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# Designing healthier cities to improve life quality: unveiling challenges and outcomes in two recent Spanish cases

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**ABSTRACT**

This study assesses the early outcomes of the Poblenou Superblock in Barcelona and a nature-based solutions project in Valladolid. By critically analysing available data and collecting residents' perceptions, the analysis depicts to what extent the project's interventions enhanced environmental quality and residents' well-being. Results highlight the role of the traffic space recovery strategy in Barcelona as a driver for larger benefits, allowing the creation of socially attractive public spaces along with greenery. This led to more appreciated interventions, possibly boosted by the post-pandemic context and city branding strategy. A potential downside concerns the likely gentrification processes triggered by these improvements.

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## Introduction

With most people expected to live in urban areas, cities and their citizens are facing fast-increasing negative effects of massive urbanization such as congestion and air pollution, a lack of inclusive communities and healthy public spaces, and social inequalities (M. J. Nieuwenhuijsen 2016). In addition, climate change effects and related impacts call for adaptation interventions that are particularly important in urban areas to enhance their resilience (IPCC 2021). Now more than ever, urban planners and designers are called upon to develop appropriate and sustainable approaches to cope with such challenges and enhance the social and environmental conditions in which citizens live (Dawson 2019).

The European Commission has launched a series of programs, strategies, and initiatives for sustainable development over the past few decades (European Commission 2016). Among the most recent and prominent ones, are the Green Deal (European Commission 2021), which defines a set of climate, energy, transport, and tax measures to reduce net greenhouse gas emissions, and the Biodiversity Strategy for 2030 (in continuity to the 2020 Strategy). The latter strongly recognizes the need to support measures for greening urban areas to mitigate and adapt to climate change and to reduce environmental pressures on cities while providing socio-environmental co-benefits to their inhabitants (European Commission 2020). Moreover, the 2020 pandemic outbreak has remarkably

accelerated the urgency of addressing these pressing issues and the need to enhance the social and environmental sustainability of urban areas (Florida, Rodríguez-Pose, and Storper 2023).

This work focuses on two urban planning and design approaches that have been recently implemented in two Spanish cases to improve urban resilience and socio-environmental conditions of the city and its inhabitants: the Superblock approach promoted in Barcelona and the Nature-based Solutions (NbS) program implemented in Valladolid through the EU-funded project URBAN GreenUP. The reason for selecting these two case studies is threefold. First, both approaches provide feasible and topical solutions to implement the above-mentioned EU strategies and policies. Second, they seek to simultaneously tackle multiple contemporary social (e.g., recreational opportunities) and environmental (e.g., climate change adaptation and alleviation of other environmental risks) city challenges, which is paramount to provide more effective outcomes within a context of competing demands for budgets and land use typical of compact (Mediterranean) urban areas (Longato et al. 2023). Third, their implementation has recently been completed. Therefore, attempts to collect and critically analyse the early outcomes and consequences of the projects on residents' well-being can be carried out to inform future insights.

On the one hand, the Superblock approach provides a paradigm shift from car-dependent towards people-centred city planning to prioritize people over cars by reclaiming public space, increasing green areas, reducing motorized transport, and promoting active mobility (Mueller et al. 2020). A superblock is a traffic-regulated cell of city blocks: in the outer streets, buses and car traffic can circulate, while the clusters of inner-minor streets are closed to through traffic. The newly created space in the interior is mainly reserved for pedestrians and cyclists, becoming a green public space that is open and safe for varying purposes, while vehicles are allowed primarily for accessing residences, public transport, disabled people, and emergency vehicles (Rueda 2019).

On the other hand, the URBAN GreenUP project focuses on the implementation of different types of NbS in Valladolid (and other cities). In the last few years, the concept of NbS has become increasingly popular to designate actions that deploy, enhance, or conserve nature to deliver multiple ecosystem services (e.g., air purification, global and microclimate regulation, flood prevention, recreation) and other co-benefits to people (Croeser et al. 2021; Engström et al. 2018; Raymond et al. 2017). According to the European Commission (2015), NbS are defined as 'solutions that are inspired and supported by nature, which are cost-effective, simultaneously provide environmental, social and economic benefits and help build resilience. Such solutions bring more, and more diverse, nature and natural features and processes into cities, landscapes and seascapes, through locally adapted, resource-efficient and systemic interventions'. Examples include green roofs built to reduce surface runoff that may simultaneously cool down temperatures (Pianella et al. 2016), and constructed wetlands that reduce flood risk and enhance water quality while supporting local biodiversity (Aronson et al. 2017). 'Scaling up' NbS implementation through a mix of interventions is nowadays seen as one of the main goals for new city strategies and programs (Fastenrath, Bush, and Coenen 2020), especially because they can address multiple problems (e.g., water, air, and noise pollution, climate-related impacts, etc.) at a time. Overall, the interventions promoted by the two approaches can provide a substantial contribution to handling some of the main

challenges that both cities are called to face nowadays, including counteracting and adapting to climate-related impacts, attenuating noise levels, and reducing the ambient air pollution, which is considered to cause several hundreds of premature deaths each year (1,037 in Barcelona and 280 in Valladolid) (Khomenko et al. 2021).

While contributing to enhancing the quality of life of residents, these kinds of projects can also result in negative effects for (some of) them, especially because they may trigger 'gentrification' processes associated with public space improvement and/or urban greening projects; in the latter case it is also called green, ecological, or environmental gentrification (Amorim Maia et al. 2020). This process occurs when new and improved public and/or green amenities increase neighbourhood appeal to wealthier residents (and real estate speculators), contributing to the rising of housing prices that may burden low-income residents who can no longer afford rents or taxes (Derickson, Klein, and Keeler 2021). This may cause the displacement of poorer people and enhance socio-economic inequities – another priority challenge to address for the European Commission (2022).

This study aims to provide an overview and critical analysis of the impacts of these two projects. First, by estimating the extent of physical transformations in the urban built form and the potential contribution to improving human health and well-being of residents thanks to the alleviation of key urban problems (i.e., mitigating microclimate, reducing noise and air pollution). Second, according to the citizens' opinions about the outcomes of the projects and their perception about the quality and benefits of the spaces created/improved, which are collected through questionnaires.

The remainder of the article is organized in the following sections. Section 2 describes the case studies, materials, and methodologies. Section 3 presents the results of our analysis and the responses to the questionnaires. Section 4 critically discusses the results in terms of lessons learned, with a focus on gentrification and post-pandemic city planning aspects, as well as research challenges and possible further steps. Finally, Section 5 provides the concluding remarks about the main findings of the work.

## Method

### *Case studies*

#### *Barcelona superblocks*

In Barcelona, the Superblock concept, despite not being new (e.g., in the neighbourhoods of El Born and Gracia, similar approaches were implemented in 1993 and 2005, respectively), was recently re-framed by the Barcelona Agency of Urban Ecology under the so-called 'Ecological Urbanism' as a new mobility and public space model for cities that support ecologically-oriented design interventions (Agencia d'Ecologia Urbana de Barcelona 2008; Rueda 2014). Under this new paradigm, Barcelona City Council proposed the Superblocks as an integrated solution to various societal challenges, including climate change, sustainable mobility, lack of green space, and the need for shared public space (Ajuntament de Barcelona 2023b, 20–23). The implementation of Superblocks was promoted in the 2013–2018 and 2019–2024 Urban Mobility Plans (Ajuntament de Barcelona, 2011) to improve the mobility network by favouring public transport and active mobility (e.g., increasing bus and bike routes) and reducing car dependency to reduce the negative impacts of private car traffic (e.g., noise and air pollution). This approach initially struggled to take place, with only

a few Superblock pilot projects implemented starting from 2016 (Zografos et al. 2020). The 2020 pandemic has accelerated the acceptance and extension of this solution in other city areas, with Superblocks now gaining international credibility and increasing support for its replication (Brenner et al. 2024; Sjöblom et al. 2021). Other similar approaches have been proposed in other Spanish cities, such as in Vitoria-Gasteiz, which stands out for its car reduction strategy and successive implementation of Superblocks (Ayuntamiento de Vitoria-Gasteiz, 2022, 2023). Superblocks are standardized ~ 400-x-400-metres neighbourhood units that group nine square-shaped blocks of Cerda's Extension with an average of 5,500 inhabitants (Rueda 2019, 140). The interior system comprises 3 × 3 standard blocks closed to general traffic and mainly devoted to slow mobility, public space, and green areas. The speed limit is restricted to a maximum of 10 km/hour on the interior, thus creating safer and more undisturbed public space. The exterior road system is dedicated to through traffic and motorized vehicles (Rueda 2019, 141).

