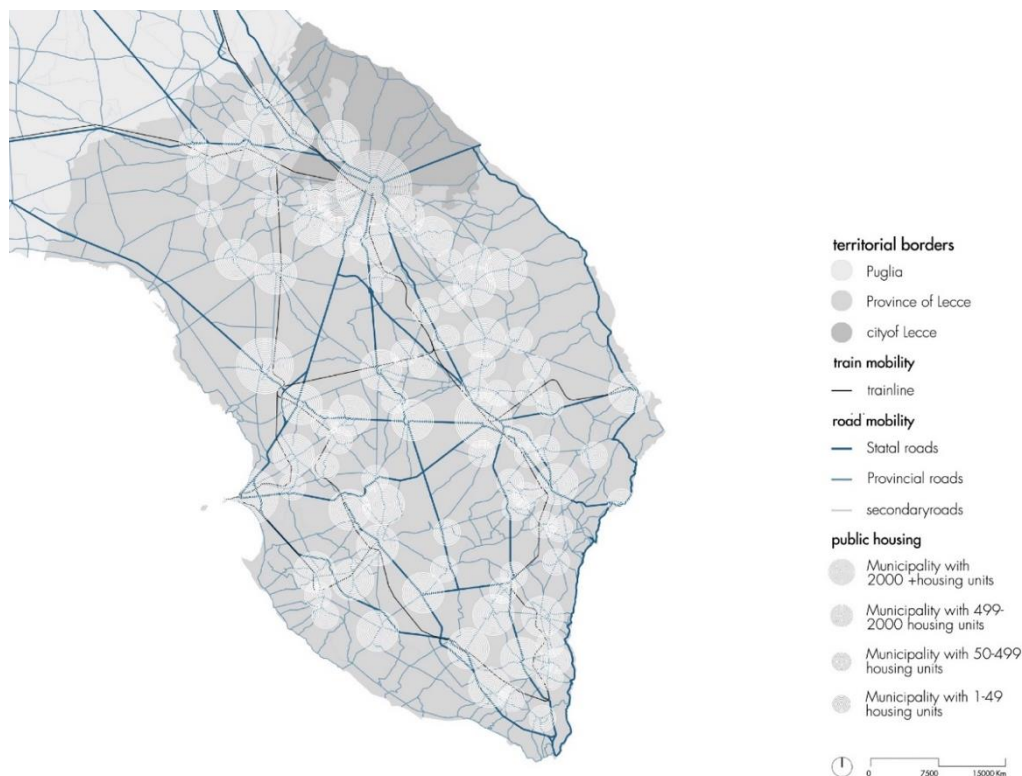
No ERS initiatives have yet been started, except for La Casa and Galateo in Lecce, which are still under construction. Moreover, there are no data on the "grey" target, which is supposed to be a large amount of the population considering that South Salento is one of the poorest areas in Italy. Consequently, no useful urban

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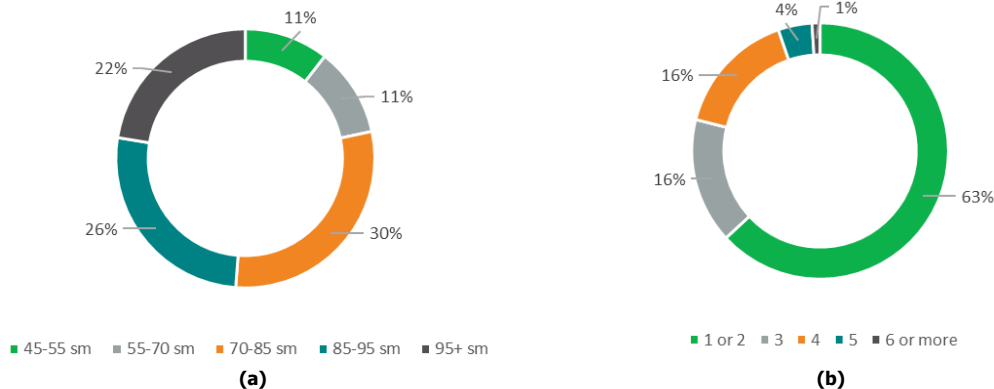
<sup>15</sup> ARCA (Regional Agency for Housing and Living policies) is a Provincial authority in charge of the management and implementation of the local public housing system. ARCA Sud Salento works in the area of the current study, whose website is: [arcasudsalento.it](http://arcasudsalento.it)

policies can be properly defined and hence there is a high risk of making private interests prevail over public ones. Instead, ARCA has collected data on the users of public housing units thanks to a 2018 survey. Anyway, these data have never been elaborated on.

The analysis of ARCA properties – that is, improperly excluding municipal properties – shows a capillary distribution of the apartments; anyway, this distribution is unequal between different Municipalities. Indeed, over 96 Municipalities 89 are provided public housing and the major concentration of public apartments is in the biggest centres such as Maglie and Lecce (Fig. 3). Concerning all said, generating greater cooperation among Municipalities. This is because, according to the Regional Law 10/2014<sup>16</sup> over “Allocation and lease determination of public housing units”, Municipalities do own a smaller part of public housing and at the same time they are in charge of matching houses and inhabitants. Consequently, ARCA is unable to have a complex outlook of the housing system of its territory of action. Also, concerning territorial relations and the abovementioned shrinkage problems of the smaller centres of South Salento, inter-institutional and territorial cooperation could be a wide-area response strategy against housing distress.



**Fig.2 Public Housing distribution in south Salento**



**Fig. 3 (a) Housing units dimensions and (b) Number of families depending on the number of components**

<sup>16</sup> This law is the most important one for managing the public housing system. It establishes the dimensions of housing units depending on the family dimension, the way to calculate the rent of the users, who can enter the public system and who should exit it, how to make the mobility tool work.

### 5.3 Best practices suitable for the local housing system

After examining the abovementioned characteristics and criticalities of South Salento, and studying them through the analysis of its landscape morphology and inter-urban synergies, and its housing system, different possible strategies emerged. In detail, thanks to a desk analysis of international, national best practices in the housing field and the efforts of the local managing authorities and academic researchers, strategies are extrapolated and generalized to apply them to the “peripheral territories” (with similarities to the case study), as a filter.

A relevant best practice that implements the number of housing units is the reuse of an existing and abandoned building to obtain new housing units. In this category, relevant examples are the reuse of Torino Porta Palazzo (Spadafina & Scarpelli, 2022) and Caserne de Reuilly (Habitat, 2020). Another variation of this strategy is to loop and exchange soils by demolition and reconstruction. This alternative possibility has emerged in the latest studies and is based on the consideration of the underuse of the heritage, its weak maintenance status, and its low architectural and constructive qualities can lead to demolition that is now acquiring a new value (Merlini, 2019).

In other best practices, such as Grand Parc Bordeaux and Rooftop Housing (Paris & Bianchi, 2019), new housing units are obtained through a different action, that is the addition of new parts to the existing building. Grand Parc Bordeaux is also significant because it focuses on the energy retrofit and extraordinary maintenance of the existing building (Paris & Bianchi, 2019).

The huge investments for ecologic transition together with the necessity of maintenance of the housing heritage underline the importance of this strategy.

