

COMMUNITY ENGAGEMENT AND GREENING STRATEGIES AS ENABLING PRACTICES FOR INCLUSIVE AND RESILIENT CITIES

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ABSTRACT

The climate change challenges call for innovative and sustainable policies and governance models, capable of achieving adaptation and mitigation goals working on a necessary behavioural societal change, both at individual and collective levels. Cities and their public spaces represent an ideal ground for the implementation of innovative strategies, which combine participatory and engagement practices to physical transformations of urban areas in a regenerative perspective. Co-design and participatory paths can trigger reactivation and re-appropriation of underused spaces, generate new dynamics in the public space use and provide effective solutions to tackle climate change, improving outdoor microclimatic comfort conditions. The implementation of demonstrative and temporary interventions – based on greening actions co-created with local administrations, stakeholders and citizens and supported by technologies – represents a viable and effective practice in order to experiment, test, monitor and evaluate shared pathways to more liveable, resilient and sustainable cities. This combined approach was experimented in the Bologna University area by the EU Horizon 2020 project ROCK – *Regeneration and Optimisation of Cultural Heritage in Creative and Knowledge Cities* (GA 730280) – through a series of pilot actions aimed at public open space utilization and potential enhancement in particular in the historical city centres, generating new resilient processes in terms of environmental sustainability and social inclusion.

Keywords: *co-creation, co-design, community engagement, environmental sustainability, EU ROCK project, integrated approach, policy making, public spaces, temporary transformations, urban regeneration.*

1 INTRODUCTION

In Europe, where the urbanization process is constantly increasing, it is estimated that by 2050 almost 85% of the inhabitants will live in urban contexts. Cities, with the production of approximately 70% of the global greenhouse gas emissions [1], significantly contribute to climate change and, at the same time, suffer its most intense effects: heat waves, periods of drought, violent storms and floods are phenomena that occur with a growing frequency and intensity, with a progressive rise up to 60% of extreme weather events in the past 30 years [2].

In the last decade, the European Community recognized the need to undertake a synergistic action, which, on the one hand, includes climate mitigation strategies, containing greenhouse gas emissions and, on the other, adopts adaptation measures to face inevitable climatic impacts and their economic, social and environmental costs.

In 2013, with the ‘EU strategy on adaptation to climate change’, the European Commission identified the main objectives and actions to make cities more resilient and encouraged Member States to implement adaptation strategies at local scale through networking initiatives, such as the ‘Covenant of Mayors for Climate and Energy’ [3].

Another important challenge was tackled at the 2015 international conference in Paris (COP21) with the signature of the first legally binding global climate agreement, in which 195 countries agreed to limit global warming below 2°C above pre-industrial temperature levels [4]. However, the 2018 European Commission report on the adaptation policies

implementation - despite the overall strategies to respond to climate change having achieved the expected objectives - underlines how the country is still deeply vulnerable to climate change impacts and how, consequently, a revision of those policies is needed [5].

Building on these premises, the ‘EU Green Deal’ was issued at the end of 2019 as further long-term strategy aimed at reducing Europe’s greenhouse gas emissions to net zero by 2050. The ‘European Climate Law’, defined as the legislative basis for all measures relating to adaptation and mitigation to climate change, and the ‘The Just Transition Fund’, aimed at financing sustainable initiatives in the most backward and vulnerable EU regions, are the last two key measures implemented to promote a just, inclusive and citizen-centred transition [6].

To be successful, the path to climate neutrality requires, in addition to careful and targeted legislation and environmental policy to facilitate the transition, a substantial change in behaviour at both the individual and collective levels. This path cannot be undertaken without including considerable changes in societal practices and in the behaviour of all individuals, communities and public and private organisations through collective and participatory processes as enabling tools towards a sense of environmental citizenship and climate justice. To engage citizens in co-creative and deliberative ways, effective and inclusive actions on the social and behavioural aspects must be implemented, working on structures, tools and mechanisms that empower citizens to start environmentally sustainable initiatives [7].