The first Superblock implemented in Barcelona, which is the object of this study, is located in the Poblenou neighbourhood, towards the eastern part of the city. It was implemented between 2016 and 2017 and covers an area of 16 hectares with 5,580 inhabitants (Agència d'Ecologia Urbana de Barcelona 2015) (Figures 1–5).

### *Valladolid URBAN GreenUP project*

The city of Valladolid recently partnered in the EU-funded project called 'Urban GreenUp', which lasted from 2017 to 2022. This project aimed at promoting urban greening

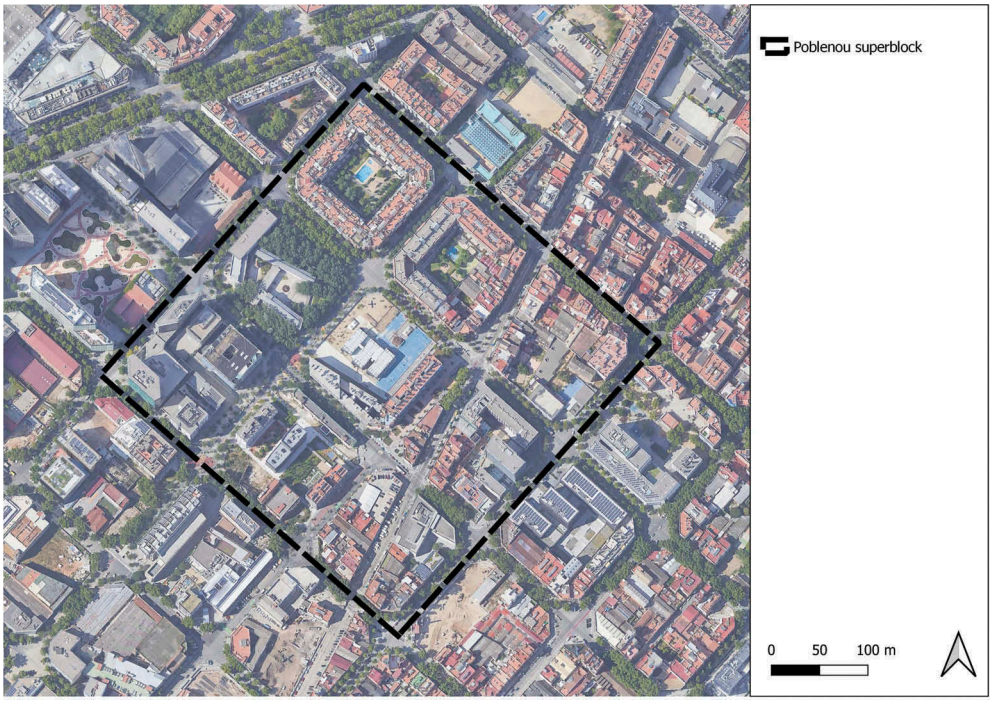


Figure 1. Aerial image with the localization of the Poblenou Superblock. Source: elaboration by the Authors (2024).

Figure 2. A playground area in the middle of a former car traffic crossroad. Source: photo taken by the Authors (2023).

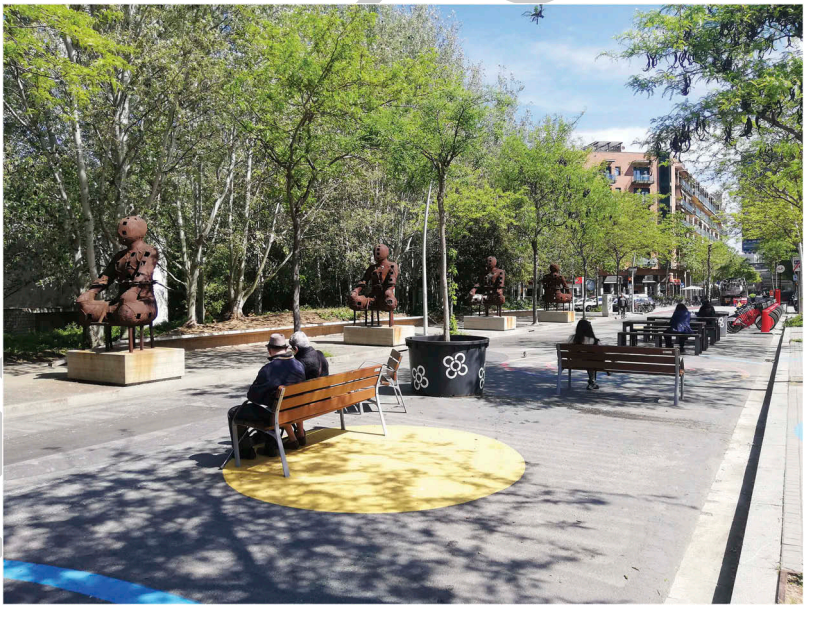

Figure 3. Public space facilities installed in an interior Superblock street. Source: photo taken by the Authors (2023).

initiatives for the integration of NbS into the built environment and the implementation of demonstrative projects in several cities. Among the desired benefits pursued with the implementation of NbS in Valladolid, there are the mitigation of and adaptation to the climate change effects and related impacts, the improvement of air quality and water

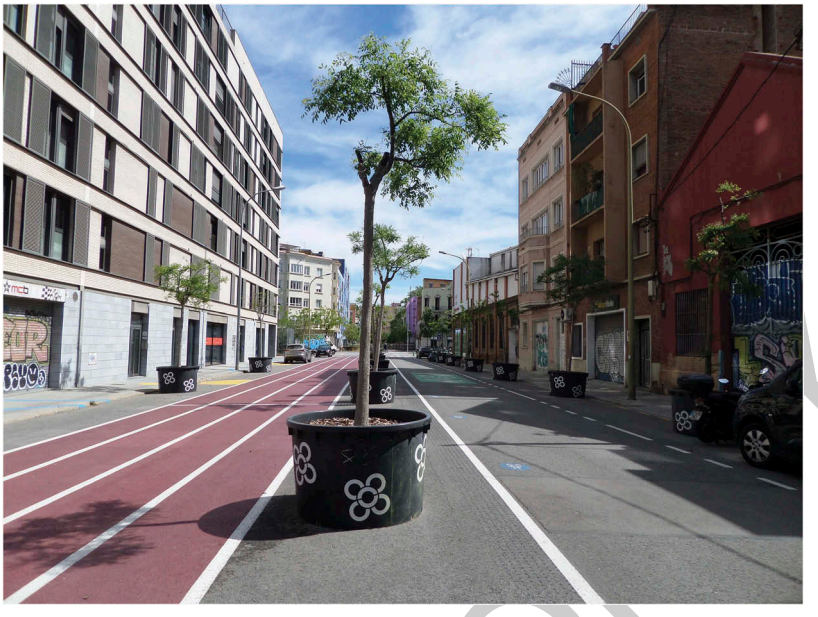

Figure 4. Former car traffic road converted to a slow mobility and recreational area with an athletics track. Source: photo taken by the Authors (2023).