As stated, the application of collaborative economy and co-housing strategies can realize housing resilience. This has been done in La Borda in Barcelona, where private spaces are reduced to create common services and spaces (La Borda, 2022), and in *Cenni di Cambiamento* in Milan, where a common space “for working mothers” has been built; in this space, mothers can help each other to educate and look after children (FHS, 2022).

A significant best practice is the social mix: despite being an emerging strategy in Italy, it has been widely tested in the Netherlands. It means creating a specific mix of people to promote integration. In Italy, *Ospitalità Solidale and Casa dell’Accoglienza* (Castelli et al., 2019) are some of the most relevant examples.

Closely in touch with the creation of the social mix, it is to be stated the possibility to match spaces, targets, and services for its specific necessities and services. This strategy, studied by the “Service-oriented Urbanism” (Izza et al., 2007), also responds to the emerging need of a 15-minutes city (Abdelfattah et al., 2020).

When thinking of urban regeneration and social cohesion processes, another significant experience is represented by DAR Casa Milano, a program where residents pay a minor rent in exchange for hours of social activities to obtain more social cohesion (Spadafina & Scarpelli, 2022).

This objective has also been reached in *Cenni di Cambiamento* by FHS Milano<sup>17</sup> where a specific non-profit organization has been founded: *Associazione Officina Gabetti 15*.

In this specific context, actions to better environmental awareness are developed, through events and associations (FHS, 2022).

Another successful action is to establish a mandatory percentage of ERP and ERS units in big private operations. This possibility is supposed to have great success in Milan, in the area where it is planned by PGT<sup>18</sup> (2019).

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<sup>17</sup> Fondazione Housing Sociale is a no-profit found involved in providing a house to “grey targets”. Nowadays, it represents one of the most important and best-working bodies in the housing field

<sup>18</sup> Piano di Governo del Territorio (Territorial Management Plan) is a planning document where the main strategies to obtain the vision of Milan 2030 are listed.



Strategy	Best practice	Source
Recovery and Reuse of the existing heritage	Torino Porta Palazzo and Caserne de Reuilly	<a href="https://www.officina-artec.com/project/officina-36/">https://www.officina-artec.com/project/officina-36/</a> <a href="https://www.parishabitat.fr/nos-programmes/caserne-de-reuilly/">https://www.parishabitat.fr/nos-programmes/caserne-de-reuilly/</a>
Extraordinary maintenance and energy efficiency	Grand Parc Bordeaux and Rooftop Housing	Paris, S., & Bianchi, R. (2019). <i>Ri-abitare il moderno</i> . Macerata: Quodlibet.
Reuse of soils	Demolition as a territorial reform (2019) by Merlini	Merlini, C. (2019). Demolition as a Territorial Reform Project. In S. Della Torre, C. Cattaneo, C. Lenzi, & A. Zanelli, <i>Regeneration of the Built Environment from a Circular Economy Perspective</i> . Milano: Springer Open.
Common and shared spaces	La Borda and Cenni di Cambiamento	<a href="http://www.laborda.coop/ca/">http://www.laborda.coop/ca/</a> <a href="http://www.cennidicambiamento.it/">http://www.cennidicambiamento.it/</a>
Operation over Social Mix	Ospitalità Solidale and Casa dell'Accoglienza	<a href="http://www.darcasa.org/portfolio/ospitalita-solidale-2/">http://www.darcasa.org/portfolio/ospitalita-solidale-2/</a> <a href="http://www.casadellaccoglienza.org/">http://www.casadellaccoglienza.org/</a>
Users with specific tasks	DAR Casa Milano	<a href="http://www.darcasa.org/">http://www.darcasa.org/</a>
Activities to create sense of community and environmental awareness	Cenni di Cambiamento	<a href="http://www.cennidicambiamento.it/">http://www.cennidicambiamento.it/</a>
Applying sharing economy and co-housing tools	La Borda and Cenni di Cambiamento	<a href="http://www.laborda.coop/ca/">http://www.laborda.coop/ca/</a> <a href="http://www.cennidicambiamento.it/">http://www.cennidicambiamento.it/</a>
Definition of a relationship between target and service	Service-oriented Urbanism	Izza, S., Vincent, L., & Burlat, P. (2007). An Approach for Service-Oriented Urbanism. In R. Gonçalves, J. Müller, K. Mertins, & M. Zelm, <i>Enterprise Interoperability II</i> (p. 879-890). Londra: Springer.
Mandatory percentage of social and public housing in new interventions	PGT Milan	<a href="https://www.pgt.comune.milano.it/">https://www.pgt.comune.milano.it/</a>
Territorial management of services	ALER Milan	<a href="https://aler.mi.it/">https://aler.mi.it/</a>
Agency to match demand and supply	Milano Abitare	<a href="https://milanoabitare.org/">https://milanoabitare.org/</a>
Reuse of touristic apartments during no-touristic periods	UK and Ireland	

**Tab.3 Best practices and strategies coming from bibliographical research and suitable for bettering the local housing system**

Another important experience has been led by ALER Milano<sup>19</sup>, which is now managing the apartments owned by Milan Municipality. This improves efficiency by creating unique management of data and apartments. Milan Municipality also developed Agenzia Abitare Milano, in cooperation with Fondazione Welfare Ambrosiano, which enriches the low-cost rent market and helps the “grey target” to access an apartment. This agency works to create a contact between offer and demand inside of the private sector and helps the “grey target” by either bestowing them facilitation or giving the owners the assurances the private cannot guarantee

<sup>19</sup> Agenzia Lombarda Edilizia Regionale of Milan is the responsible housing association for the Province of Milan. It is the local equivalent of ARCA.

(Spadafina & Scarpelli, 2022). This strategy is particularly important because in Italy around 12% of the private housing units are unused (Agenzia delle Entrate, 2019).

Colleges in the UK represent the last reported significant best practice. In summer, they are used for tourists and, in the other periods of the year, they are used to respond to student housing needs.

Tab.3 summarizes the presented actions and references.

## 5.4 Emerging strategies within the local housing system

Many positive strategies are emerging within the case study area. It is worth mentioning the valorisation of public and open space and mobility systems, already proposed by PPTR, with particular reference to peri-urban areas and slow mobility. Considering the interurban synergies of South Salento, the implementation of these systems and the connection of the housing system with the other layers of the urban structure are key aspects to improve system integration.

One more interesting experience is the research work "*Città Pubblica nel Mezzogiorno*"<sup>20</sup>, developed in a degree thesis at the Polytechnic University of Bari, whose reflection starts from the oversizing of the housing units, and proposes fragmentation policies for the built environment. The study proves the adaptability of some best practices that have been developed in Northern Europe and Italy, within the city of Lecce and hence within South Salento. The main examples presented by the work are the fragmentation of the existing units in De Flat Kleiburg (Paris & Bianchi, 2019) and Ausbauhaus Neukolln (Richter Praeger, 2014) and the case study of Piazzale Cuneo in Lecce.

