

The impact of urban acupuncture: Adopting a social innovation lens to assess the value of localized urban intervention

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ABSTRACT

In a world faced with grand societal challenges, sustainable and inclusive urban planning becomes a priority. Several tools and approaches to urban regeneration have been developed to involve communities in urban regeneration interventions. Among those, urban acupuncture represents a means to promote localized interventions to reclaim urban spaces. Interventions as such are conceptualized as sustainable social innovation bridging the gap between physical regeneration of the space and collaborative practices shared by participating individuals, groups and organizations. In this conundrum of planning and social practices, urban acupuncture can generate social, economic and environmental effects at the neighborhood level and ignite a transformation at the wider city level. Along these lines, the “Piazze Aperte” program implemented in Milan offered an opportunity to innovate urban planning tools by focusing on collaboration between public administrations and grassroots initiatives. To study the effects generated by 4 projects executed in the NoLo district, we developed a multi-dimensional evaluation model based on Multi-Attribute Value Theory (MAVT). Results indicate that urban acupuncture effectively foster social cohesion, improve quality of life, and stimulate collaboration. However, it faces limitations in achieving environmental sustainability and adaptability.

1. Introduction

In an ever-evolving world faced with grand societal challenges, sustainable and inclusive urban planning becomes a priority to address the effects of climate change, avoid exacerbation of inequalities, and counteract urban issues such as gentrification and displacement (George et al., 2023; Hamdouch & Galvan, 2019; MacCallum et al., 2009). To be sustainable and inclusive, cities must be capable to develop participatory governance models and innovative processes to engage residents in defining solutions for their neighborhoods (Attademo & Berruti, 2022; Oevermann et al., 2016; Rodriguez, 2009).

The United Nations' Sustainable Development Goals (SDGs) embody the importance of social inclusion in achieving sustainable growth for everyone, promoting the wider participation at different level of governance, including urban planning. Although several structural and systemic barriers - rooted in social norms, institutions and policies - still pose significant challenges to the achievement of such objective

(Westely et al., 2007). Urbanization is no exception in this sense. Urban sprawl can lead to socio-economic disparities, affecting health and quality of life even within the same city (United Nations Department of Economic and Social Affairs, 2018). Facing challenges as such requires approaches and solutions that to rethink and transform cities, questioning to whom the city belongs in a way to rebalance information asymmetries and power imbalances generated by the real estate market.

In this context, social innovation and urban innovation emerge as key elements to transform urban spaces in a more equitable way. Social innovation promotes the adoption of new ideas, strategies, products, or approaches aimed at achieving positive societal outcomes by emphasizing cross-sectoral collaboration and adaptive approaches. Urban innovation adopts a similar lens to increase the level of participation in urban planning. Approaches as such are crucial to address socio-economic challenges connected with urban regeneration to ensure needs, interests and values of different stakeholders are taken into consideration in the decision-making process.

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Among innovative tools for inclusive urban planning, urban acupuncture conjugates social innovation and urban innovation by promoting a grassroots approach to city planning (George et al., 2019; Lydon & Garcia, 2015). These approaches, aligning with core principles of social innovation, gained prominence for their ability to empower communities to contribute to decision-making and urban planning. Through a process that integrates context analysis, stakeholders' engagement, resource mapping, participatory design, definition of common outcomes, development of monitoring indicators and continuous adaptation, cities can evolve in a more sustainable and equitable way.

Adopting a social innovation lens to urban acupuncture, our research aims to explore the impact of such interventions in specific policy contexts. In particular, we address the question as whether and how urban acupuncture projects contribute to the generation of positive societal outcomes at the neighborhood level and how they can be transmitted at the city level. Therefore, we aim to study specific interventions within their context understanding how contextual factors influenced the design and execution of projects and how the latter generated territorial and community effects and changes. This can provide a valuable tool for urban planners and public administrations to support decision-making when promoting urban regeneration interventions.

Our research originated in the context of the "Piazze Aperte" program in Milan, aiming to foster urban acupuncture towards an inclusive approach to urban regeneration. Within this framework, we selected a series of 4 case studies in the NoLo neighborhood, given the homogeneity in contextual and socio-economic determinants, to unravel the effectiveness of community engagement strategies employed and to assess the interventions' social and environmental performances. In this light, we developed a multi-criteria framework, based on multi-attribute value theory (MAVT), to assess and evaluate outcomes generated by localized interventions against stakeholders' interests and values, overall policy objectives and specific project's goals.

To achieve its objectives, the paper is structured as follows. In the next section (§2), the theoretical background for the research is presented. The "Piazze Aperte" program and the specific case studies selected are presented in §3, while we introduce our research methods in §4. We present the results of the study in §5 and §6 offers conclusive reflections on the study and possible future development.