Figure 5. A former car traffic crossroad prioritizing slow mobility and walkability with public trees and benches. Source: photo taken by the Authors (2023).

management, and the increase of socio-environmental sustainability (URBAN Green UP 2017, 2018). According to the NbS type categorization used in the project, four typologies of solutions have been implemented across the whole city area. First, 're-naturing

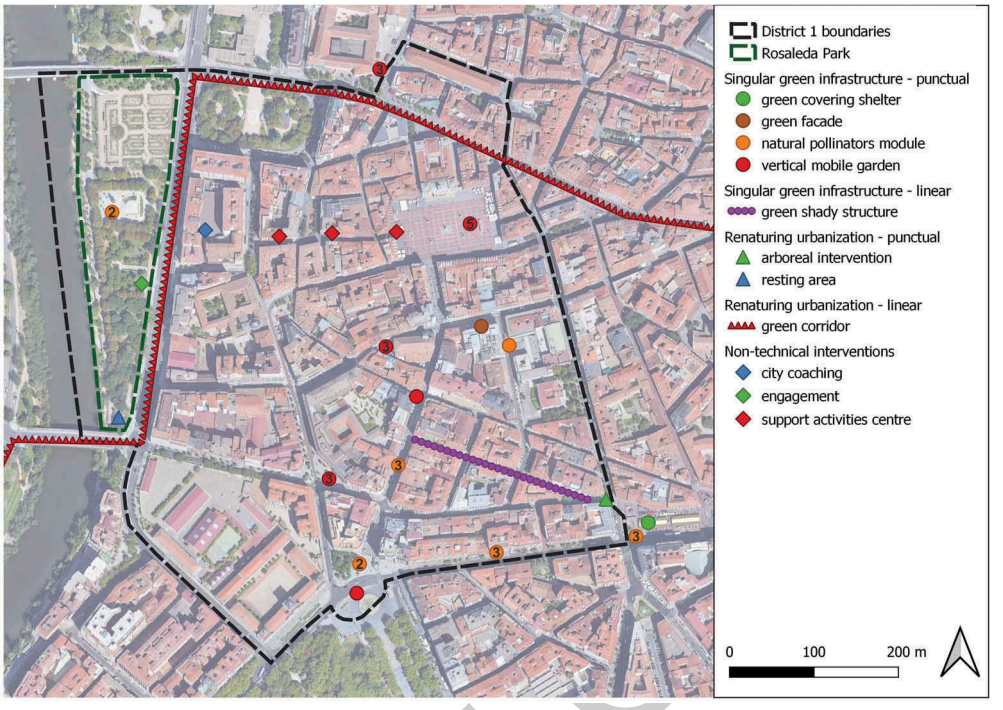


Figure 6. Aerial image with the localization of the NbS interventions in Valladolid's District 1. Source: elaboration by the Authors (2024).

urbanization', namely multiple interventions aimed at greening urban built areas, such as arboreal interventions, green routes, resting areas, and carbon capture interventions. Second, 'water interventions', namely interventions aimed at better managing stormwater, including flood management actions, green pavements, Sustainable Urban Drainage Systems (SUDS), and water treatment systems. Third, 'singular green infrastructures', namely interventions aimed at integrating green elements in specific urban spaces or buildings/infrastructures, such as cycle pedestrian infrastructures, smart soils, pollinators, vertical green infrastructures, horizontal green infrastructures, pollutants filters, and urban farming. Finally, 'non-technical interventions', namely activities aimed at raising awareness and building capacity that do not promote physical interventions, including city coaching, citizens' engagement, and educational activities. Although the interventions were implemented across the whole municipality area, it was decided to limit the analysis to the central district of the city (see Figure 6 and Table 1), where most of these NbS were implemented (although with no interventions related to the category 'water interventions') (examples are given in Figures 7–10). The case study area thus includes the District 1 named 'Centro' and a conterminous major public space at the borders of District 1, namely España square. This area covers more than 73 ha with a total of 8,888 inhabitants (Ayuntamiento de Valladolid 2023).

**Table 1.**

| NbS implemented in District 1 through the URBAN GreenUP project | | | Estimated green area size in $m^2$ (according to technical specifications provided in deliverables D2.3 and D2.7) | Number of interventions | |
|---|---|---|---|---|---|
| | | | | Urban fabric | Rosaleda park |
| Singular green infrastructure | Green vertical garden | Vertical mobile garden | 130 | 16 [A] | / |
| | | Green façade | 366 | 1 | / |
| | Green horizontal garden | Green covering shelter (light type of green roof) | 488 | 1 | / |
| | | Green shady structure | 146 | 1 [B] | / |
| | Natural pollinator's modules | | 80 [C] | 12 | 2 |
| | Smart soils | | 0 [D] | | |
| Renaturing urbanization | Green corridor | | 1000 [E] | 1 | / |
| | Arboreal intervention | | 200 [F] | 10 street trees [G] | / |
| | Resting areas | | 100 | / | 1 |
| Non-technical interventions | Support activities centre | | / | 3 | / |
| | City coaching (ecological reasoning/intelligent) | | / | / | 1 |
| | Engagement (sponsoring activities) | | / | / | 1 |

Notes: aInterventions include one vertical garden formed by the letters of the city name Valladolid (18 m2), one vertical rectangular garden 'board type' with 7 m2 of vegetation layer on both sides (14 m2 total), and 14 rectangular gardens 'totem type' with 7 m2 of vegetation layer on one side (the 'totem type' vegetation layer's size is assumed to be the same as the 'board type' one since there is no specific information reported on that). bThe installation of a second green shady structure of 91 m2 in Zuniga Street is mentioned in the first project deliverables, while in the final one only the structure implemented in Santa Maria Street is acknowledged. Currently (June 2023), the second structure still is not installed. cThe two standard modules installed in Rosaleda Park are 10 m2 each and the 12 compact modules installed within the urban fabric are 5 m2 each. dThe 'Smart soils' intervention does not imply new vegetated areas, since it refers to a type of soil that is used as a substrate in other NbS such as the resting areas and the pollinator modules. eSince about 1/8 of the green corridor passes through the case study area, it is assumed that about 1/8 of the declared 7800 m2 of new green spaces that are to be provided along the corridor, mainly through green permeable surfaces and tree planting, are within the case study area (i.e., 1000 m2). fAssuming that each street tree can reach a crown size of about 20 m2, which is the mean crown size of a medium-sized street tree according to the report drafted by Ajuntament de Barcelona (2011). gThis data is based on the number of new trees planted in Phase III of the tree plantation programme, during which plantation efforts have been focused in the city centre (e.g., surroundings of España Square) (URBAN GreenUP, 2020: 30). Source: elaboration by the authors (2024) based on URBAN GreenUP (2017; 2018; 2019; 2020). 175


**Figure 7.** The green façade installed on the building of El Corte Inglés. Source: photo taken by the Authors (2023).

## *Developing a qualitative assessment to evaluate the project's outcomes*

The first step of the case study analysis concerns an estimation of the impacts of the analysed projects according to selected specific criteria related to two main aspects, namely: i) the physical transformations they provoked in the urban built form; ii) the 175

**Figure 8.** A vertical mobile garden installed in the public square 'Plaza Mayor'. Source: photo taken by the Authors (2023).

potential benefits to residents that they promoted/are expected to promote in terms of human health and well-being by alleviating key urban problems. The first aspect was analysed by screening the published information about the extent of physical modifications in the urban built form induced by the projects, supported by authors' on-site visits before, during, and after the implementation of the projects (respectively in 2016, 2018, and 2022). The second aspect was analysed according to the observed or assumed expected outcomes as reported in the literature. This involved the screening, collection, and interpretation of relevant information contained in both scientific and grey literature, including archival documents (i.e., Barcelona's Urban Ecology Archive – *Arxiu Central d'Ecologia Urbana* – and Valladolid's Municipal Archive – *Archivo Municipal de Valladolid*), international scientific publications (using the databases 'Scopus' and 'JSTOR'), and other non-scientific information sources (e.g., city administration reports, governmental documents, press articles). It has to be noted that for the Valladolid case, only physical interventions were used in the qualitative assessment, thus excluding 'non-technical interventions'. The proposed criteria, grouped into the two analysed aspects, are the following:

- Physical transformations in the urban built form. It covers the changes observed in the 'plan elements' that together constitute a 'town plan' according to Conzenian tradition in the field of urban morphology (Conzen 1960; Whitehand 2001, 104), i.e., streets, plots, and buildings. The changes observed in each of these three elements are thus the three criteria proposed. They were selected to better frame and understand the type and extent of physical changes induced by the projects. Conzen (1960, 5) claimed that when these three elements are taken together, they create


**Figure 9.** The green shady structures installed along 'Santa Maria Street'. Source: photo taken by the Authors (2023).

uniqueness from the site circumstances and establish a measure of morphological homogeneity or unity, which can influence how citizens recognize and/or perceive that space.