The urgent need to act on urban areas to face the climate crisis and to involve citizens as the engine of this multi-level process of transition - fully anchored on the European Green Deal Strategy to make Europe climate neutral by 2050 – is also addressed by the mission ‘100 climate-neutral cities by 2030 - by and for the citizens’, proposed by the European Commission in June 2020.

Cities play a central role in these innovative dynamics, representing ideal realms where decarbonisation strategies can be experimented, tested and monitored in the fields of energy, mobility, buildings and open spaces: engaging citizens is crucial as they are not only political actors in a governance structure but also users, producers, consumers and owners. The mission, considering cities as the arena of experimentation and innovation hubs, will support, promote and showcase 100 European cities in their systemic transformation towards climate neutrality by 2030, working through tools such as the Climate City Contracts, adjusted to each city’s realities [8].

In addition to the need to work on a change of mindset and to encourage the sharing of approaches and best practices, the climate challenge might to be faced with physical transformation actions, acting on the main scenario of daily life, with the aim to improve comfort and quality, together with the implementation of real citizens’ involvement and the enhancement of sense responsibility and awareness towards climate issues.

In particular, the intensification – in terms of frequency and intensity – of the heatwave phenomenon and violent rainfall makes necessary to urgently intervene right on public and open spaces. Moreover, urban public spaces can play a determinant role in the experimentation of strategies and solutions aimed at enhancing resilience to climate impacts [9].

In order to improve cities’ green footprint and to create a more sustainable attitude for future development in cutting emissions and reducing pollution, nature-based solutions represent effective opportunities to obtain not only ecological but also social, economic and health benefits in addressing society’s challenges and in increasing the quality of life and sustainability in urban areas [10]. Thus, an approach to urban space design that involves physical interventions integrating green and blue infrastructures can contribute to tackle climate change effects and risks [11].

The inclusion of vegetation and green solutions in urban areas provides different kinds of benefits: on the one hand, it helps to attenuate heatwaves' impact, thanks to the shading of the trees and their evapotranspiration effect [12]; on the other hand, it reduces water runoff effect, thanks to the permeability of green surfaces and to tree canopies' ability to intercept precipitation, slowing the water flow [13]. The use of mirrors and water blades – the so-called blue solutions – can also act on temperature mitigation, thanks to the effect of evaporative cooling [14], while the creation of temporary basins, for the collection and reuse of water, represents a valid solution to manage heavy rainfall and to avoid flooding events [15]. The increase, conservation and restoration of green areas and trees, as well as the insertion of green roofs and walls, also act on the causes of climate change, reducing the concentrations of climate-altering gases.

Despite their effectiveness, physical interventions are not sufficient if they are not supported and integrated by active involvement processes of all local stakeholders both at private and public levels, as stressed by EU Green Deal priority of 'making sure no one is left behind' [16]. Rethinking and redesigning the attractiveness and liveability of urban public spaces in a more sustainable way could be done through demonstrative and symbolic actions aimed at making our cities more climate-responsive, at raising awareness among citizens on resilience to climate change and at changing user's behaviours and attitude towards these urgent issues. This necessary community commitment finds in co-planning, co-production, self-construction and co-management fundamental steps for experimental urban transformation processes able to achieve long-term results in public spaces caring and regeneration process through temporary and pilot actions.

The present contribution – building up a contents' selection reported in Boeri, A., Longo, D., Orlandi, S., Roversi, R. & Turci, G., 'Temporary transformations to access and experience sustainable city public spaces', *WIT Transactions on Ecology and the Environment*, Vol 249, WIT Press, 2020, ISSN 1743-3541 [17] – is aimed at providing a reflexion on the crossing relation between open public spaces regeneration, transformation process and communities' involvement as effective and combined tools to enhance urban resilience. This paper is structured in two main sections: the first one offers a general overview on innovative engagement strategies and tools for a resilient regeneration of public space; the second section deepens H2020 EU ROCK project experience and results in the city context of Bologna (Italy).