2. Urban acupuncture at the crossroad of sustainability and social innovation

In this paper we promote the idea of urban acupuncture as a sustainable social innovation intervention based on a multiplicity of formal and informal actions at the neighborhood level. Adopting a social innovation lens for the evaluation of urban acupuncture interventions allowed us to take into consideration both the site-specific project and the processes implemented by the stakeholders involved in the interventions. Integrating a social innovation lens in our evaluation framework was also fundamental to understand the environmental and social sustainability and resilience of interventions conceptualizing how multiplicity of impacts influence each other and contribute to the achievement of overall interventions' objectives.

Given the complex and wicked nature of urban challenges, solutions can no longer be found through traditional problem-solving methods but need to take into consideration transformative changes for communities and the planet (Christiaens et al., 2007; MacCallum et al., 2009; Russell et al., 2023). Social innovation embraces this complexity promoting the idea that innovative solutions have an intrinsic ability to deliver improved outcomes (Moulaert, 2019). Social innovation focuses on addressing complex problems in ways that bring tangible and quantifiable benefits to communities. In the context of planning and urban regeneration, social innovation has a transformative potential by enhancing participation and collaboration processes introducing flexible tools for site-specific projects (Moulaert, 2019).

Social innovation emerges as a response to the inadequacies of conventional approaches, signaling a departure from the status quo (MacCallum et al., 2009; Moulaert, 2019). It recognizes that the complexity of "intractable problems" requires a multifaceted approach that transcends sectorial limitations and that not only addresses immediate symptoms but also transforms underlying systemic issues (Nicholls et al., 2015).

The lens of social innovation offers a new paradigm to look at urban transformations. Social innovation can support to analyze the inclusiveness of urban development solutions and to assess their innovative potential (Moulaert & MacCallum, 2023; Moulaert & Mehmood, 2020). A social innovation lens can support to analyze co-benefits that projects generate for the community together with the wider effects that those solutions bring to the city (García & Moulaert, 2023; Moulaert & MacCallum, 2023).

As part of the social innovation approach to urban planning, urban innovation embodies flexible strategies to transform urban communities, neighborhoods, and cities (George et al., 2019). Therefore, we can consider urban innovation as a social innovation process where bottom-up and top-down approaches to planning are combined with participatory tools to maximize the generation of social and environmental impact. Urban innovation can address social issues to empower marginalized communities fostering collaboration and reducing socio-economic divides (George et al., 2019; Lydon & Garcia, 2015).

This approach recognizes the complexity of modern cities and requires collaboration among actors from various sectors – policymakers, design professionals, urban planner, community members, entrepreneurs – as a crucial point for developing holistic solution to urban challenges (George et al., 2019; Lydon & Garcia, 2015). Urban transformation becomes a value-based strategy, emphasizing the importance of identifying, sharing, celebrating and challenging values (Radywyl & Bigg, 2013).

In value-based approaches, participatory processes are identified as both a barrier and a driver for achieving wider shifts in sustainable urban transformation. Participation represents a means for stakeholders to navigate differences, discover commonalities, and come to terms with their interdependences (Attademo & Berruti, 2022; Oevermann et al., 2016). By placing values at the core of urban transformation, cities can craft a collective vision that aligns with their inhabitants' aspirations, needs and expectations.

To be effective, urban innovation needs to differentiate its tools and approaches based on the scale of intervention (García & Moulaert, 2023; George et al., 2019). Urban innovation solutions must be open, inclusive and participatory looking at new ways to valorize and manage shared urban resources (Feinberg et al., 2021; Radywyl & Bigg, 2013). As such, urban innovation interventions, when locally implemented, can play a relevant role in fostering sustainability by promoting behaviors, cultures and institutions aligned with equitable resource sharing (Radywyl & Bigg, 2013). Innovative practices are co-created by and with members of the community to enhance livelihood and sustainability of the neighborhood while protecting the spirit of the place.

Against this background, urban acupuncture represents a valuable tool for leveraging innovative participation forms towards urban transformation. Coined by Manuel de Solà Morales in 1998, the concept recalls the traditional Chinese medicine practice of acupuncture encompasses targeted projects with a high degree of reversibility aiming to transform the physical space and livelihood of neighborhood (De Solà Morales, 2008). Lerner (2015) sees it as a mean to bring immediate improvements to the urban environment, bypassing lengthy decision-making processes and economic obstacles, stating that "lack of resources is no longer an excuse not to act" and that "the idea that action should be taken only after finding all the answers and resources is a sure recipe for paralysis". In this way, urban acupuncture becomes a way to promote collaboration among experts and non-experts in co-creating solutions aiming to tackle localized needs and to satisfy expectations of different stakeholders. Urban acupuncture, although being localized,

aims to trigger positive effects at the urban level, by enhancing reproduction of interventions as a positive energy flow stimulated by the “needle” inserted in the urban tissue (Lerner, 2015). As such urban acupuncture represents a holistic and strategic approach to revitalization of neighborhoods and cities, integrated into long-term urban visions and aiming to unlock latent urban potential.