Within the same thesis, housing strategies have been proposed considering Regional Law 10/2014<sup>21</sup> and the abovementioned incoherence between housing unit dimensions and users. Housing mobility is scarcely practiced in South Salento but should be implemented, making mobility compulsory or voluntary depending on the situation (e.g. mandatory within the same building and the same small municipality). This framework of housing mobility could help disabled and elder persons to stay on the ground floors, while voluntary mobility between different cities should be possible. Another important innovation for housing mobility strategies can be the accompaniment of people who are no more suitable for public housing but still stay within the "grey target" and should be helped to find a new house.

Apulia Region is considering the construction of a continuously updated online system to match user and housing units, and to manage the mobility system on a territorial scale, as it has been done in Lombardy. This is supposed to be helpful because Municipalities take years to assign housing units, resulting in incompatibility with rapidly changing housing needs. Concerning data collection, Apulia has already developed the PUSH<sup>22</sup> platform to collect data on the "grey targets" and the ORCA platform to collect data over Regional Law 431/98<sup>23</sup>. At the same time, in the framework of the regional research project B@ARCA – BIM at ARCA<sup>24</sup>, ARCA Sud Salento virtualized data on maintenance status through BIM and GIS technology and collected information from users through a specific app, improving the citizens' engagement. Both strategies are in effect – yet partially – but require implementation and use on a larger scale.

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<sup>20</sup> The thesis, entitled "*Città pubblica nel Mezzogiorno Bisogni emergenti e politiche urbane per i luoghi dell'abitare contemporaneo*", includes design studies on housing system within the city of Lecce and develops two possible intervention projects on the heritage. The first one reuses Manifattura Tabacchi, a historical building by Pierluigi Nervi. The second one splits the housing units of a '70s building to obtain smaller units. The thesis has been made by Pio Emanuele Longo, Sabrina Mellacqua, Francesca Palmieri, Rossella Pellicani, Domenico Scarpelli, and Lorenzo Susca, under the guide of Professors Nicola Martinelli and Giovanna Mangialardi.

<sup>21</sup> Ibidem 16.

<sup>22</sup> Puglia Social Housing is an information system of the Puglia Region for collecting and digitization of the main information over the public and social system. It is part of the ORCA (Regional Observatory over Housing) system.

<sup>23</sup> "National fund for supporting the access to rented dwellings". This law establishes a fund for reducing the pricing of rented dwelling and is addressed to the same target of public housing.

<sup>24</sup> The experimental project called BIM at ARCA "B@ARCA" has been made by the cooperation between ARCA Sud Salento and University of Salento, and Gravili, N&C, and Altea firms. The specific website is: [www.bimatarca.it](http://www.bimatarca.it)

Although the local emerging strategies in South Salento demonstrate both the academic and public interest in improving the local housing system, some significant strategies are not completely efficient because they have not been fully applied, implemented, or systematised.

Tab.4 synthesises the strategies, in relation to the existing criticalities.

Existing criticality (para. 4.2)	Emerging strategy	Existing action	Source
Inefficiency of the mobility system. No integration with the housing system	Implementation of the mobility and slow mobility system	PPTR	<a href="https://pugliacon.regione.puglia.it/web/sit-puglia-paesaggio/tutti-gli-elaborati-del-pptr">https://pugliacon.regione.puglia.it/web/sit-puglia-paesaggio/tutti-gli-elaborati-del-pptr</a>
Low quality of the urban space, especially near public housing building	Implementation of public and open space	PPTR	<a href="https://pugliacon.regione.puglia.it/web/sit-puglia-paesaggio/tutti-gli-elaborati-del-pptr">https://pugliacon.regione.puglia.it/web/sit-puglia-paesaggio/tutti-gli-elaborati-del-pptr</a>
Insufficient number of housing units of too big dimension	Fragmentation of the existing housing heritage	"Città pubblica nel Mezzogiorno" thesis	-
Absence of correspondence between housing units and users	Mobility tool	"Città pubblica nel Mezzogiorno" thesis	-
No ERS experiences	ERS implementation	National law 3904/2008 Galateo in Lecce	<a href="https://www.leccesocialhousing.it">https://www.leccesocialhousing.it</a>
Too slow assignation system. Only on municipal level	On-line territorial system for housing units assignation	Regione Lombardia law 16/2016	-
No data over "grey target"	Collection of data over "grey target"	PUSH Platform	<a href="https://push.regione.puglia.it/">https://push.regione.puglia.it/</a>
Incomplete data over public housing potential users	ORCA implementation	ORCA Platform	<a href="http://old.regione.puglia.it/web/orca">http://old.regione.puglia.it/web/orca</a>
Absence of information over maintenance status	B@ARCA implementation	B@ARCA Project	<a href="https://www.arcasudsalento.it/">https://www.arcasudsalento.it/</a>

**Tab.4 Relationship between the existing criticalities, the emerging strategies and their references**

## 6. Circular Living Model definition

This paper has analysed the existing literature, and its deficiencies concerning CE, resilience, and their relationship with the housing system. The following phase has been the collection of some significant strategies and best practices at the international, national, and local levels, through bibliographic research and case study analyses. Putting them into relation, this contribution has defined a Circular Living Model.

The *CL Model* proposes a set of strategies that can define a complex and organic set of actions to partially solve the described criticalities of the housing system of the South Salento, and/or similar contexts.

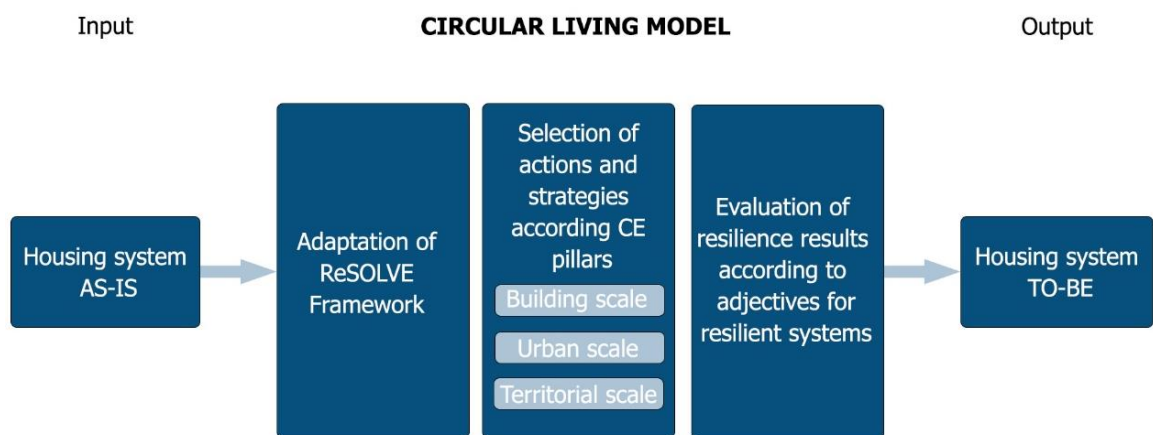
The different actions, as already stated, are supposed to work according to the various pillars of CE and at the same time implement the resilience of the system.

The achieved resilience is evaluated qualitatively through the adjectives defined by the City Resilience Framework (Silva, 2015). Consequently, each strategy is related to one (or more) pillar of CE and one (or more) adjective of resilience.