2 INNOVATIVE ENGAGEMENT STRATEGIES AND TOOLS FOR RESILIENT PUBLIC SPACES

Urban regeneration processes in cities – involving all their social, ecological and spatial dimensions – call for more sustainable models, tools and strategies. The availability of physical space joint with a large target of population, and the proximity between different stakeholders, makes cities appropriate scenarios and experimentation grounds for testing innovative approaches to tackle environmental challenges. Public spaces – in addition to representing the arena where such diversities mix and the democratic practices are expressed – constitute the sites where citizens' needs, desires and sense of appropriation take shape and manifest themselves: they can be conceived as platforms for rethinking, sharing, debating, experimenting, prototyping and monitoring ideas and solutions on the future of the city [18].

In this perspective, cities can be considered essential hubs for citizens' direct engagement in policy decisions, which play a crucial role in contributing towards shaping urban conditions [19] and providing innovative, creative and tailored solutions. The integration of multiple points of view and practices involving all components of society, exploiting their potential, is a fundamental step to develop a sense of shared responsibility and awareness, with the aim of incorporating them into urban planning processes.

The design of public spaces can work on different pressure points: reducing environmental impacts; providing efficient mobility; increasing social cohesion and moving towards a city overall liveability. Therefore, the project and physical intervention are not to be understood as simple instruments – even if powerful and significant – to transform the public space but as the reflection of a possible change also in the way urban transformation processes and dynamics are conceived, activated, curated and perceived in a perspective of deliberative democracy, where citizens and all subjects involved are active and aware protagonists. Citizens' involvement in the city processes of change itself becomes a design tool, establishing new connections and stimulating the co-production of innovative ideas and places.

Several experiences in European cities are testing new roles and responsibilities for citizens, new forms of collaboration between communities and several other actors in city governance, hinging methods, tools and technologies to rethink the future of urban territories, showing how new forms of engagement-led governance and policy making are increasingly becoming significant components in urban regeneration strategies, pushing forwards behavioural and institutional changes that will benefit all [20]. Experimentations of innovative design approaches to public space are based on temporary transformations, which – inspired by movements and informal practices of designing actions to solve urban problems, creating new opportunities and services for the public [21] – have progressively been converted into formal adopted policy at the institutional level and implemented in numerous geographical contexts. Significant examples in this sense, matched with participatory forms of urban planning, are: the ‘Superilles’ programme in Barcelona [22], an organizational model of the urban fabric designed to promote sustainable mobility, productivity, greenery and biodiversity, as well as parking spaces for pedestrians.; the ‘Open Squares’ project [23] promoted by the Municipality of Milan (in collaboration with Bloomberg Associates, National Association of City Transportation Official and Global Designing Cities Initiatives), involved in the transformation of various spaces in the city into meeting places, pedestrian areas, play areas and spaces for events, based on an idea of public space for meeting and socializing. These practices can be considered tactical urbanism actions – by definition ‘a city and/or citizens-led approach to neighbourhood building using short-term, low-cost and scalable interventions intended to catalyse long-term change’ [24] and typically linked to key concepts like provisional, improvisational, guerrilla, unsolicited, tactical, temporary, informal, DIY (Do It Yourself), unplanned, participatory or open source – which share an optimistic willingness to overcome conventional practices in favour of ‘tactics’ to make cities more sustainable and accessible. This kind of practices, providing temporary public spaces for testing first, review, correct and test again solutions for cities that are constantly changing and evolving, attempts to slow down the threat of climate and global changes with small local successful efforts.