Urban acupuncture shares the same grassroots approach to urban planning with tactical urbanism and other forms of temporary interventions based on informality and collaboration between city users and public administrations. The term tactical urbanism, used for the first time by Mike Lydon, refers to a set of low-cost, temporary and community-led interventions in urban spaces designed to improve the quality of the built environment and to test ideas before committing to permanent changes (Lydon & Garcia, 2015). Tactical urbanism becomes a way to engage communities in the design and management of small-scale projects, typically at the neighborhood level, to reclaim public spaces for sustainable generation of changes (Lydon & Garcia, 2015; Rossitti et al., 2023).

Urban acupuncture can be seen as a peculiar form of tactical urbanisms that attempts to scale localized interventions into holistic urban plan and policies. Urban acupuncture shares its tools - including co-creation, public art and placemaking - with tactical urbanism towards the development of innovative and low-budget urban revitalization projects. As such, urban acupuncture builds on the experience of tactical urbanisms and goes beyond the testing of new solutions aiming to promote the generation sustainable societal outcomes through comprehensive and collaborative projects understanding the valorization of urban spaces as a means to achieve greater vitality and livability. Strategies employing urban acupuncture have a significant positive impact by promoting social cohesion, enhancing quality of life of residents, improving the overall well-being of the community, empowering residents to play a significant role in shaping their own environment (Lydon & Garcia, 2015; Rossitti et al., 2023). Their adaptability to physical, economic, and social characteristics of the context allows for easy replication in similar situations or gradual expansion over time, offering a holistic approach to innovation in urban planning.

Thanks to their minimum-intervention approach, urban acupuncture as cost and time effective and economically viable solutions for urban environment regeneration and neglected area recovery (Salman & Hussein, 2021). Urban acupuncture represents a participatory tool to implement environmentally sustainable solutions and provide grassroots approaches to climate change and heatwaves that characterize many European cities (Al-Hinkawi & Al-Saadi, 2020; Moussavi et al., 2024). Furthermore, these approaches empower communities to act and make positive changes in their living environment by fostering placemaking process safeguarding local identities (Bugarić, 2018).

3. Case study – “Piazze Aperte” program in NoLo, Milan

The Italian panorama presents several initiatives that embodies the characteristics of urban acupuncture interventions described above and that ranges from informal interventions promoted by local groups or non-profit organizations (NPOs) to structured municipal policies that foster cross-sectorial collaborations for the implementation of initiatives (Rossitti et al., 2023). Among these, we selected the case of “Piazze Aperte” in Milan as an example of a public-led program promoting collaborative interventions with NPOs and the private sector.

“Piazze Aperte” was launched in 2018 by Milan city council in collaboration with Agenzia Mobilità Ambiente Territorio (AMAT), Bloomberg Associates, and the Global Designing Cities Initiative. The program aims to extend pedestrian-friendly areas prioritizing safety, champion sustainable modes of transportation, and elevate the overall livability of neighborhood. Based on an idea of proximity as an enabler of cooperation and sustainable interventions, the program seeks to strengthen the connection between people and their neighborhoods by reimagining public spaces.

The approach adopted has a holistic vision in terms of urban regeneration, considering not only physical infrastructure but also social, economic and environmental factors. As such it mixes tools and approaches of tactical urbanism and urban acupuncture - including public art, sustainable placemaking, inclusive design and co-creation - promoting a way to test solutions, assess its effects and develop more permanent interventions based on results achieved during the experimental phases (Comune di Milano, 2023). The initiative promotes the use of participatory and inclusive planning and management of interventions as tools to engage marginalized communities, activate latent resources and involve residents in taking actions to protect and renovate their neighborhoods.

“Piazze Aperte” is based on the principle of “*temporariness as policy approach*” allowing the municipality to test the feasibility of a preliminary phase before permanent implementation, ensuring a long-term perspective for assessing social impact (Rossitti et al., 2023; Sdino et al., 2025). Employing urban acupuncture techniques, the policy envisions a new approach to localized interventions and neighborhood revitalization based on co-production to enhance the effects of interventions at the local level.

“Piazze Aperte” has significantly reshaped Milan’s urban fabric, covering over 25,000 square meters of public spaces with over 40 interventions between 2018 and 2022 (Comune di Milano, 2023). As shown in Fig. 1 the high number of implementations underscores the program’s commitment of widespread urban regeneration with a particular focus on peripheral areas.

Within the framework “Piazze Aperte”, our work delves into four case studies in NoLo (North of Loreto), Milan, to understand the impact of these projects and the broader implications for urban planning. NoLo, located in the NIL¹ 20, is a semi-peripheral neighborhood in the north-eastern quadrant of Milan, as shown in Fig. 1 (above). This choice gave the opportunity to work with homogenous socio-economic conditions, understanding the impact that different projects had on the targeted community.