In the selected actions, both material (e.g. the reuse of existing buildings) and immaterial strategies (e.g. the agency matching demand and supply of housing units) appear; they are divided into 3 different categories depending on the scale of the intervention: that is, building, urban, or territorial. When referring to the building scale, the model focuses on a single building and its immediate adjacent areas, seen both in their physical and social dimensions. Instead, the urban scale focuses either on a neighbourhood or, in the case of the small village, on the whole Municipality.

This is because, concerning both the dimension and number of inhabitants, the majority of South Salento centres are more similar to urban districts. The widest scale is the territorial one; in this case, the whole South Salento area.

The possibility to consider a wide territory as an area of intervention for housing is due to its specific characteristics (par. 4.1) that allow interactions and synergies among close Municipalities. The CL Model process and dimensions are shown in Fig. 4; instead, Fig. 5 outlines the CL Model, highlighting the different strategies, their scale, and relations to the CE pillars and resilience.



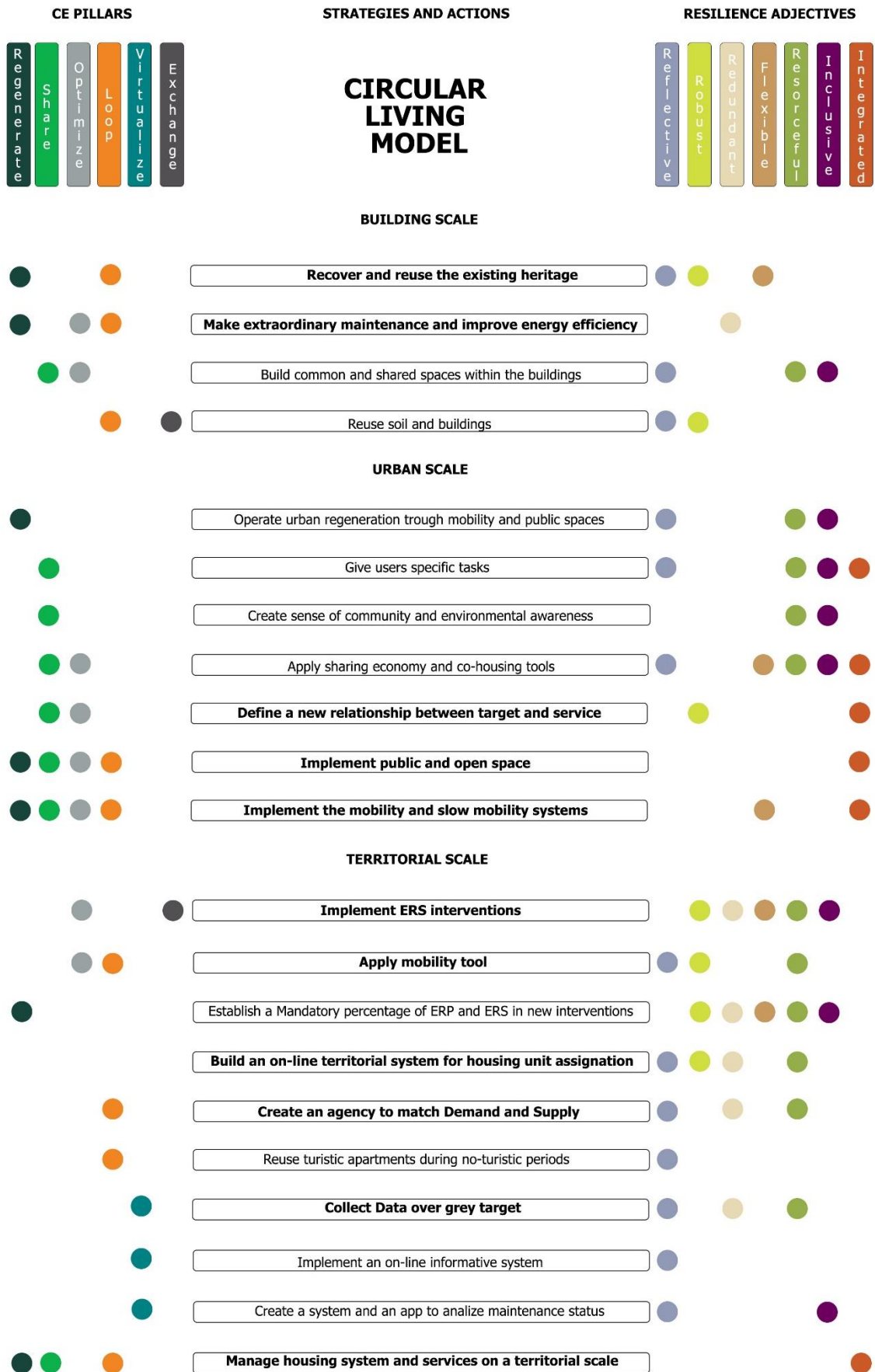
**Fig.4 The process from input to output through the Circular Living Model**

A possible application of the *CL Model* is represented by the use case of a '70s ERP building, located in Piazzale Cuneo, that is one of the most frequent conditions of South Salento's public housing heritage. The use case is meant to clarify the actors, aims, and use modality of the Model, to show its possible practical application. In detail, the main objective of the application is to solve typological, functional, and social criticalities thanks to a collaboration between institutional actors (Apulia Region, Lecce Municipality, and ARCA Sud Salento) and the users/inhabitants of the building. The Model is not applied as a whole; instead, according to the specific characteristics of the building, the most significant strategies are selected and placed in chronological order to ease its application.

All the actions still work on different scales and both on material and immaterial aspects.

Starting from a good knowledge of the situation and the application of the mobility strategy, the main physical actions consist of the addition of two winter gardens on both sides of the building, to obtain more space and to improve energy efficiency, and into the fulfilling of the ground floor with housing units, common spaces, and services.

The material actions also insist on the public spaces of the neighbourhood. At the same time, a set of immaterial actions over the community, which are typical of urban regeneration, are applied. The process is graphically shown in Fig.7.



**Fig.5 Circular Living Model.** The figure reports the different actions that are supposed to better South Salento housing system. They are grouped according to the scale of the intervention. For each action it is stated the CE pillars (left side) and the resilience adjectives (right side) it is related to

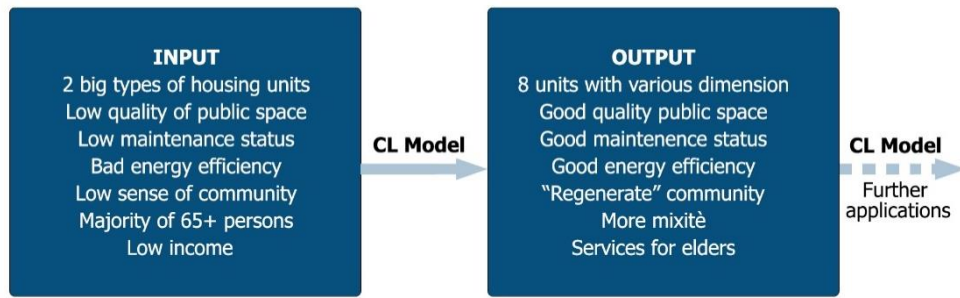


Fig.6 Input and expected output of the application of CL Model to the case use of Piazzale Cuneo public building