Another more inclusive urban governance tool for designing public space and enhancement of citizens' awareness and engagement refers to participatory online platforms: open-source online infrastructure for cities and organizations (e.g. ‘Decidim’ in Barcelona, ‘Decide’ in Madrid, Smart City in Amsterdam, ‘Yo Participo’ in Bogotà, etc.) through which people could affect urban transformation actions, organising themselves democratically on several levels by making proposals, fostering decision-making discussions and monitoring the implementation of decisions.

The participatory approach effectiveness with regard to more sustainable urban policies is also reflected in the spread of a wide range of new institutional bodies and arrangements across cities, networks that are significantly empowering cities and accelerating the evolution of urban governance towards more horizontal cooperation and knowledge exchange. These collaborative forms of sharing good practices between cities and urban stakeholders –

implemented both within and outside Europe – are effective tools in taking measures to tackle climate change and in providing new strategies to integrate climate-change mitigation and adaptation activities. Worldwide, there is an increasing number of transnational networks on climate actions driven by cities and local governments working towards a resilient and low-emission society, among which a relevant example is the Global Covenant of Mayors for Climate and Energy: ‘the largest global alliance for city climate leadership across the globe’, built upon the commitment of over 10,000 cities and local governments [25].

The above-mentioned experiences and practices – participation mechanisms, multilevel governance structures and citizens’ engagement – represent effective and possible strategies to contribute in regeneration processes of urban space, boosting the process towards more liveable, sustainable and resilient cities, facing climate adaptation challenges with necessary societal and cultural changes.

3 COMMUNITY ENGAGEMENT-LED APPROACHES AND TRANSFORMATIONS OF PUBLIC SPACES: BOLOGNA URBAN POLICIES AND EUROPEAN ROCK PROJECT CASE STUDY

3.1 The case of Bologna: climate-responsive and collaborative city

In the last few years, the city of Bologna (Italy) has activated a series of policies, framed in the European climate change perspective, aimed at reducing climate-altering gas emissions, at improving the quality of urban systems and at making the city increasingly attractive and liveable. In 2008, with the signing of the Covenant of Mayors, the city committed to reduce CO₂ emissions and, by compiling the Baseline Emission Inventory, it prepared the Sustainable Energy Action Plan [26]. Since 2012, the Municipality has been supporting the decarbonization process promoting a path aimed at making the city increasingly resilient: with the collaboration of ARPAE, Kyoto Club and Ambiente Italia, Bologna won the Life project *BlueAp*, and it adopts an innovative and pragmatic Adaptation Plan to face climate change-related challenges [27]. The Plan, approved in 2015, consists of an analytical part of investigation on the risks generated by climate change and an applicative section exploring strategies, actions and monitoring measures to provide a concrete response to the vulnerabilities that emerged in the local context. In the following years, also thanks to Bologna participation in some applied research projects on the city [28–31], several actions planned by the Municipality have been implemented and the modification of some planning tools has been undertaken to make their contents more practical and operational. Starting from 2018, the Municipality is working on the new General Urban Plan. The Plan, adopted in December 2019, identifies three macro-areas where the city aims to act: Resilience and Environment, Habitability and Inclusion, Attractiveness and Work. These three macro-strategies highlight how the environmental aspects, always central for the city of Bologna, are confirmed as a strategic priority. In particular, the goal of an increasingly resilient city passes through four lines of action on which it is particularly urgent to act: the fight against soil consumption, the development of an urban eco-network, the prevention of environmental risks mainly related to Urban Heat Island (UHI) phenomenon and the energy transition and circular economy processes [32]. After the renovation of its adhesion to the Covenant of Mayors for Climate and Energy, the Municipality is currently engaged in the drafting of the new Sustainable Energy and Climate Action Plan aimed at improving climate-altering emission targets and at reviewing its climate change adaptation policies and strategies [33].