Currently a vibrant district with a very diverse population, NoLo has been a neglected area for a long time. With few exceptions like Parco Trotter, the district lacked public spaces and aggregation spaces for residents. NoLo features a relatively young and highly multi-cultural population. Over time, this created conflicts and frictions in the neighborhood. For this reason, the choice of this area allowed us to examine how urban acupuncture can address issues of inclusivity and accessibility, while promoting collaborations at the local level.

In addition to that, NoLo’s case offers a microcosmic view of the scalability and replicability of the “Piazze Aperte” model. Lessons learned from this district can provide valuable insights for the future planning initiatives not only in Milan but also in similar urban contexts. It serves as a testing ground for evaluating the transferability and implementation of the program, addressing similar challenges faced by diverse communities.

As show in Fig. 1, a total of 4 projects were executed in NoLo district. A brief overview of the four projects is provided in the following paragraphs.

Project 1. The project area is located at the intersection of via Venini and via Spoleto, a heavily trafficked junction close to the Central Station. The intervention was motivated by the desire to increase the safety of the entrance and exit of the Cerisola Primary School, which main gate is located on the intersection. The intervention created a new square in the neighborhood thanks to the diversion of traffic, creating a new social space for residents with the use of urban furnishings (flowerbeds, racks, benches, and ping-pong tables). The intervention brought public spaces back to the center of urban life, enhancing the quality of public

¹ The acronymous NIL stands for Nuclei di Identità Locale (Nucleus of Local Identity). Each NIL identifies a specific and sub-municipal territorial context as defined by the Municipal Plan.

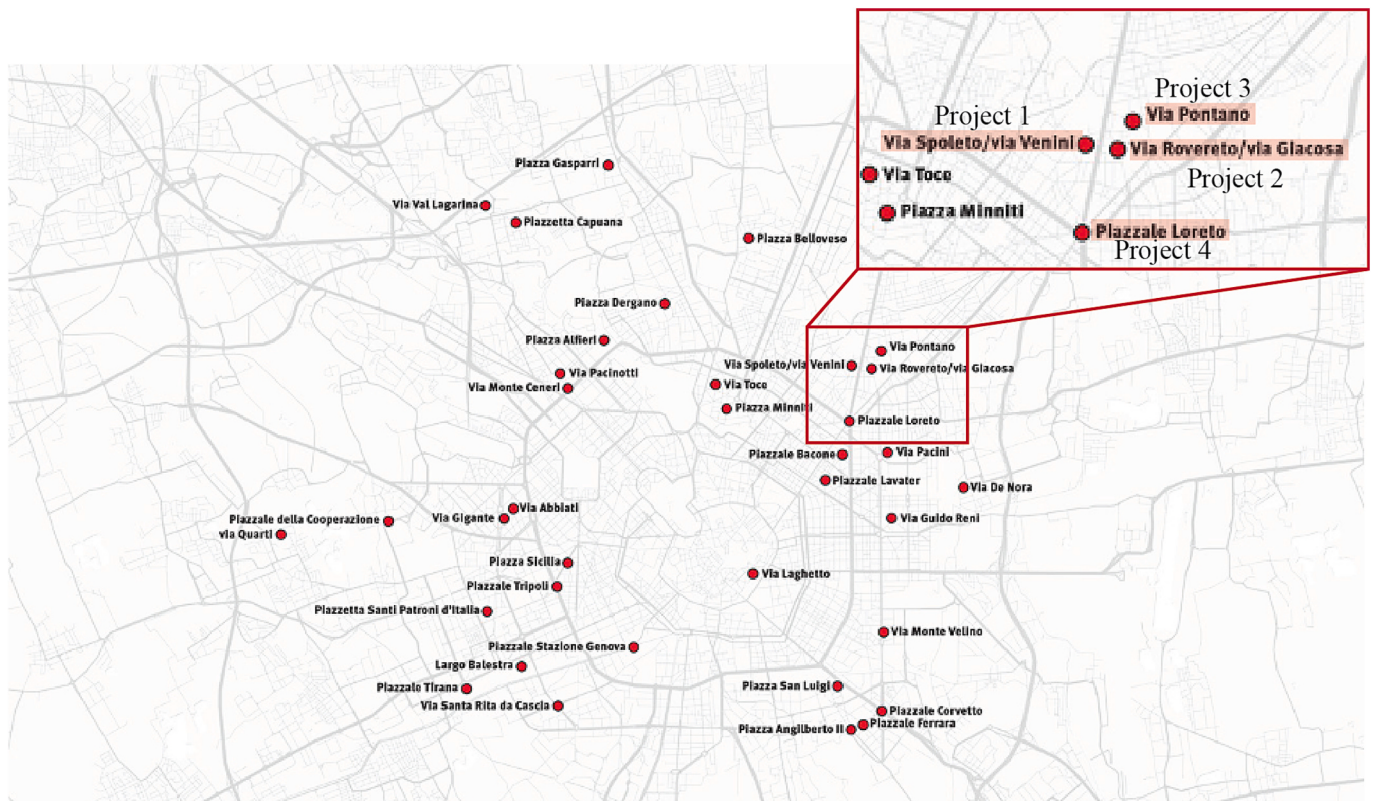


Fig. 1. Location of the intervention promoted by “Piazze Aperte” program (Piazze Aperte, Un programma per lo spazio pubblico di Milano, AMAT in collaboration with Bloomer Associates, (Comune di Milano, 2023) and zoom in the area selected for the case study (North of Loreto).

environment for pedestrians and cyclists. Fig. 2 shows the area before and after the intervention.