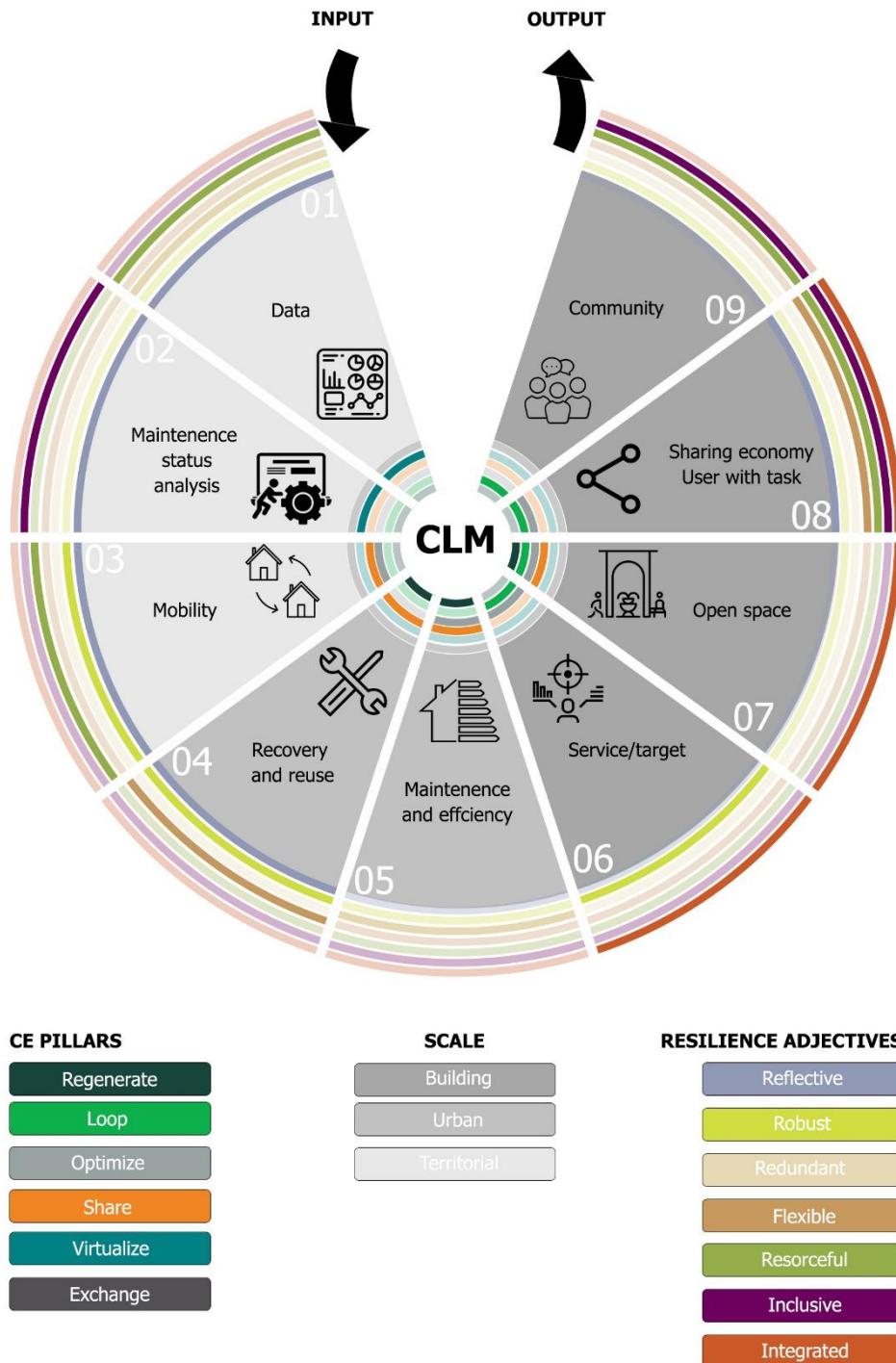


Fig.7 Application of the CL Model to the case use of Piazzale Cuneo public building

The input building of the application of the CL Model (Fig.6) is characterized by most of the described criticalities of the housing system (paragraph 5.2); the expected output (Fig.6) is better responding condition to both housing and resilience needs, in a circular way. Consequently, ARCA Sud Salento has considered the output to be highly interesting. It is worth specifying that the application of the CL Model on a use case is not supposed to be applied once but also to be done in a loop, with different strategies, to constantly implement the life quality and resilience of the housing system. At this point, monitoring actions have great importance.

## 7. Discussion

The proposed Circular Living Model defines a set of different scale strategies to be applied both in the case study and in comparable contexts and relates actions both to the ReSOLVE Framework (McKinsey, 2015) and to resilience adjectives (Silva, 2015).

The proposed Model has practical and theoretical implications, as described below.

On the theoretical side, the article innovatively declines CE to the housing system by recycling and reusing the existing heritage, by redistributing resources within the whole area and by adapting integrated solutions. Moreover, the article tries to overcome the literature gaps related to the absence of studies that address in an integrated way the application of circular economy to make social housing stock resilient at different scales (urban, neighbourhood, building). The research fits into an innovative field of study because the relationship between housing and resilience is a scarcely explored field and has been mainly investigated from an environmental (Marvogianni et al., 2015) and management-related (Gibb et al., 2016) standpoint. This paper, like the one by Kraatz (2019), is one of the few that point out both the physical and socio-economic dimensions in relation to resilience, while considering housing as a complex system. Anyway, no study yet had adopted the adjectives of resilience, described by the City Resilience Framework, to qualitatively evaluate resilience in housing systems and, consequently, to support the orientation of future strategies. At the same time, the correlation between CE and housing is particularly innovative because it has mainly been studied only either at the building scale, as by Marchesi & Tweed (2021) and Giorgi (2020), or in its social dimension, as done by Cetin, Vincent & Straub (2021). Instead, this study also addresses it in a complex way at the neighbourhood, urban and intercity scales. The provincial management of the apartments, using for example the mobility strategy, can be a positive opportunity to create a deeper interconnection between the owned and public heritage that can work as a complex system, generating a territorial circular social housing economy. In the Model, it is necessary to consider the public housing of cities of peripheral territories as a whole system. These connections represent a new vision of system interaction. At the same time, the innovation brought about by the model is related to its interdisciplinarity, and its multiple foundations coming from international, national, and local best practices. Even though the proposed strategies are not new but come from verified studies and experimentations, the association of the actions and their organization are innovative.

Another important theoretical contribution of this article is represented by the developed method (Gregor & Jones, 2007). The classification of strategies according to the CE pillars had indeed been used only once by Prederville et al. (2017), where it was done after the strategies were practically applied; this paper instead takes advantage of the CE pillars while defining strategies, therefore, it defines a method not only to classify but also to develop them. The confirmation of the impact of the actions in terms of resilience, at the design stage, is also an important method to be applied in territorial governance definition moments.