- Contribution to human health and well-being of residents. An improvement in the quality of life of citizens – who are often exposed to negative consequences of urbanization such as noise and air pollution, and urban heat island effects – is becoming increasingly desirable in new urban models to promote more sustainable, livable, and healthier cities, which are mostly grounded on urban greening strategies due to green space's recognized multiple benefits. For this reason, the analysis focuses on the project's capacity to alleviate key urban problems (i.e., in terms of environmental issues). First, by considering the increase of green areas as an overall indicator for estimating the magnitude of the green space's benefits provided. Second, according to the capacity to specifically improve air quality, decrease noise levels, and reduce local ambient temperature and the heat island effect of the measures/interventions implemented within the two projects, which are among the main challenges affecting the two cities (see Introduction). When no evidence data is available, the qualitative assessment relies on assumed expected outcomes as reported in the analysed literature sources.


Figure 10. The vertical mobile garden reproducing the city name installed in 'Zorrilla Square'. Source: photo taken by the Authors (2023).

### *Collecting the residents' perception*

The second step of the analysis is to collect residents' perceptions about the potential impacts of the interventions and the quality of the (mainly public) spaces created/improved through the projects. This was performed through questionnaires submitted to residents living in the two study areas, with questions that the respondents were asked to answer with 'Yes' (Y), 'No' (N) or 'I don't know' (DK). The questionnaire includes two sections: the first consists of seven general questions about citizens' opinions on the realized interventions. The second concerns more specific questions about the quality of the spaces created/improved according to sixteen criteria grouped into four tangible qualities that were proposed by the project named 'Project for Public Space' (2000; PPS). The PPS framework was used since it provides a systematic organization of qualities and criteria that are commonly used for valuing the success or failure of public spaces, namely:

- access and linkage: convenient to use, visible, and easy to get to and move within;
- uses and activities: providing a reason to be there, vital, and unique;
- comfort and image: safe, clean, green, full of character, and attractive;
- sociability: fostering neighbourliness, friendship, interaction, diversity, and pride.

Before starting, respondents were asked if they were aware of the implementation of such interventions in their neighbourhood. When answering yes, the questionnaire was administered. This was done iteratively until the questionnaire was completely answered by 40 respondents in each case study. The interviews were conducted through call phones

during April and May 2022 starting with a brief explanation of the purpose of the questionnaire and the description of the criteria proposed. Each questionnaire was filled through a telephone interview that usually lasted between 25 and 35 minutes and, eventually, included a short interaction with the respondent to provide further commentary on the questions. Appendix 1 contains the detailed list of questions submitted.

## Results

### *Impacts and benefits provided by the interventions*

The implementation of the two projects impacted the urban environment and potentially contributed (or is expected to contribute) to citizens' well-being with different magnitudes (Table 2).

Concerning the physical transformations in the urban built form, the Superblock implementation significantly modified the physical attributes of a large portion of the neighbourhood at the level of streets. The Superblock involved the (almost) complete redesign of the whole internal traffic network and public space, while did not affect existing plots and buildings. In particular, the interior vehicular traffic was cut to convert an area of 13,350 $m^2$ into a pedestrian public space. New social amenities were installed, such as 349 benches, 37 premises for activities at street level, 1,000 $m^2$ of cycle path, an electric vehicle charging point, and 2,483 $m^2$ of playground, interactive game areas, and an athletics track. The public space redesign actions were accompanied by substantial greening interventions (e.g., 212 new trees and increasing street green) (Ajuntament de Barcelona 2018).

In Valladolid, the implementation of NbS in the city centre has made some streets (e.g., green shady structure, street trees) and buildings (e.g., green wall or roof installation in some private buildings and public structures such as the roof of a public market covering structure) greener, without affecting entire single or contiguous plots. The principal interventions at the street level are the green shady structure and the green corridor that passes through the city centre, being essentially a bike lane with arboreal elements.

As regards the contribution to human health and well-being of residents, so far not all the performances of the interventions in terms of improving air quality, reducing urban noise, and mitigating local temperatures and the heat island effect have been monitored and quantified, especially in the Valladolid case. However, when evidence data is not available, some clear assumptions can be made about the projects' contributions based on the expected benefits as reported in the literature analysed (see also Table 2).

In Barcelona, the green areas doubled from 7,195 $m^2$ to 14,803 $m^2$ (an improvement from 1.28 $m^2$/inhabitant to 2.65 $m^2$/inhabitant). Vehicle traffic dropped by 58% on interior roads, while it increased by 2.6% on the external road network. This led to a significant 5% average reduction in daytime noise levels (Ajuntament de Barcelona 2023b, 144–145). While no evidence data showing an improvement in air quality and mitigation of local temperatures exists, the Barcelona Public Health Agency' organized a focus group with residents to collect their perception about the socio-environmental benefits promoted by the project (Agència de Salut Pública de Barcelona 2021, 45; 68). The results reveal positive feedback concerning air quality improvement, possibly driven by the double beneficial effect of increased pollutants uptake by vegetation and decreased pollutant

**Table 2.**

| | Physical transformations in the urban built form | | | Contribution to human health and well-being | | | |
|---|---|---|---|---|---|---|---|
| | Streets | Plots | Buildings | Increasing green spaces | Reducing noise levels | Reducing local temperatures and the heat island effect | Improving air quality |
| Superblock unit (Poblenou neighbourhood, Barcelona) | Complete redesign of streets with slow-mobility-network facilities, social amenities, and greening interventions | None | None | 7,608 $m^2$ (+1.37 $m^2$/inhab.) | 5% average reduction (daytime) | Expected benefit from newly realized green spaces confirmed by residents' positive perception | Expected benefit from newly realized green spaces and car traffic cut confirmed by residents' positive perception |
| NbS implemented in the URBAN GreenUP project (Valladolid city centre) | Street greening interventions (e.g., green shady structures and street tree planting) | None | Building greening interventions (e.g., green wall and roof installation) | 2,510 $m^2$ (+0.28 $m^2$/inhab.) | Negligible | Excepted benefit from newly realized green spaces | Excepted benefit from newly realized green spaces |

emissions due to traffic reduction within the area. Positive was also the feedback on the mitigation of temperatures and the urban heat island effect at the local scale, even if a substantial reduction of urban temperatures may depend on a cumulative effect of interventions at the city scale (Mueller et al. 2020). Previous studies that simulated the expected benefits deriving from the upscaling of Superblocks in Barcelona (e.g., Rueda 2019) confirm somehow these positive outcomes, estimating substantial health benefits for residents (e.g., 667 premature deaths prevented thanks to the reduction in air and noise pollution (Mueller et al. 2020, 9–10)).

In Valladolid, no precise information about the overall size of the realized NbS nor evidence data and specific surveys assessing the environmental benefits of the interventions are currently available (January 2024). However, by screening the various project deliverables (i.e., URBAN GreenUP 2017, 2018, 2020) it was possible to roughly estimate the size of the new green areas (Table 1).[1] The project-related new green spaces in District 1 account for about 2,510 $m^2$, corresponding to an increase of 0.28 $m^2$/inhabitant. The information about the potential contribution to address environmental challenges of the realized NbS is provided according to estimations found in the project's deliverables or the literature for similar solutions, thus based on assumed (not locally measured nor assessed) outcomes. For instance, the green corridor is expected to particularly encourage sustainable mobility and enhance air quality thanks to newly planted trees (URBAN GreenUP 2017, 2018). The green façade of El Corte Inglés building and the vertical mobile gardens are expected to capture air pollutants as the main benefit (URBAN Green UP 2018). Such benefit is likely to be provided also by the street green shady structures, the green covering shelter, the green resting areas, and the arboreal interventions, which are also expected to mitigate local temperatures (e.g., Author et al., 2023). In addition, the smart soil is supposed to capture about 1.665 kg/year of NO2 (URBAN Green UP 2019, 133). Other interventions are claimed to not provide substantial benefits to the analysed challenges (e.g., natural pollinator modules for air quality enhancement) due to their small size (URBAN Green UP 2018, 135). Finally, a negligible impact on (traffic) noise is expected since no interventions with this aim have been implemented in the District 1 area.