Project 2. The project area is located at the entrance of a public park, Parco Trotter, and was formally used as parking area. A first attempt to transform the area was already promoted before the execution of the “Piazze Aperte” program with an idea to valorize the entrance to the park making it safer for pedestrians. In the framework of “Piazze Aperte”, the area offered the opportunity to implement a 30kmh Zone aimed at improving the safety and quality of the area. The concept of the 30kmh Zone embodies a simple, effective and cost-efficient urban intervention designed to promote harmonious coexistence among different road users. The Municipality’s intervention involved significant structural modifications, focusing on key aspects such as road safety, pavements improvements, redevelopment of parking areas, introduction of new green spaces and flowerbeds and the creation of cycling paths. The combination of these directives of intervention

created a more welcoming and secure environment, promoting a green connection between Parco Trotter and the surrounding neighborhood. Fig. 3 shows the area before and after the intervention.

Project 3. The area object of intervention is located at the intersection between via Pontano and via Morandi, under the railway bridge leading to the central station. A former neglected area perceived as unsafe by pedestrians and reported as an area object of criminal actions, particularly drug dealing. Against this background, the intervention, part of the “Tunnel Boulevard project”, tried to dynamically integrate the overall renewal of the railway stretch with the installation of murals as part of *Muri Liberi* (“free walls”) initiative. The primary objective of the intervention was to offer an outdoor graffiti gallery and create a cycling connection between three focal places for the neighborhood: Piazza del Governo Provvisorio, Parco Trotter and via Rovereto. The project is based on actions of social design and public art, highlighting the urban art route along the railway walls, showcasing the history and evolution



Fig. 2. Project 1: the intersection of via Venini and via Spoleto before and after the intervention (Comune di Milano, 2023).



Fig. 3. Project 2: the area adjacent to Parco Trotter entrance before and after the intervention (Comune di Milano, 2023).

of city street art and providing space for the expressive creativity of artists. Fig. 4 shows the area before and after the intervention.

Project 4. Piazzale Loreto is one of the main nodes in the city's inner viability, connecting the central area of the city with the first peripheral belt in the north. A highly trafficked intersection and a focal point for the city viability, it hosted parking spaces on the outer side that have been removed to allow the creation of a cycling lane. This left a part of the square empty with little possibility to re-use it. "Piazze Aperte" offered a chance to use public art as a tool to engage people in the re-development of this neglected area. The project delivered a pedestrian zone defined by flower beds and trees, alongside which a bike lane runs. Unlike other "Piazze Aperte" projects focused on creating social spaces for the neighborhood residents, this square is specifically designed to enhance the safety of the bike lane and, thus, develop urban transformation practices geared towards sustainable mobility. Following a competition won by the Jungle agency in collaboration with the artist Camilla Falsini, the asphalt was colored with bright and lively geometric shapes. The street artist worked closely with the citizens committee to involve them in the graphic choices and color selection for the intervention. Fig. 5 shows the area before and after the intervention.

4. Method and materials

The effects of urban acupuncture interventions require examination from a broad sustainability perspective, encompassing social, environmental, and economic dimensions (Colomi et al., 2017). To this aim, traditional and monetary-based evaluation methodologies, which mainly focus on assessing the direct results of the project, risk to produce a limited understanding of the outcomes generated on the medium and long terms by those interventions. Rossitti et al. (2023) attempted to develop a framework to assess the cumulative impact of these

interventions, capturing their long-term effects. Focusing on the economic dimension of urban acupuncture projects read in terms of effects on real estate market values. Whereas Sdino et al. (2025) offered an approach to the estimate the effects of urban acupuncture on local and proximity economy, evaluating the increase in commercial activities at the neighborhood scale.

Indeed, despite the scientific effort to assess the social impacts of urban regeneration processes at different scales (Bottero et al., 2023; Cerreta & La Rocca, 2021; Escolà-Gascón et al., 2024; Zawadzki, 2024) up to date few studies have been conducted to understand the influence of stakeholders' participation in urban acupuncture, and these interventions' long-term impacts from a social perspective. Studies as such focus either on the contribution of bottom-up approaches to the implementation of localized urban interventions (Cervera et al., 2021; Porębska & Rizzi, 2017), on their capacity to trigger cooperation and collaboration at local level (Careva et al., 2017; Houghton et al., 2015) or on stakeholders' perception of effects and changes generated by urban acupuncture interventions (Daugelaite et al., 2018; Naghibi et al., 2020; Xi et al., 2021). All these studies show how urban acupuncture interventions presents a high level of interconnection between project design and community practices making it impossible to evaluate the physical transformation without considering the practices to create it and the contribution of the different stakeholders.