The Model could be an important starting point for the scientific community because further studies can use it, not only for classifying and reorganizing actions, but also for developing new ones, based on the theoretical matrix. This can be done both for the housing system of different territorial contexts and, also, for different systems, even from different fields of study, which need circular strategies for improving resilience

On the practical side, the model's importance stands in the adaption to specific contexts, because it defines strategies and actions that can be applied by its territorial administrations, overcoming the lack of strategic

view in management choices that characterize the housing system. Through its application, the CL Model is supposed to implement resilience and to reduce the housing crisis by "regenerating, sharing, optimizing, looping, virtualizing, and exchanging" the existing public and private heritage. After application, actions could be monitored by comparing their real effect with the expected one to better evaluate and constantly modify the model. Moreover, the set of strategies can be implemented by adding actions that have not been considered in this paper. The practical importance of the study also stands in its application to similar contexts. As said, South Salento has specific characteristics, such as an inefficient housing system, a total population of 800,000 persons, and a network of middle and small centres, which are interconnected and complementary, defining a "widespread Salento city". Consequently, the CL Model could be applied to similar territories, without relevant modifications. It is to be pointed out that the model can, not only, respond to the housing crisis and needs but also become an important planning tool for defining urban policies and visions.

## 8. Conclusions

In this current unstable situation, the implementation of the resilience of complex systems is as necessary as ever. At the same time, the above described inefficiencies of the housing system require a new strategic view to solve the existing housing crisis. This paper has great relevance within this recent situation, characterized by environmental, social, economic, and health problems because it is aimed at reducing the effects of these phenomena and transforming the housing system into a resilient and competitive part of the urban system. This is even truer when considering that the paper suggests a possible use of the great number of economic resources that are going to be invested for post-pandemic recovery.

The importance of operating on social housing in a circular way, that is sustainably using existing tangible and intangible resources to meet a strong housing need, is powered by the presence by the huge financing given by the Italian PNRR<sup>25</sup> (NextGeneration EU, 2021) (Gargiulo, 2022). This amount of money will be a great opportunity to innovate and implement the housing system and shows how social housing are relevant to the main aims of Next Generation EU: inclusive recovery and green transition.

The proposal tries to create a basis to improve social heritage management and face housing access problems, operating with complex actions of urban regeneration, exploiting the built heritage by reusing buildings, and avoiding the sale of housing units and land consumption. In this research, circular economy stands as a tool to achieve resilience in the social housing system, including strategies at the building, neighbourhood/city, and territorial scales. This is achieved by proposing a Circular Living Model, which adopts the circularity strategies of resources at all levels. In detail, the article aims at creating a model to be applied to housing contexts in critical situations, but with evident opportunities for intervention, and to improve its resilience through the application of CE approaches and strategies.

In light of the existing gap in the literature, the emerging environmental necessities, and the chronic problems in accessing an accommodation, this study interprets housing as a complex system and as one of the most important layers of urban planning and operates on public and social housing on a territorial level. The case study method helps to analyse how the approach to housing welfare and social housing management must take on innovative features to overcome the limits of administrative boundaries and be based on the planning and programming of interventions that recognise the existing inter-municipal synergies to respond to housing needs with quality. The CL model is developed on the South Salento peripheral territory case study, but the variety of its strategies allow application to similar contexts. The South Salento case study aims at building initial understandings of a situation and are not particularly concerned about generalizing. The explorative literature review, the single case study and the lack of model validation by expert represent the limits of the research. Therefore, future research will be oriented to validate the model through key actors involved in

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<sup>25</sup> *Piano Nazionale di Ripresa e Resilienza, Italy's recovery and resilience plan*



urban transformation processes. Moreover, further research will verify the applicability of the model to different contexts such as metropolitan ones.

## References

- Abdelfattah, L., Deponete, D., & Fossa, G. (2022). The 15-minute city: interpreting the model to bring out urban resiliencies. *Transportation Research Procedia*, 330-337. <https://doi.org/10.1016/j.trpro.2021.12.043>
- Agenzia delle Entrate. (2019). Lo stock immobiliare in Italia: analisi degli utilizzi. In G. Guerrieri, & M. T. Monteduro, In Gli immobili in Italia. Retrieved from: [https://www1.finanze.gov.it/finanze/immobili/public/contenuti/immobili\\_2019.pdf](https://www1.finanze.gov.it/finanze/immobili/public/contenuti/immobili_2019.pdf)
- Bassens, D., Koblowski, W., & Lambert, D. (2020). Placing cities in the circular economy: neoliberal urbanism or spaces of socio-ecological transition? *Urban Geography*. <https://doi.org/10.1080/02723638.2020.1788312>
- Bell, E., Bryman, A., & Harley, B., (2018). *Business research methods*. Oxford university press. ISBN: 9780198869443
- Blackwell, T., & Bengtsson, B. (2021). The resilience of social rental housing in the United Kingdom, Sweden and Denmark. How institutions matter. *Housing Studies*. <https://doi.org/10.1080/02673037.2021.1879996>
- Bolici, R., Leali, G., & Mirandola, S. (2020). Reusing built heritage. Design for the sharing economy. In S. Della Torre, S. Cattaneo, C. Lenzi, & A. Zanelli, *Regeneration of the built environment from a circular economy prospective*, 311-320. Milano: Springer Open. <https://doi.org/10.1007/978-3-030-33256-3>
- Castelli, I., Kleinhans, R., & Mugnano, S. (2019). Reframing social mix in affordable housing initiatives in Italy and in the Netherlands. Closing the gap between discourses and practices? *Cities*, 131-140. <https://doi.org/10.1016/j.cities.2019.01.033>
- Cetin, S., Vincent, G., & Straub, A. (2021). Towards circular social housing: an exploration of practices, barriers and enablers. *Sustainability*. <https://doi.org/10.3390/su13042100>
- Ciarimboli, Nicholas and Brad Guy (2007). *Design for Disassembly in the built environment: a guide to closed-loop design and building*. In: Pennsylvania State University <https://www.lifecyclebuilding.org/docs/DfDseattle.pdf>
- Comune di Milano (2020). Piano di Governo del Territorio (PGT). Milano. Retrieved from: <https://www.pgt.comune.milano.it/>
- Cottafava, Dario, and Michiel Ritzen. (2021) Circularity indicator for residential buildings: Addressing the gap between embodied impacts and design aspects. *Resources, Conservation and Recycling* 164 (2021): 105120.
- Czyschke, D., & Pittini, A. (2007). Housing Europe, Review of Social, Co-operative and Public Housing in the 27 EU Member States. Bruxelles: CECODHAS European Social Housing Observatory. ISBN 978-92-95063-04-4
- Di Biagi, P. (2001). Introduzione. In P. di Biagi, *La grande ricostruzione: il piano INA casa e l'Italia degli anni Cinquanta* (p. XXIII-XXVI). Roma: Donzelli Editore. EAN: 9788860365347
- Di Biagi, P. (2013). Il piano INA-Casa: 1949-1963. Retrieved from: [https://www.treccani.it/enciclopedia/il-piano-ina-casa-1949-1963\\_%28II-Contributo-italiano-alla-storia-del-Pensiero:-Tecnica%29/](https://www.treccani.it/enciclopedia/il-piano-ina-casa-1949-1963_%28II-Contributo-italiano-alla-storia-del-Pensiero:-Tecnica%29/)
- Durmisevic, E, Ö Ciftcioglu, and CJ Anumba (2006). *Knowledge Model for Assessing Disassembly Potential of structures*. Delft University of Technology, Faculty of Architecture, Department of Building Technology ISBN-13: 978-90-9020341-6
- Esopi, G. (2018). Urban commons: social resilience experiences to increase the quality of urban system. *Tema. Journal of Land Use, Mobility and Environment*, 11(2), 173-194. doi: <http://dx.doi.org/10.6092/1970-9870/5532>
- European Parliament (2022) Circular economy: definition, importance and benefits. Retrieved from: <https://www.europarl.europa.eu/news/en/headlines/economy/20151201STO05603/circular-economy-definition-importance-and-benefits>
- FederCasa. (2020). Dimensione del disagio abitativo pre e post emergenza Covid-19. Nomisma FederCasa. <http://cms.federCasa.it/download.aspx?id=9fe957dd-f413-476f-ba81-4c05cf30149e>
- FHS, M. (2022). Cenni di Cambiamento. Retrieved from: Fondazione Housing Sociale <https://www.fhs.it/progetti/residenze/cenni-di-cambiamento/>
- Garrefa, F., Barbosa Villa, S., Carrer Ruman de Bortoli, K., Stevenson, F., & Barcelos Vasconcellos, P. (2021). Resilience in social housing developments through post-occupancy evaluation and co-production. *Ambiente Costruito*, 151-175. <https://doi.org/10.1590/s1678-86212021000200519>
- Geraedts, Rob (2016). FLEX 4.0, a practical instrument to assess the adaptive capacity of buildings. In: *Energy Procedia* 96, pages 568–579 <https://doi.org/10.1016/j.egypro.2016.09.102>
- Gargiulo, C., Guida, N., & Sgambati S. (2022). NextGenerationEU in major Italian cities. *Tema. Journal of Land Use, Mobility and Environment*, 15(2), 287-305. <https://doi.org/10.6092/1970-9870/9260>