In terms of improving air quality and reducing local temperatures and the heat island effect, the interventions implemented in the Valladolid case can be considered moderately less effective than those in the Barcelona case. Although the size of the new green spaces undoubtedly contributes to having more or fewer benefits in terms of air quality, in Valladolid these benefits are solely reliant on the vegetation's capacity to uptake pollutants. In contrast, in Barcelona the reduction of pollution source areas (i.e., car traffic space) also plays a significant role in reducing air pollution, even if a simulation study showed that air quality improvements inside a Superblock area may be offset by traffic pollution increases around it (Rodriguez-Rey et al. 2022). Concerning the green space's cooling benefits, which mostly depend on the size of the space and vegetation type/density (e.g., Author et al. 2023; Yan, Jia, and Zhao 2021), the Superblock case is characterized by more greenery distributed in a rather smaller area (thus with a bigger green space density). For this reason, it can potentially provide more effective and appreciable cooling effects at the local scale than the single NbS interventions implemented in Valladolid.

### *The residents' perceptions about the realized interventions*

A total of 41 and 49 phone calls – corresponding to 1 and 9 respondents unaware of the analysed interventions – were carried out in Barcelona and Valladolid, respectively, to obtain a completely answered questionnaire by 40 residents in each case study.

The frequency and statistics of responses are reported in Table 3 and Figure 11 (general questions about the projects), and in Table 4 and Figure 12 (specific questions about the quality of the spaces created/improved, see Appendix 1 for the detailed list of questions).

Almost all the interviewees in Barcelona consider the Superblock project extremely positive in contributing to improving human health, mitigating the negative effects of climate change, strengthening local identity, and providing a more beautiful and inclusive urban environment, even if many of them raised concerns about the increased cost of living. In particular, Poblenou residents understand the great opportunity they have to live in a more people-centred, healthier, and more enjoyable environment, and expressed their preference to live in that area rather than other areas not affected by Superblock implementation, 'especially after the 2020 pandemic outbreak and related restrictions' (respondents 12, 14, 31). For many residents, more space for pedestrians and cyclists meant also the possibility of better maintaining social distancing recommendations and decreasing the risk of transmitting infection in urban environments. In addition, since within the Superblock unit most of the space is dedicated to residents' leisure time, including sports and play areas for children and the elderly, they do not need to move to other areas to enjoy their free time. At the same time, also non-residents are attracted to spending their free time in the Superblock area.

Valladolid's respondents seem more divided and doubtful about the contribution of the URBAN GreenUP project to the abovementioned issues. Many respondents pinpointed the fact that some of the interventions were too small and punctual to substantially contribute to an increase in the residents' quality of life. However, they surely represent an opportunity 'to be introduced to the general public for generating consensus so as to be further scaled up more systematically' (respondent 14). Some of the interventions were undoubtedly appreciated by many respondents, such as the green shady structure along Santa María street, which is thought to contribute to the formation of identity more than the others.

Finally, almost all the respondents in both case studies recommend the extension of the interventions in other parts of the city, although 'systematic planning and better integration of the interventions is needed' (respondent 9).

According to the residents' responses about the quality of public space, the Superblock project contributed to a great improvement in access, linkage, and use for slow mobility, even though it made it difficult for cars. The interventions implemented in Valladolid are also evaluated positively although the green corridor 'cut space for vehicles and contributed to rush-hour traffic congestion' (respondent 13 and, similarly, respondents 24 and 27).

As regards uses and activities, the facilities installed within the Superblock with many spaces dedicated to playgrounds and interactive games 'usually attract people from all the neighbourhood' (respondents 1, 7, 28, 37) and, to a lesser extent, 'from outside' (respondents 9, 15), making the experience of Superblock 'pretty singular' (respondent 28). Concerning the NbS implemented in Valladolid, although not all support leisure and free-

Table 3.

| | | 1. Would you define positive the implementation of the project for improving human health and mitigating the negative effects of climate change? | 2. Do you think that the project provides a more aesthetically appreciable and inclusive urban environment? | 3. Do you think that the project has positively influenced the formation of identity, sense of community, and emotional and social well-being? | 4. Would you state that the project has increased the cost of living? | 5. Would you define positive the experience of living near the areas affected by the interventions during the pandemic period due to the changes in the urban environment promoted by the project? | 6. Would you say that non-residents are coming to experience the areas affected by the project in their free-time? | 7. Would you recommend the extension of the project in other parts of the city? |
|---|---|---|---|---|---|---|---|---|
| Barcelona | Y | 34 | 39 | 36 | 25 | 38 | 34 | 29 |
| | N | 1 | 0 | 1 | 2 | 0 | 1 | 7 |
| | DK | 5 | 1 | 3 | 13 | 2 | 5 | 4 |
| Valladolid | Y | 23 | 29 | 15 | 2 | 20 | 14 | 32 |
| | N | 5 | 6 | 14 | 19 | 15 | 11 | 2 |
| | DK | 12 | 5 | 11 | 19 | 5 | 15 | 6 |

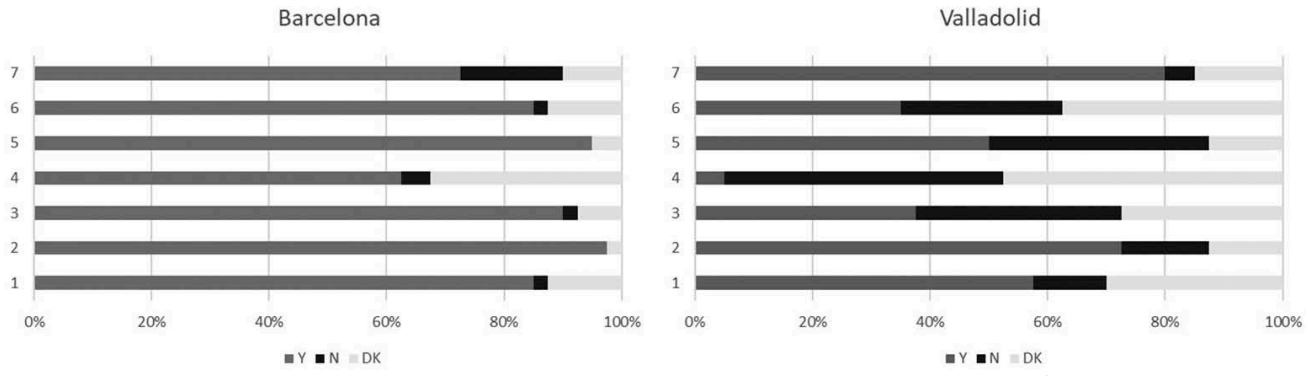


Figure 11. Percentage of responses to the general questions in the two cases analyzed. Y = Yes; N = No; DK = Don't Know. Each number corresponds to a question (see Table 3 for correspondence). Source: elaboration by the Authors (2024)

time activities, they all somehow contribute to creating a greater sense of uniqueness (e.g., the green shady structures installed along Santa Maria Street 'provide a pleasant environment for walking' (respondent 5)).

As concerns comfort and image, the new public spaces designed within the Superblock are perceived as good places in which people feel comfortable staying, being very attractive. The fact that vehicular traffic is almost absent is seen as a positive element for safety and cleanness, especially in terms of 'noise, smell, and air pollution' (respondents 5, 14, 32, 39). The interventions in Valladolid keep attractive and sufficiently green the streets and public spaces affected, even though the green corridor is not considered always safe, with sections where 'there is no separation with regular traffic or between pedestrians and cyclists' (respondent 3 and, similarly, respondent 36).

Finally, regarding sociability, the Superblock experience is claimed to positively contribute to sociability in all its forms, while in Valladolid these feelings are less common and limited to some spaces (e.g., interaction in urban parks). Here, vertical mobile gardens are sometimes claimed to 'increase pride' (respondents 22 and 29) while Santa María street has apparently 'not improved sociability, although it made the street more attractive' (respondent 19).