Lessons learned from the evaluation of the impact of social innovation, as a valuable tool to address complex systems and understand the mechanisms behind the generation of social effects at the community level, is an appropriate reference for urban acupuncture (Moulaert & MacCallum, 2023). Adopting a lens that recognizes the centrality of stakeholder participation can enhance the evaluation quality and produce a novel understanding about how localized interventions generate positive societal impacts for the community and the neighborhood. At



Fig. 4. Project 3: the intersection of via Pontanto/via Morandi before and after the intervention (Comune di Milano, 2023).

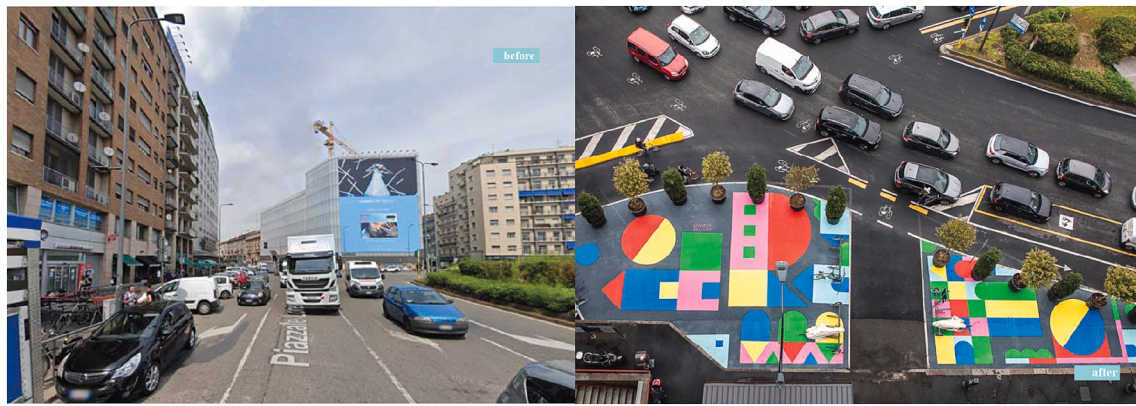


Fig. 5. Project 4: Piazzale Loreto before and after the intervention (Comune di Milano, 2023).

the same time, it allows to understand how different processes work in different contexts to respond to community needs and interests, while leveraging on community resources and networks (Moulaert & MacCallum, 2023; Rolfe, 2019).

Based on these considerations and taking into consideration the relation between social, economic and environmental effects connected with urban acupuncture, we adopted an evaluation model based on Multi-Criteria Decision Analysis (MCDA). Methodologies as such allow to evaluate and compare alternatives based on a set of criteria towards enhancing the depth of the evaluation process (Bottero et al., 2022).

In particular, we adopted a model based on Multi-Attribute Value Theory (MAVT), given its capacity to meet the opportunity to provide a cumulative measure of interventions' ability to generate societal impacts (Ferretti & Comino, 2015; Oppio et al., 2021). MAVT employs a single-criterion approach to evaluation by converting different criteria into one single attribute. This method assumes that, for each decision issue, it is possible to identify value functions which express the preferences of involved stakeholders (Berta et al., 2018). An overview about how to employ a MAVT method to assess the social value of urban interventions is available in Annex 1. Given the objective of our study – evaluate the social impact of urban acupuncture interventions – for the implementation of the MAVT evaluation model, we followed a two-stage process composed of a problem structuring phase and an implementation one as described in Fig. 6.

As explained above, we conceptualized urban acupuncture interventions as social innovation practices implemented at the neighborhood level as part of wider urban regeneration strategies. At first, we identified a set of outcomes applicable to interventions as the ones described above. Secondly, we linked one indicator for each evaluation criterion, ensuring that to each dimension correspond one and only one indicator (Saaty, 2013). This allowed to measure the performances of

each criterion on quali-quantitative scales avoiding double counting. Even in this case, to identify the indicators to be adopted we referred to the list of papers reviewed to identify impact dimensions. The list of indicators is available in Table 1. The process for the selection of outcome dimensions and indicators is available in Annex 1.