- Gibb, K., McNulty, D., & McLaughlin, T. (2016). Risk and resilience in the Scottish social housing sector: 'We're all risk managers'. *International Journal of Housing Policy*, 435-457. <https://doi.org/10.1080/14616718.2016.1198085>
- Giorgi, S., Lavagna, M., & Campioli, A. (2020). Circular economy and regeneration of building stock: policy improvements, stakeholder networking and life cycle tools. In S. Della Torre, S. Cattaneo, C. Lenzi, & A. Zanelli, *Regeneration of the built environment from a circular economy perspective* (p. 288-297). Milano: Springer Open. [https://doi.org/10.1007/978-3-030-33256-3\\_27](https://doi.org/10.1007/978-3-030-33256-3_27)
- Guarino, M. (2010). Verso una nuova qualità dell'abitare: la riqualificazione dell'edilizia residenziale pubblica. Salerno: Università degli Studi di Salerno. <http://elea.unisa.it/jspui/bitstream/10556/156/1/tesi%20M.%20Guarino.pdf>
- Habitat, P. (2020). La Caserne de Reuilly. Retrieved from Paris Habitat: [fr.calameo.com/read/00426177420a9d0ac1c4a](http://fr.calameo.com/read/00426177420a9d0ac1c4a)
- Hammond, Geoffrey P and Craig I Jones (2008). "Embodied energy and carbon in construction materials". In *Proceedings of the Institution of Civil Engineers-Energy* 161.2, pages 87-98. <https://doi.org/10.1680/ener.2008.161.2.87>
- Holz, E. D. (2016). Towards Self-Managed (Urban) Resilience. Berlino: Technische Universität Berlin. [https://www.urbanmanagement.tu-berlin.de/fileadmin/f6\\_urbanmanagement/Study\\_Course/student\\_work/2016\\_Masterthesis\\_Evandro\\_Holz.pdf](https://www.urbanmanagement.tu-berlin.de/fileadmin/f6_urbanmanagement/Study_Course/student_work/2016_Masterthesis_Evandro_Holz.pdf)
- Izza, S., Vincent, L., & Burlat, P. (2007). An Approach for Service-Oriented Urbanism. In R. Gonçalves, J. Müller, K. Mertins, & M. Zelm, *Enterprise Interoperability II* (p. 879-890). Londra: Springer. [https://doi.org/10.1007/978-1-84628-858-6\\_94](https://doi.org/10.1007/978-1-84628-858-6_94)
- Jong, d., Joss, Schraven, Zhan, & Weijnen. (2015). Sustainable-smart-resilient-low carbon-eco-knowledge cities; making sense of a multitude of concepts promoting sustainable urbanization. *Journal of Cleaner Production*. <https://doi.org/10.1016/j.jclepro.2015.02.004>
- Kurt, B & Spence, I. (2003) Use case modeling. Addison-Wesley Professional ISBN-13: 978-0201709131
- Kraatz, J. (2019). Innovative approaches to building housing system resilience: a focus on the Australian social and affordable housing system. *Australian Planner* Vol 55 No 3-4, 174-185. <https://doi.org/10.1080/07293682.2019.1632361>
- La Borda, C. (2022). Architettura. Retrieved from Cooperativa La Borda: <http://www.laborda.coop/ca/projecte/architettura/>
- Leising, E., Quist, J., and Bocken, N.M.P., 2018. Circular economy in the building sector: three cases and a collaboration tool. *Journal of Cleaner Production*, 176, 976-989. <https://doi.org/10.1016/j.jclepro.2017.12.010>
- Lodi Rizzini, C. (2013). Il social housing e i nuovi bisogni abitativi. In F. Maino, & M. Ferrara, *Primo rapporto sul Welfare in Italia* (p. capitolo 8). Torino: Centro di Ricerca e Documentazione Luigi Einaudi. ISBN13: 9788890941740
- Mangialardi, G., Palmieri, F., Pellicani, R., & Zappatore, S. (2021). Innovazioni nelle politiche abitative. Le esperienze dell'ARCA Sud Salento. *Urbanistica Informazioni*, 42-44. <https://www.aisre.it/wp-content/uploads/aisre/60fb06e737ed09.95122457/Zappatore.pdf>
- Marchesi, M., & Tweed, C. (2021). Social innovation for a circular economy in social housing. *Sustainable Cities and Society*. <https://doi.org/10.1016/j.scs.2021.102925>
- Marchesi, Tweed, & Gerber. (2020). Applying circular economy principles to urban housing. *World sustainable built environment conference*. <https://doi.org/10.1088/1755-1315/588/5/052065>
- Martinelli, N., Mangialardi, G., & Spadafina, G. (2020). Abitare la Puglia. Criticità e sfide per nuovi modelli abitativi nel Mezzogiorno. QuAD. ISSN 2611-4437
- Marvogianni, A., Tailor, M., Davies, C., & Kolm-Murray, J. (2015). Urban social housing resilience to excess summer heat. *Building Research & Information* Vol.43, 316-333. <https://doi.org/10.1080/09613218.2015.991515>
- McKinsey, C. f. (2015). Growth within: a circular vision economy for a competitive Europe. Ellen Macarthur Foundation. <https://emf.thirdlight.com/link/8izw1qhml4ga-404tsz/@/preview/1?o>
- Mehaffy, M., & Salinger, N. (2014). *Verso un'architettura resiliente*. Il Covile. ISSN2279-6924
- Merlini, C. (2019). Demolition as a Territorial Reform Project. In S. Della Torre, C. Cattaneo, C. Lenzi, & A. Zanelli, *Regeneration of the Built Environment from a Circular Economy Perspective*. Milano: Springer Open. <https://doi.org/10.1007/978-3-030-33256-3>
- Micalella, M. L. (2014). New Orleans Lezione di città resiliente. Roma: Sapienza-Università di Roma. [https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&ved=2ahUKEwiLj9OE9dX6AhVwXvEDHW7gBR8QFnoECAsQAQ&url=https%3A%2F%2Firis.uniroma1.it%2Fretrieve%2Fhandle%2F11573%2F918288%2F329003%2FMicalella\\_New%2520Orleans\\_2014.pdf&usq=AOvVaw2eCZ02iStTgkIvRWahCjDA](https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&ved=2ahUKEwiLj9OE9dX6AhVwXvEDHW7gBR8QFnoECAsQAQ&url=https%3A%2F%2Firis.uniroma1.it%2Fretrieve%2Fhandle%2F11573%2F918288%2F329003%2FMicalella_New%2520Orleans_2014.pdf&usq=AOvVaw2eCZ02iStTgkIvRWahCjDA)
- Mielis, P. (2011). La valutazione della qualità globale degli edifici residenziali nella programmazione degli interventi di riqualificazione alla scala del patrimonio edilizio. Cagliari: Università degli Studi di Cagliari. <https://core.ac.uk/download/pdf/35315415.pdf>
- Miglietta, R., Scarpelli, D., Spadafina, G., & Susca, L. (2021). Pensare alle forme dell'abitare per i nuovi bisogni abitativi. AISRe. Lecce. <https://www.aisre.it/wp-content/uploads/aisre/60fbd82982b7d4.29846176/Spadafina.pdf>