In addition to being a particularly active reality in the environmental transition process, Bologna is working in the direction of a strong citizen involvement in the care and regeneration processes of urban public spaces in a perspective of improvement in terms of quality, accessibility and climate resilience [34]. In this context, the city can boast some significant experiences: in 2014, Bologna was the first city to adopt the *Regulation on collaboration between citizens and administration* and the *Collaboration Pacts* to promote daily care and maintenance of urban commons [35], and, in 2017, it introduced the *Participatory Budget* as a useful tool for citizens who want to propose innovative action to improve proximity spaces fruition and regenerative actions in the neighbourhoods where they live and work [36]. With the diffusion of Fridays for future movement in Italy and by leveraging on the increasing interest of the new generations in the climate emergency, the Municipality of Bologna has activated some educational paths to inform and raise awareness among citizens on these issues and has approved the Climate Emergency Declaration [37]. With this Declaration, Bologna undertook a process towards the reduction of its climate impact and launched the *Chiara.eco* project, with the support of the city agency Urban Innovation Foundation (Fondazione Innovazione Urbana, FIU) – centre of analysis, communication, processing and co-production on urban transformations to face social, environmental and technological challenges – and of the University of Bologna [38]. The project defines an open and constantly evolving digital space that allows deepening the dynamics related to the ecological crisis, to implement strategies and solutions to address climate change and to collaborate in the activation of practical experiences to be put into practice in Bologna context. FIU declines different engagement methodologies starting from the proximity approach to deliberative climate assemblies to promote co-evolutive transformation between infrastructures and local communities in the short and long term, with the aim to achieve a sustainable climate transition through incremental empowerment of citizens.

Among the possible developments of climate and environmental policies, the view of nominating Bologna among the 100 European cities that aspire to carbon neutrality by 2030 is emerging in recent months, adhering to the EU-funded mission *100 climate neutral cities by 2030 by and for the citizens* [39]. In this complex context, as pointed out by the administration [40], there is an increasing need to look at the environmental and social issues in an integrated way in order to prevent the acceleration of measures aimed at combating climate change from generating or further exacerbating inequalities among citizens. The city of Bologna can be considered a model of ‘Collaborative City’ thanks to a wide and consolidated network of shared public spaces, accessible cultural goods, enabling technologies and open data which are giving substance to this vision.

3.2 The EU Rock project in Bologna: ecological solutions, participatory practices and enabling technologies towards more sustainable public spaces

The Municipality of Bologna carried out some experimentations in close collaboration with FIU and the University of Bologna Department of Architecture under the ROCK project (Regeneration and Optimisation of Cultural Heritage (CH) in creative and Knowledge cities – G.A. 730280) – funded in 2017 under the EU Horizon programme in the axis ‘Climate Action, Environment, Resource Efficiency and Raw Materials’, ‘Greening the Economy’ in response to the call ‘Cultural Heritage as a driver for sustainable growth’ (Call ID: H2020 - SC5-2016-2017) [41]. These initiatives can contribute to exemplify how the citizens’ involvement in urban transformations and environmental sustainability issues is an essential component not only when the social or behavioural dimensions are involved but also the physical one, concerning the built environment. ROCK field of action are historic city centres, interpreted as

privileged living laboratories where new models of urban strategies and practices are tested to demonstrate how tangible and intangible CH can be a strategic regenerative resource to gain sustainable development and economic growth for the whole city. By providing new ways to access CH and by promoting an innovative perception of shared heritage as a collective property, ROCK project fosters the experimentation of actions focuses on public open spaces, whose regeneration allows improving both social inclusion and competitiveness of the city in term of resilience and liveability through co-design processes. This sustainable and CH-led urban regeneration approach was experimented by ROCK project systematically, working on spatial and use reconfigurations of some public spaces of the Bologna University historical area. Piazza Rossini, Piazza Scaravilli and the terrace of Opera House in Piazza Verdi have been involved in a synergic set of actions, ‘The Five Squares’ of the University Zone, developed within the programming of ‘Bologna Design Week’ and ‘Researchers’ Night’ in September 2019 (Fig. 1). The Five Squares wanted to represent a proposal and an event dedicated to urban regeneration, optimization and accessibility of CH, incentive and promotion of public space care through the deployment of its potential and the testing of unconventional uses according to an environmental sustainability perspective.