## Discussion

### *Lessons learned*

The common character of the two projects is their key role in providing greener, healthier, and more pleasant urban environments by especially improving public space. The analysis performed to understand the physical changes they induced and their contributions to dealing with current environmental challenges, together with the interviewers' responses, reveals some differences in terms of benefits and perceptions between them. However, it is necessary to take into account the different types and scales of intervention that they involved (in terms of starting point and planning objective, location, size, and extent of projects) when interpreting the results.

The Superblock project is based on a comprehensive neighbourhood-scale renovation intervention that relies on an existing urban layout (in this case the regular grid of streets and blocks of the Cerda's Plan) within a spatially-bounded area that covers a full urban

Table 4.

| | | Quality 1: Access and linkage | | | Quality 2: Uses and activities | | | Quality 3: Comfort and image | | | | | Quality 4: Sociability | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1. Convenient to use | 2. Visible | 3. Easy to get to and move within | 4. Providing a reason to be there | 5. Vital | 6. Unique | 7. Safe | 8. Clean | 9. Green enough | 10. Full of character | 11. Attractive | 12. Fostering neighbourliness | 13. Fostering friendship | 14. Fostering interaction | 15. Fostering diversity of users and uses | 16. Fostering pride |
| Barcelona | Y | 35 | 39 | 37 | 37 | 34 | 38 | 31 | 34 | 35 | 38 | 39 | 39 | 32 | 38 | 37 | 39 |
| | N | 4 | 0 | 3 | 1 | 1 | 0 | 3 | 1 | 2 | 1 | 1 | 0 | 6 | 0 | 2 | 0 |
| | DK | 1 | 1 | 0 | 2 | 5 | 2 | 6 | 5 | 3 | 1 | 0 | 1 | 2 | 2 | 1 | 1 |
| Valladolid | Y | 21 | 33 | 28 | 20 | 24 | 18 | 19 | 27 | 31 | 25 | 26 | 22 | 16 | 21 | 20 | 26 |
| | N | 11 | 5 | 5 | 15 | 8 | 16 | 15 | 10 | 8 | 12 | 12 | 14 | 15 | 12 | 15 | 12 |
| | DK | 8 | 2 | 7 | 5 | 8 | 6 | 6 | 3 | 1 | 3 | 2 | 4 | 9 | 7 | 5 | 2 |

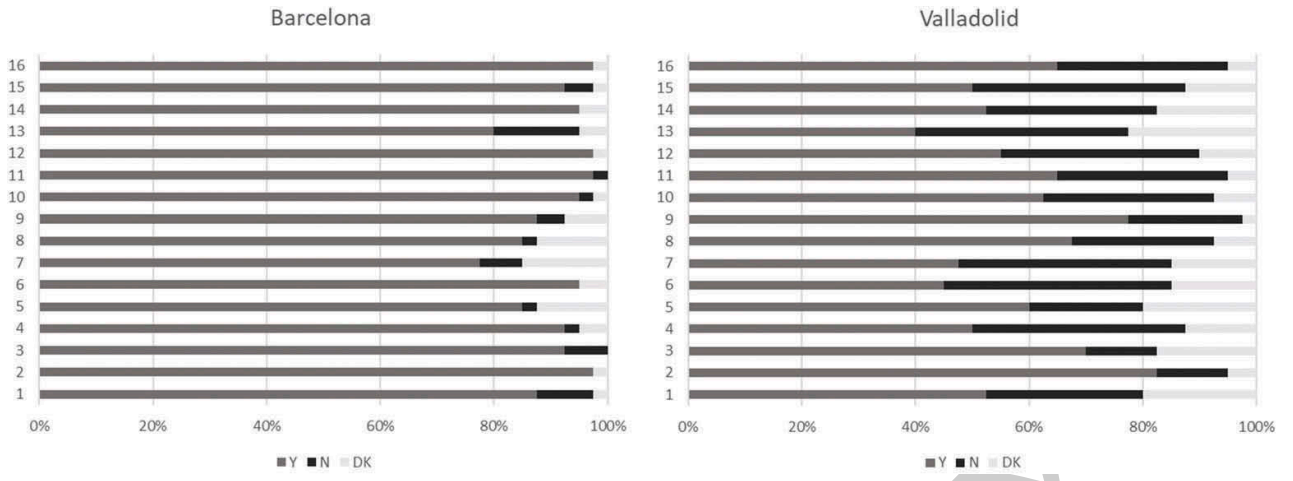


**Figure 12.** Percentage of responses to the specific questions about the quality of the spaces created/improved in the two cases analyzed. Y = Yes; N = No; DK = Don't Know. Each number corresponds to a question (see Table 4 for correspondence). Source: elaboration by the Authors (2023)



component (i.e., a multi-block area). It has been conceived as part of a comprehensive city-planning strategy aimed at reducing space dedicated to road traffic in favour of higher-quality public space for pedestrians in terms of improved walkability, enhanced public equipment provision, and increased green areas. Within the Superblock, streets become shared public spaces, serving many functions, from slow mobility (walking or cycling) to entertainment, sports, or social gatherings. The absence of through traffic reduces noise and air pollution and the new public space seeks to encourage multi-modal transportation and sociable street life (Roberts 2019). This implies changes that affect the entire neighbourhood system by creating new areas of centrality, sociality, and proximity while maintaining the greening of the new spaces available for pedestrians (and, consequently, the provision of benefits to residents in terms of ecosystem services, e.g., cooling down local temperatures) as a central concept. The case of Valladolid instead focuses on a NbS implementation program involving a set of punctual interventions that, despite being locally adapted, can be generally applied at any scale/location, and they can consist of a single component (e.g., a tree) or an entire element of the landscape (e.g., a tree alley). The program was financed by an EU pilot project that was not initially conceived and (fully) embedded within a comprehensive city planning and design process or strategy. Although these interventions could provide cumulative benefits at the neighbourhood or city scale (e.g., air purification), they are primarily focused on local-scale environmental improvements through single NbS demonstrative projects. In this case, poor attention is paid to other aspects such as improving the attractiveness and sociality of public spaces in the area or substantially reducing car traffic. In both cases, there was initially limited (public) space available for interventions. However, in Barcelona they succeeded in recovering space by subtracting it from car traffic functions through an integrated approach, enabling larger interventions and, consequently, outcomes/benefits. In contrast, in Valladolid city centre the size of most of the solutions implemented is relatively small according to the (smaller) available space.

Accordingly, the responses of residents reveal a rather clear difference in how the outcomes of the two projects are perceived and appreciated. The case of Barcelona received more positive feedback regarding socio-environmental benefits and spatial

qualities, but also raised more concerns about the potential negative effect related to the increase in the cost of living due to the improvements promoted by the project. This is quite surprising since, initially, the citizens' general perception of this project, especially before COVID-19 pandemic and particularly concerning the first phases of implementation of the pilot Superblock in Poblenou, was not so positive with considerable resistance from the local population (but also with many people supporting the project). Residents raised several concerns about, e.g., the elimination of parking lots, alterations to bus routes, and restrictions on vehicle direction, which even resented criticism of tactical urbanism of the overall Superblock work (Montaner 2023, 65–70). However, this could (also) depend on the fact that, during the first phases of implementation, the perceived negative consequences were not compensated by positive outcomes, since the interventions were mostly felt as temporary or even absent/insufficient to justify such a big change in the mobility network, and because there were concerns regarding gentrification and governance aspects (M. Nieuwenhuijsen et al. 2024). In addition, there was a lack of public consultation and proper communication with residents, which instead became one of the key aspects of the implementation in more recent experiences with other Superblocks (e.g., in San Antoni and Cent de Cent) (M. Nieuwenhuijsen et al. 2024). Today the perception could have changed with the conclusion of the project and the permanent installation of, e.g., playgrounds, outdoor seating, meeting spaces, and vegetation planting, with public space improvements that are now visible, usable, and appreciable.