Given the peculiarities of the case study, we defined the 10 criteria according to the role they play in the implementation of urban acupuncture projects. “**Inclusivity**” addresses issues of participation and equality, being strictly connected with “**Active participation**”, as a means to promote sense of ownership among community members, and “**Cooperation**”, essential to develop shared solutions to urban challenges. “**Environmental sustainability**” addresses the contribution of the intervention to environmental sustainability. “**Inclusive economic growth**” is the main economic criterion, and it considers interventions' contribution in creating sustainable job opportunities. “**Well-being & Quality of life**” reflects the effects that the project created for residents and other city users; while “**Identity**” refers to how they envision and use the space. “**Education & Training**” aims to capture the capacity of interventions to engage with educational institutions or to promote learning for everyone. “**Access to digitalization**” assess the capacity to reducing the digital divide, ensuring fair and inclusive access to technologies and utilizing digital tools for effective project management and community engagement. Lastly, “**Resilience**” captures the responsiveness of interventions to the evolving needs of the community.

Based on the set of indicators, we used different methods to collect and analyze data. We employed document analysis to gather data from existing reports, combining it with statistical data, to better understand the situation before and after the intervention to be able to evaluate changes and effects. Furthermore, we conducted field observations to analyze the physical transformations and to assess the status of the interventions. While conducting observations, we engaged some local

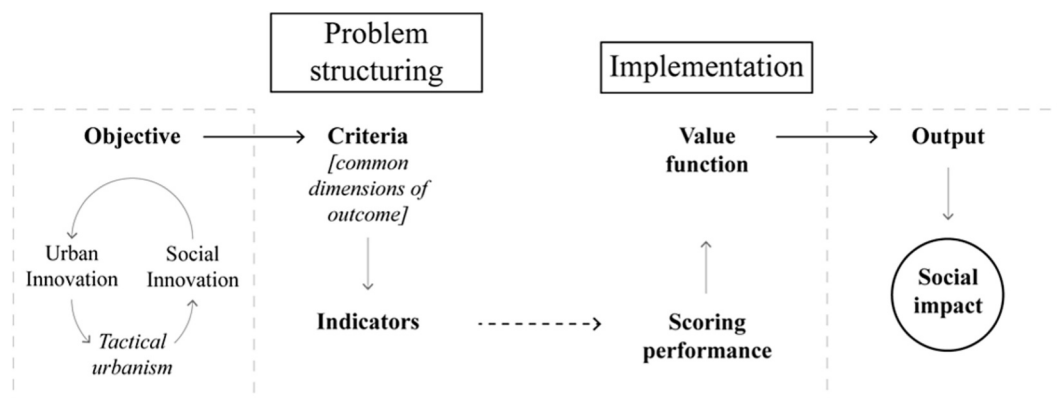


Fig. 6. Process adopted to develop the evaluation framework.

Table 1
list of criteria and indicators included in the evaluation framework.

	Criteria	Indicator	Score definition
1	Inclusivity	Diversity of activities offered in the intervention area	$I = \frac{N \text{ of activities' typologies}}{N \text{ of activities}}$ 0 – no strategy 1 – basic elements 2 – intermediate interventions 3 – innovative devices
2	Environmental sustainability	Typology of bioclimatic strategies in intervention area: (i) basic elements (plants and trees); (ii) intermediate elements (sustainable and permeable materials); (iii) innovative devices (tools to mitigate temperature, humidity, air quality)	0 – none of the above 1 – one of the three phases 2 – two out of three phases 3 – all three phases
3	Active participation	Active involvement of local communities in the following phases: (i) decision-making process; (ii) definition of the intervention; (iii) management of the intervention	0 – none of the above 1 – only (i) 2 – (i) + 1 other typology of partnership 3 – all three
4	Cooperation	Typology actors involved in collaborations: (i) public entities and local communities; (ii) private sector (for profit and non-profit), (iii) other administrative bodies	$\frac{N \text{ of new activities} - N \text{ of existing activities}}{N \text{ of existing activities}}$ 0 – none of the above 1 – one of the three elements 2 – two out of three elements 3 – all three elements
5	Inclusive economic growth	Increase in commercial activities in the area as a result of the intervention	0 – none of the above 1 – one of the three elements 2 – two out of three elements 3 – all three elements
6	Well-being & quality of life	Intrinsic and extrinsic elements of the intervention that impact the quality of space: (i) urban furnishing; (ii) continuity of public space; (iii) lightning	0 – none of the above 1 – one of the three elements 2 – two out of three elements 3 – all three elements
7	Education & training	Elements that facilitate the use of space for education and training: (i) proximity to schools; (ii) adaptability to host training; (iii) presence of education-related activities	0 – none of the above 1 – one of the three elements 2 – two out of three elements 3 – all three elements
8	Identity	Recognition and valorization of the space by local people: (i) transit space (a space where people only pass by); (ii) staying space (a space where people stop by and interact with physical components); (iii) meeting space (a space that people use for social gathering and other forms of interaction)	0 – none 1 – transit space 2 – staying space 3 – Meeting space
9	Access to digitalization	Digital infrastructures in the intervention: (i) presence of furnishing with digital support; (ii) digital communities; (iii) optimization of the space through digital models	0 – none of the above 1 – one of the three elements 2 – two out of three elements 3 – all three elements
10	Resilience	Elements that characterize reversibility of the intervention: (i) spatial configuration, (ii) urban furnishing; (iii) activities in relation to changing needs of the community	0 – none of the above 1 – one of the three elements 2 – two out of three elements 3 – all three elements

stakeholders present in the premises in informal and unstructured interviews to better understand individual and collective dimensions of changes that they experimented. An additional round of semi-structured interviews targeted practitioners directly involved in the interventions to learn more about the situation before the intervention and the changes they've noticed.