ROCK project combined public spaces’ physical transformation with innovative uses to make CH more accessible and to test greening solutions with low environmental impact. Through the diffusion of slow mobility, the adaptive reuse of the historical buildings and spaces, the promotion of sustainable events and the implementation of greening interventions, the University area started a transition process towards a sustainable and citizen-friendly district.

Actions to improve the environmental quality and fruition of the area were accompanied by a process of local communities’ continuous involvement. Most of the transformations were temporary pilot experimentations, co-constructed by citizens and university students: the technological constructive systems did not require specific technical skills. Co-design,

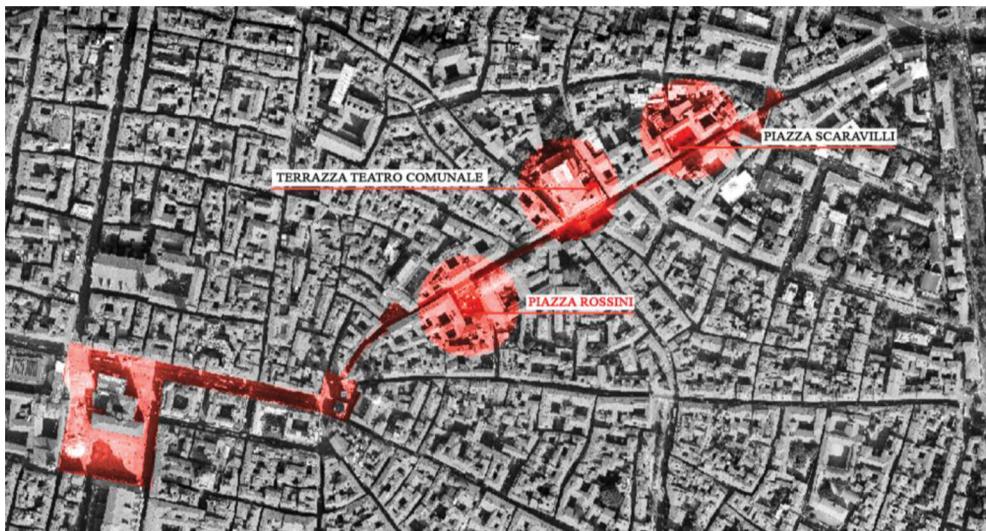


Figure 1: The U-Zone system of open public spaces involved in The Five Square workshop. The red circular spot points out Piazza Rossini, Piazza Scaravilli and the terrace of Opera House, object of the temporary urban transformations. (*Source: ROCK Project, 2019*).



Figure 2: (a) ‘U-Garden’, the project for the pocket garden realized on the terrace of the Municipal Theatre of Bologna in the summer 2019 and (b) the intervention on Piazza Scaravilli implemented by ‘The Five Square’ workshop (*Source: ROCK Project, 2019*).



Figure 3: ‘Malerbe’ temporary construction in Piazza Scaravilli, outcome of a co-design and co-construction workshop coordinated by the Department of Architecture, University of Bologna with Centro Antartide that changes the parking area into a dynamic urban garden. (*Source: ROCK Project, 2019*).

self-construction and co-management were key steps in involving local stakeholders in a daily-care process for these public spaces. Such experiences demonstrate the potential of low-cost, participated and temporary transformations on CH and their capability to positively influence long-term urban dynamics and to re-activate communities as well as places.