In this regard, planning approaches aimed at creating healthier urban places that simultaneously involve multiple 'planning spheres' (e.g., green space planning and design, traffic and transportation planning, and public facility improvement, as in the Superblock project) to promote integrated planning strategies seem more likely to generate greater positive outcomes and citizens' appreciation than the ones solely relying on urban greening (standalone) strategies, such as in the Valladolid case. This integrated approach is particularly needed in dense urban areas where the space available for improvements is limited, such as in the two analysed case studies. In Barcelona, this led to more available space for interventions enabling greater physical transformations that could have more positively influenced the citizens' opinion on the project compared to Valladolid. However, it has to be noted that today's perception of residents may be influenced by factors that go beyond the project's interventions. For instance, in Barcelona, another factor that may have influenced public opinion on Superblocks is the enforcement of city marketing strategies promoting them as a global model for healthy living, especially since the implementation of more recent Superblocks (Anguelovski, Honey-Rosés & Marquet, 2023). In Valladolid the URBAN GreenUP project may have instead suffered from a lack of promotion by the city administration, resulting in low visibility, resonance, and understanding among residents. This occurred in Liverpool, another city taking part in the project, in which, also due to the project's overtly technical character, it was shown that small NbS interventions were viewed by residents as less socially and ecologically valuable compared to larger investments (Mell, Clement, and O'Sullivan 2023). The same authors conclude that strategic, integrated, larger-scale, and more visible investments are required to accrue substantive benefits and gain public acceptance of planning interventions promoting urban greening (and healthier urban environments in general), confirming our position on this aspect.

### *Potential unwanted outcomes triggered by the projects: green gentrification*

Although the beneficial socio-environmental outcomes of the two analysed projects are undoubtedly relevant, to fully achieve the goal of improving the living conditions of all citizens also possible negative consequences for the inhabitants should be monitored and addressed.

As a confirmation of the residents' concern about the rising cost of living raised by the respondents in Barcelona, the Poblenou Superblock has been already marked as a project that is likely to trigger gentrification processes (Anguelovski et al. 2022). Its implementation occurred in a city sector undergoing a significant renovation process, which is aimed to convert the whole Poblenou area into a technological and innovation district (the so-called 22@ Innovation District). This transformation, which was conceived thanks to the opportunity offered by the 1992 Olympic Games to renovate the Poblenou abandoned former industrial areas in the wake of the urban entrepreneurship paradigm (Camerin and Longato 2023), includes the addition of new leisure and residential spaces, which has already triggered gentrification issues (Charnock, Mansilla, and Ribera-Fumaz 2023).

The gentrification phenomenon has been extensively recorded and studied, particularly in US cities (e.g., the case of New York City's High Line elevated park (Black and Mallory 2020)) and, more recently, in Europe (Anguelovski et al., 2018). In this regard, city governments should put in place appropriate housing policies (or be ready to eventually do it) to prevent or mitigate gentrification processes when promoting these types of intervention, even though the policy options that can provide effective results are not many. To date, the only solution that seems to succeed is social housing, namely rents subsidized by the public (state or city) (Roberts 2019). The Barcelona City Council has been committed to building two social housing projects in the area affected by the analysed Superblock based on the 2016–2025 'Right to Housing Plan' (Ajuntament de Barcelona 2016), for a total of 86 social housing units (of which 68 already realized in 2020) (Ajuntament de Barcelona 2023a). However, if housing prices would substantially increase in the surrounding areas in the future, as already warned, the risk is that the social housing units might be affected by segregation dynamics that favour the ghettoization of poorer people. Currently, clear gentrification trends in this area are difficult to detect and quantify for two reasons. First, the quite novelty of the project. Second, since this process typically affects the immediate surroundings of the intervention area, the housing price data that are usually provided at the whole neighbourhood or district level make it difficult to identify localized price deviations. Yet, the data elaborated by the platform 'Idealista' for the two neighbourhoods affected by the analysed Superblock implementation, namely 'El Poblenou' and 'El Parc i la Llacuna del Poblenou', shows the following dynamics. The housing sale prices have experienced growth in 2022 (December 2022 updates show sale prices of 4,780 and 4,541 €/sqm with an annual variation of + 7% and + 6.4%, respectively). This is against the average trend recorded for the same period in the whole District area (Sant Martí District recorded a negative trend of minus 0.5%), which also shows an average housing sale price (3,544 €/sqm) well below the Poblenou area values (Idealista 2023b). In terms of housing rental prices, the two neighbourhoods recorded higher values (21.1 and 25.9 €/sqm with annual variation of + 31,1% and + 32.5% in 2022, respectively) than the whole District area (20.0 €/sqm with annual variation of + 28.2%) (Idealista 2023a).

These data alone do not offer the proper basis to confirm that the recent Superblock implementation is favouring a prominent gentrification process. However, it is not unlikely that (also) this project is contributing to this trend, although the broader urban renewal process that has characterized the Poblenou area in the last decades still appears to be the main driving factor for the housing price increasing values (Camerin 2019). Further research should investigate more in detail the localized price trends in the areas within and surrounding the Superblock project(s). This is especially important since the city administration is committed to reproducing this approach in other parts of the city.

In the Valladolid case study, to date, no signs nor concerns about possible gentrification processes caused by the improvements introduced by the NbS projects have been detected. However, possible future dynamics of housing price and land value increase in the areas most interested by the interventions should be monitored, since this trend has been already recorded in other cases of NbS implementation (Anguelovski and Corbera 2023).

### *Framing the analyzed projects within the post-COVID-19 city planning*

A topical aspect emerging during the recent COVID-19 pandemic is the positive contribution that proximity public spaces and urban green areas can make during pandemic situations. According to the growing epidemiological studies assessing the impacts of COVID-19 in urban environments (Sharifi and Khavarian-Garmsir 2020), they can positively influence some of the causes of higher contagiousness, hospitalization, and mortality rates. Various epidemiological investigations (e.g., Perone 2022) showed that the combination of specific weather conditions (i.e., lower temperatures and higher humidity) with high levels of pollution and poor pre-existing health conditions makes COVID-19 hit worse and to a greater extent. Moreover, people living in urban areas with low(er) green space density and high(er) levels of air pollution potentially suffered from a higher risk of hospitalization and mortality than people living in more open and greener environments (Brunekreef et al. 2021). The contribution of green spaces is essential to, e.g., mitigate air pollution and promote healthier lifestyles that favour better physical condition of people, thus potentially alleviating the grave consequences of pandemic diseases (M. J. Nieuwenhuijsen 2021). In addition, the larger the public green areas available at the neighbourhood level, the easier is to maintain appropriate social distancing without depriving citizens of the possibility to (safely) enjoy green spaces during pandemic periods. This situation was shown to play a vital contribution to urban dwellers' physical and mental well-being, also due to their increased desire to spend time for outdoor recreation with limited alternative options available (Geneletti, Cortinovis, and Zardo 2022).

When viewed from this perspective, the two projects analysed become even more significant. Both projects promote more – and more pleasant – green open space and outdoor recreation opportunities for citizens, as well as healthier urban environments (and, possibly, lifestyles) that may contribute to alleviating some of the causes that increase hospitalization and mortality risk.

Both projects can differently provide benefits according to the post-COVID-19 city planning paradigm, embracing concepts such as NbS and green space's benefits for

residents, urban biodiversity, and climate (i.e., addressed in both projects), and 15-minute cities to enhance walking/cycling trips and reduce emissions (i.e., partly addressed in the Superblock project), among others (see Giles-Corti et al. 2023).

Q8 As pointed out by Honey-Rosés et al. (2021), on the trust of the urgency for healthier cities fostered by the recent pandemic period and the funds made available for the economic recovery, many cities' agenda launched a new wave of urban development and renovation processes focused on the provision of greenery and improvement of public spaces. Yet, much has to be done to address the aspects of inequities and exclusions of more disadvantaged populations from these transformations. The above-mentioned gentrification is just one of the potential negative aspects to account for. Others involve, for instance, the tendency to propose the implementation of these types of intervention in areas that are already privileged from the socio-economic and environmental point of view due to their greater appeal and capacity to attract resources (Garcia-Lamarca et al. 2021). The main challenge of post-COVID-19 city planning is thus to design cities to create healthier and more livable urban environments but at the same time to address the problems of inequities and exclusions of more disadvantaged population groups.