- Mirzahosseini, H., Noferesti, V., Jin, X. (2022). Residential development simulation based on learning by agent-based model. *Tema. Journal of Land Use, Mobility and Environment*, 15 (2), 193-207. <http://dx.doi.org/10.6092/1970-9870/8980>
- Moffatt, Sebastian and Peter Russell (2001). Assessing the adaptability of buildings. In: IEA Annex 31 <https://doi.org/10.1088/1755-1315/225/1/012012>
- Murphy, C., & Rosenfield, J. (2016). The circular economy: moving from theory to practice. McKinsey & Company. <https://www.mckinsey.com/~media/McKinsey/Business%20Functions/Sustainability/Our%20Insights/The%20circular%20economy%20Moving%20from%20theory%20to%20practice/The%20circular%20economy%20Moving%20from%20theory%20to%20practice.ashx>
- NextGeneration EU. (2021). Retrieved from Unione Europea : [https://europa.eu/next-generation-eu/index\\_it](https://europa.eu/next-generation-eu/index_it)
- Palvarini, P. (2006). Il concetto di povertà abitativa: rassegna in tre definizioni. Working paper del Dottorato in Studi europei urbani e locali. Università di Milano Bicocca. [https://boa.unimib.it/bitstream/10281/7615/3/phd\\_unimib\\_R00763.pdf](https://boa.unimib.it/bitstream/10281/7615/3/phd_unimib_R00763.pdf)
- Palvarini, P. (2010). Cara dolce casa. Come cambia la povertà in Italia dopo le spese abitative. Terza Conferenza annuale ESPAnet Italia.
- Paris, S., & Bianchi, R. (2019). *Ri-abitare il moderno*. Macerata: Quodlibet. ISBN 9788822901927
- Pittini, A. (2019). The State of housing in the EU. Bruxelles: Housing Europe. <https://www.housingeurope.eu/resource-1323/the-state-of-housing-in-the-eu-2019>
- Porter, L., Steele, W., & Stone, W. (2018). Housing and resilience - When, for Whom and for What? A Critical Agenda. *Housing Theory and Society* vol 35, 387-393. <https://doi.org/10.1080/14036096.2018.1492964>
- Predenville, S., Cherim, E., & Bocken, N. (2017). Circular cities: mapping six cities in transition. *Environmental Innovation and Societal Transition*, 171-194. <https://doi.org/10.1016/j.eist.2017.03.002>
- Regione Puglia (2015). PPTR- Schede d'ambito. Retrieved from: <https://pugliacon.regione.puglia.it/web/sit-puglia-paesaggio/le-schede-degli-ambiti-paesaggistici>
- Richter Praeger, A. (2014). Ausbauhaus Neukolln. Retrieved from Praeger Richter Architekten: [praegerrichter.de/AUSBAUHAUS-NEUKOLLN-1](http://praegerrichter.de/AUSBAUHAUS-NEUKOLLN-1)
- Shirley, G. & Jones D. (2007) The anatomy of a design theory. *Association for Information Systems*. <https://doi.org/10.17705/1jais.00129>
- Silva, J. d. (2015). City Resilience Framework. New York: The Rockefeller Foundation. <https://www.rockefellerfoundation.org/wp-content/uploads/City-Resilience-Framework-2015.pdf>
- Spadafina, G., & Scarpelli, D. (2022). L'alloggio in affitto come opportunità. *Officina*, p. 78-81. ISSN 2532-1218
- Talia, M. (2021). The time profile of transformations in territorial governance *Tema. Journal of Land Use, Mobility and Environment*, 182-189. <http://dx.doi.org/10.6092/1970-9870/7746>
- Torre, C. M., Morano, P., & Tajani, F. (2017). Saving Soil for Sustainable Land Use. *Sustainability*. <https://doi.org/10.3390/su9030350>
- UNISDR, & WMO. (2012). Disaster risk and resilience. UN. [https://www.un.org/en/development/desa/policy/untaskteam\\_undf/thinkpieces/3\\_disaster\\_risk\\_resilience.pdf](https://www.un.org/en/development/desa/policy/untaskteam_undf/thinkpieces/3_disaster_risk_resilience.pdf)
- Yin, R. K., (1994). Case Study Research Design and Methods: Applied Social Research and Methods Series. *Thousand Oaks, Sage Publications*. ISBN-13: 978-1412960991

## Table sources

Tab.1: Revised by authors. Source: The Rockefeller Foundation (2014) City Resilience Framework;

Tab.2: Revised by authors. Source: McKinsey (2015) Growth within: a circular economy vision for a competitive Europe. Report commissioned by Ellen MacArthur Foundation;

Tab.3: By authors;

Tab.4: By authors.

## Image sources

Fig. 1: By authors;

Fig.2 Source: The figure is part of the inedited thesis "Città Pubblica nel Mezzogiorno. Bisogni emergenti e politiche urbane per i luoghi dell'abitare contemporaneo" by Nicola Martinelli, Giovanna Mangialardi, Sabrina Mellacqua, Pio Emanuele Longo,

Francesca Palmieri, Rossella Pellicani, Domenico Scarpelli and Lorenzo Susca. The figure is based on ARCA Sud Salento data;

Fig.3: By authors. Figure based on ARCA Sud Salento and ISTAT 2011 data;

Fig. 4: By authors;

Fig. 5: By authors;

Fig. 6: By authors;

Fig. 7: By authors.

## Author's profile

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