Physical transformations and stakeholders’ involvement were supported by the use of enabling technologies and tools designed to promote the regeneration and reappropriation of urban public spaces. Since the design phase, environmental microclimatic simulations were

performed using the software ENVI-met [42] in order both to analyse different greening scenarios and to evaluate the optimal configuration both in terms of mitigation of the UHI phenomenon and in terms of outdoor comfort conditions improvement. Moreover, the use of crowd analysis sensors for monitoring visitors' presence allowed evaluating the impact of transformations on local communities in terms of space usability and, at the same time, the use of environmental sensors allowed to monitor site-specific climatic conditions.

One of the main actions implemented in the ROCK project framework concerns Piazza Rossini, a public space in the middle of the University historical area, used for a long time as a parking lot and returned, thanks to ROCK, to its original community role. This project can be intended as an interesting opportunity to present possible integrated approaches for urban regeneration projects that find its main components in the experimentation of greening solutions, local communities engagement practices and monitoring tools to evaluate the project impact. (Table 1).

Table 1: Piazza Rossini regeneration process.

Greening solutions
<ul style="list-style-type: none"> - car removal and parking area occupation; - green law aimed at changing use and perception of the space, at reducing temperatures and at mitigating UHI effect at local level; - wooden tanks housing small vegetable shrubs, perennial herbaceous plants, aromatic herbs, ornamental grasses and first size trees selected to ensure biodiversity and to reflect seasonal changes; - iconic 'Maxxi Poppy' outdoor floor lighting (Viabizzuno srl); - presence of the green as an opportunity to raise awareness on climate change and on the importance of citizens' sustainable behaviours.
Engagement practices
<ul style="list-style-type: none"> - ROCK project Living Lab methodology application in order to experiment, observe and verify different actions and to improve accessibility to services and to CH; - Participatory laboratory on Piazza Rossini (attended by over 250 people) underlined the need to restore a social dimension to the square, paying particular attention to greening and lighting as design elements; - 'Green Please! The meadow you don't expect' is the first temporary redefinition of the square. It is the result of a shared and participatory process that passes through a co-design and co-construction workshop involving students of the Department of Architecture of the University of Bologna, with the coordination of FIU (Fig. 4); - 'Green Please 2.0! The green you don't expect' is the second temporary transition project, implemented and realized by FIU, with the scientific collaboration of the Department of Architecture – University of Bologna and BAG Studio. The new project represents a further development of the previous one, and it has educational, social and awareness purposes on ecological issues, environmental and common CH care (Fig. 5).
Monitoring tools
<ul style="list-style-type: none"> - 10 crowd analysis sensors with WiFi-GPS technology installed in Piazza Rossini after project realisation allow monitoring visitors' presence in the area; - ENVI-met simulations and data collection from the environmental sensors placed in Piazza Scaravilli – a public space overlooking via Zamboni and placed a few meters away from Piazza Rossini – allow to test the efficiency of greening strategies.

The co-designed temporary greening interventions for Piazza Rossini – in addition to the spatial transformation of the public square and its changing perception – show how a reversible intervention can trigger dynamics of re-activation of communities, as well as places, raising awareness on climate change issues, favouring the biodiversity of the area by the injection of functional green in places of culture.



Figure 4: Co-construction phases of the ‘Green Please: the meadow you don’t expect’ temporary reconfiguration of Piazza Rossini, September 2019 (*Source: ROCK Project, 2019*).



Figure 5: The ‘Green Please 2.0’ installation completed, June 2020 (*Source: ROCK Project, 2020*).

4 CONCLUSIONS

The resilience of cities to climate change can be effectively pursued through the implementation of sustainable and targeted urban planning and design policies. Actions in this regard should be able to work in a systematic and integrated way, building on effective general environmental legislation, the development of new design tools, the sharing of best practices and experiences and the promotion of social change at both individual and collective levels.

Public spaces in cities can effectively contribute to achieve environmental goals towards a more sustainable way of living for all and can represent a significant resource for experimenting and testing innovative tools, solutions and policies for the improvement of resilience to climate change, working both on physical transformation of places in the city and on behavioural aspects among all citizens, communities, businesses, workplaces, decision makers and institutional actors.