### *Main research challenges and next steps*

The main challenges of the work especially concern the fact that the two projects are pretty diverse in their nature, scale, policy context, and funding sources (see section 4.1 for more details). One involves a delimited multi-block-scale renovation project covering 16 ha for almost 5,600 inhabitants (Barcelona); the other concerns the implementation of dispersed interventions within a district area of 73 ha for about 8,900 residents (Valladolid). These different features do not allow a rigorous and systematic comparison between the two, including their outcomes/impacts. These differences could also have a major role in possibly influencing the citizens' perception/opinions about the realized interventions. In addition, the novelty of the projects does not allow to rely on accurate data and information about their impacts and benefits that should be more evident in the long-term. However, the objective of the proposed work is to provide early findings and evidence about the socioenvironmental outcomes of these two recently implemented urban design models that can be used to inform future research directions and refinements.

Besides enriching the analysis with new data about the socioenvironmental outcomes/benefits of the two projects (if/when available), possible next steps for the research may include other survey rounds with residents, and widening the scope of the survey by collecting and analysing multiple demographic data of respondents (e.g., if owners or renters, age, gender, etc.) to assess possible correlations between their perception/opinions and the different typologies of respondents. Moreover, future studies specifically attempting to assess green gentrification's causes and consequences under multiple aspects are required (e.g., in the Barcelona Superblock case but also other similar projects). To this aim, data and indicators depicting multiple aspects of the cost of living besides the housing prices (e.g., cost of food and other primary goods) may be collected, developed, and analysed to assess possible increases in the living costs associated with the project implementation and the public space qualities they promote. Specific

indicators that can be used/adapted for this purpose can be found in existing studies (e.g., Agencia d'Ecologia Urbana de Barcelona 2008; Anguelovski et al. 2022), for example concerning indicators that measure the increased environmental standards due to urban renewal/regeneration processes.

## Conclusion

This study focused on two typologies of approaches that have received growing attention in recent years, and that are being promoted as new urban models to pursue urban resilience and the improvement of socio-environmental conditions of cities and their inhabitants: the Superblock project in Barcelona and the implementation of a mix of NbS through the URBAN GreenUP project in Valladolid city centre. The overall aim was to critically analyse (without presuming to exactly quantify) the early or expected outcomes of two possible solutions that can be implemented to address some of the challenges that the current EU policies and strategies consider as the most urgent to tackle in cities (e.g., climate mitigation and adaptation, air pollution, etc.). Since the implementation of these solutions is very recent, the case study analysis presented in this paper constitutes a first step towards more detailed assessments. This is a necessary step to gain first critical insights concerning their contribution to improving the socio-environmental aspects of cities, also in the view of possible future replications (and adjustments) of these approaches.

Both the projects are (apparently) contributing to creating healthier urban environments, even though the Superblock project appears to have greater impacts in terms of physical transformations and socio-environmental benefits at the neighbourhood scale, as well as gained more appreciation according to residents' answers to the survey – even though this may be influenced by city branding strategies. Despite both projects were promoted in dense urban areas with little space available for implementation, one of the key aspects that led to greater outcomes in the Barcelona Superblock case is that an integrated approach was enforced by combining urban greening efforts with traffic regulation and public space improvement policies. This integrated approach, embracing traffic space recovery and the implementation of greening interventions associated with the creation of socially attractive spaces, has led to larger and (apparently) more appreciated transformations and benefits compared to the almost exclusively technical greening approach in the Valladolid case.

While these findings may depend on the different scopes for which the two projects were conceived, they can shed light on possible design aspects and enabling factors that can lead to more effective and appreciated outcomes when planning and designing interventions aimed at creating healthier urban environments and improving the city's (socio)environmental conditions. These include the importance of designing proximity public and green spaces that offer environmental benefits but at the same time multiple social interaction and recreation opportunities for residents. Or the deployment of integrated planning approaches to find solutions for implementing them in very dense urban areas (e.g., through recovering spaces from other functions, such as car traffic space).

Another aspect worth mentioning is the pandemic and post-pandemic context in which the projects were (in part) implemented and/or the analysis was carried out. This

may have influenced the projects' implementation/outcomes and/or the residents' opinions, since a general rising awareness of the value of living in proximity to green spaces and of having easy access to nature-based recreation opportunities occurred from the COVID-19 lockdowns. In addition, these types of solutions are well claimed to positively influence some of the environmental factors that play a major role in virus transmission during pandemic outbreaks (e.g., reducing air pollution), as well as the physical and mental well-being of residents that can benefit from them (also) during restriction periods, pushing the need to rethink our cities in the post-COVID-19 era.

Finally, another very important issue to take on board is that the implementation of such solutions may result in negative consequences for more socio-economically disadvantaged population groups due to the risk of triggering (green) gentrification processes, as might be the case of the Superblock project. For this reason, any effort to combat gentrification-driven population displacement processes through specific anti-displacement strategies should be an integral part of the early planning and design process when implementing interventions for green and/or public space improvement in cities, by adopting intersectoral approaches between environmental and housing policy-making (Derickson, Klein, and Keeler 2021).

## Notes

1. This calculation was done considering that all the planned interventions are fully implemented, although for some of them the latest information available indicates that they are just partially completed (e.g., tree planting along the green corridor) (URBAN GreenUP 2020), and this was confirmed by on-site surveys during spring 2023.
2. Number of people contacted may be different from the total number of questionnaires effectively submitted (40 in each case study); this depends by the fact that there were people that declared they are not aware of the implemented project, thus they cannot provide answers about that.
3. Regulation (EU) 2016/679 of the European Parliament and of the Council of 27 April 2016 on the protection of natural persons with regard to the processing of personal data and on the free movement of such data, and repealing Directive 95/46/EC (General Data Protection Regulation). Retrieved from https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32016R0679

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## Appendix 1

### *Questionnaire submitted to residents in Barcelona and Valladolid*

*Survey period*: 1 April 2022 to 31 May 2022.

*Number of people contacted for submitting the online questionnaire*[2]: 41 people in Barcelona (statistical reference sample indicated by the association 'Poblenou Veïns i Veïnes') and 49 people in Valladolid (statistical reference sample indicated by the association 'Asociación de Vecinos El Refugio'). The interviewees' personal data is classified in compliance with the European Union General Data Protection Regulation.[3]

The questionnaire was organized into two sections with the following questions.

**First section**: **general questions about the citizens' opinion on the implemented projects and related outcomes**

(1) Would you define positive the implementation of the project for improving human health and mitigating the negative effects of climate change?
(2) Do you think that the project provides a more aesthetically appreciable and inclusive urban environment?
(3) Do you think that the project has positively influenced the formation of identity, sense of community and emotional and social well-being?
(4) Would you state that the project has increased the cost of living?
(5) Would you define positive the experience of living near the areas affected by the interventions during the pandemic period due to the changes in the urban environment promoted by the project?
(6) Would you say that non-residents are coming to experience the areas affected by the project in their free-time?
(7) Would you recommend the extension of the project in other parts of the city?

**Second section**: **specific questions about the quality of the spaces created/improved according to 4 qualities and 16 criteria related to public space (see the main text for more details about selected criteria)**

***Quality 1***: ***Access and linkage***

V1. Do you think that the spaces created/improved though the project are convenient to use?
V2. Do you think that the spaces created/improved though the project are visible?
V3. Do you think that the spaces created/improved though the project are easy to get to and move within?

***Quality 2***: ***Uses and activities***

V4. Do you think that the spaces created/improved though the project are providing a reason to be there?
V5. Do you think that the spaces created/improved though the project are vital?
V6. Do you think that the spaces created/improved though the project are unique?

***Quality 3***: ***Comfort and image***

V7. Do you think that the spaces created/improved though the project are safe?
V8. Do you think that the spaces created/improved though the project are clean?
V9. Do you think that the spaces created/improved though the project are provided with enough green areas?
V10. Do you think that the spaces created/improved though the project are full of character?
V11. Do you think that the spaces created/improved though the project are attractive?

***Quality 4*: *Sociability***

V12. Do you think that the spaces created/improved though the project are fostering neighborliness?
V13. Do you think that the spaces created/improved though the project are fostering friendship?
V14. Do you think that the spaces created/improved though the project are fostering interaction?
V15. Do you think that the spaces created/improved though the project are fostering diversity of users and uses?
V16. Do you think that the spaces created/improved though the project are fostering pride?