The value of widespread distribution of more liveable and well-designed urban public spaces, capable of satisfying the fundamental desires and needs of people, favouring sense of citizens' responsibility and forms of urban life, strongly manifested itself during the pandemic emergency, linked to COVID-19. The pandemic has forced us to review our lifestyles and to practice different forms of social distancing, exponentially increasing the amount of time spent at home and fortifying the desire to spend more time outdoors. Public spaces in our cities, in particular those intended for social relations, represent a fundamental resource for communities: during the months of lockdown, apart from the lucky few who own homes with relevant green areas, the lack of these spaces and of the possibility to use them freely was harshly perceived. Therefore, in the present situation, 'proximity' spaces play an important role: the presence of high-quality public spaces, such as squares, green areas, parks and playgrounds, spread throughout the urban territory, represent a valuable resource for promoting an inclusive environment for the largest categories of citizens and city users and to retrieve the social dimension compromised by the forced social distancing. According to this logic, the city of Bologna promotes a series of temporary reactivation of underused urban spaces to provide citizens with comfortable and accessible urban outdoor spaces (e.g., 'Open Street Bologna' initiative), confirming this logic as an effective way to foster new activities and forms of urban life. The temporary project 'Green Please 2.0! The green you don't expect' for Piazza Rossini, created in the ROCK project framework, has worked in this direction, configuring itself as a place where re-starting to safely meet and to gather during the summer 2020, also thanks to the programming of a series of cultural events and activities promoted by Bologna Municipality in collaboration with FIU and the 'Cronopios' collective, specialized in cultural project management and facilitation of creative processes, called 'Take care of U', including guided tours and theatrical readings.

The re-design or regeneration of common spaces will be even more successful if it gives a concrete response to the needs and expectations of the communities that will benefit from them. Therefore, participatory processes and urban laboratories must be activated at the base of the requalification processes for the co-definition of strategies and solutions to be adopted according to specific local needs, opening and looking at new and innovative tools.

Community involvement practices can find in innovative technologies a significant support that can improve citizen participation in decision-making activities to address urban-specific environmental and sustainability challenges, strengthening their sense of re-appropriation and raising awareness of pressing climate issues. For example, an innovative tool is the Urban Digital Twin, a virtual representation of a city's physical assets, using data, data analytics and machine learning to generate stimulation models that can be updated and changed in real

time as their physical equivalent changes. Emerging trends and experiences (e.g., Helsinki Energy and Climate Atlas [43]) show how Digital Twins can be applied in different domains – depending on the specific needs of each city (e.g., mobility, built environment and energy transition) providing better data-based informed decision-making, efficiently contributing to participatory governance and urban planning: the digital technology can work as an informative and persuasive tool in hosting information and data, as well as exercises and experiments/simulations of alternative ‘what-if’ scenarios according to present changes and variables in citizens’ actions, triggering the interest of local communities in taking actions towards climate changes.

The city of Bologna has undertaken the path towards the first Italian digital twin [44], fostering a combined impact on digital citizenship, ethics and use of data and on the reinforcement of environmental and energy sustainability of city policies. The digital model will integrate different thematic layers, and it could potentially include ROCK projects monitoring results: ROCK data gathering activities about environmental and climatic conditions and about large crowd monitoring will be continuing for 2 years after the end of the project (December 2020) and could be further integrated in the digital twin.

In addition to providing information, knowledge, hints and tools on possible more sustainable patterns to be taken at the individual and collective levels, the Urban Digital Twin might be intended as open enabling shared space for collaboration, testing, proposal and discussion to co-design and co-produce contents and urban solutions, encouraging bottom-up and community initiatives: it may represent a complementary tool that, combined with a community physical-based approach, such as the ROCK one, can turn into an arena of experimentation to widen the participant publics and move towards increasingly effective civic-led governance models to tackle global environmental and climate challenges.

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