We re-elaborated data collected according to the unit of measurement presented above. While for quantitative indicators assessment only

provided for algebraical computation of the indicator, for qualitative data, thematic analysis was necessary to understand sentiments of stakeholders and attribute a score according to the model provided.

To be able to aggregate scores in the MAVT model, we developed a value function for each criterion to transform performances in standardized scores, ranging from 0 to 1 (Morton, 2018). When using 4-point scales, we attributed an equal value to each step of the scale, given the fact that these performances depend strongly on design choices and they

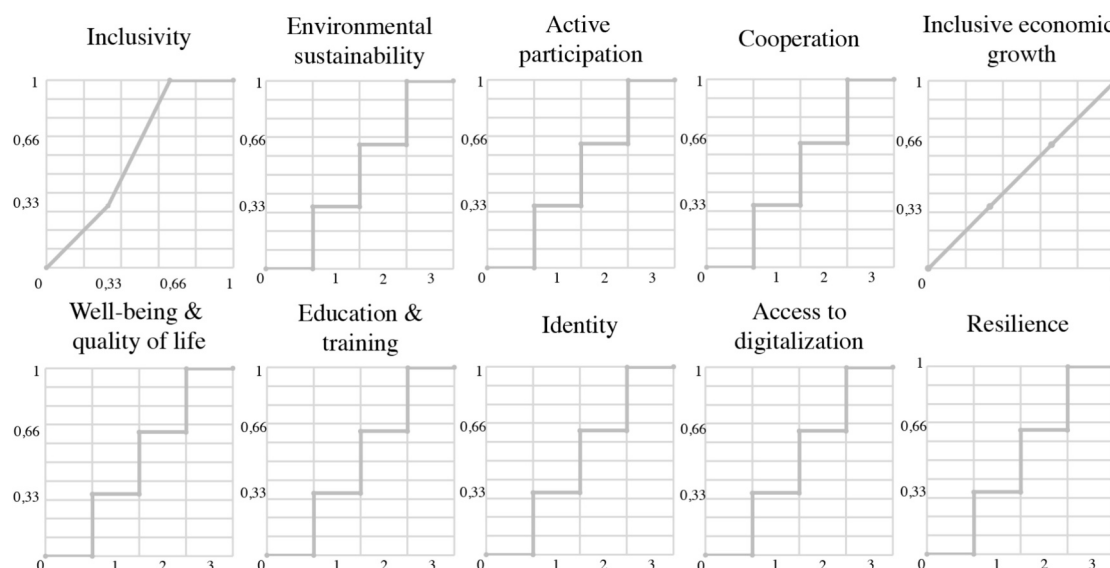


Fig. 7. Value functions for the 10 criteria: scores are indicated on the horizontal axis and values on the vertical one (elaborated by the authors).

can all be considered equally hard to achieve (Bottero et al., 2018; Bouyssou et al., 2006). Whereas when using continuous functions, we identified thresholds to convert performances in values, based on hypothetically satisfactory performance to achieve the maximum score and a gradual distribution of scores along the performance curve (Bottero et al., 2018; Bouyssou et al., 2006). The value functions elaborated are presented in Fig. 7. Further details about how we defined scales and thresholds can be found in Annex 1.

Lastly, to aggregate performances in a single score, we adopted an additive model whereby each score is multiplied by the weight of the criterion. In our case, we decided to keep the weights neutral, as all criteria are considered equally important in the achievement of interventions' objectives. For the evaluation we employed the following formula:

$$V_a = \sum \omega_i \cdot v_i(a) \quad (1)$$

where $v_i(a)$ is the single attribute value, which expresses the performance of the alternative for the considered attribute, and ω_i is the weight assigned to the attribute as the expression of its formal importance related to other attributes.

5. Findings

Thanks to our research we were able to understand the impact that the 4 interventions generated at the local level, showing their strength and weaknesses. The results, presented in Fig. 8, can be read according to individual performances or as aggregated scores, ranging from 0 to 1, as output of the MAVT method. The model allows to evaluate the interventions against their own aims and the "Piazze Aperte" objectives, attributing a performance to their effectiveness in promoting changes at the community and neighborhood levels. Although the evaluation model was not developed to compare the situation before and after the intervention, the results presented here offer a meaningful way to

analyze the capacity of interventions to generate desired social, environmental and economic outcomes. Following the presentation of the results, we will discuss each case individually by referring to their capacity of transforming the space, aggregating communities and promoting adoption of sustainability strategies for neighborhood revitalization.

The four case studies presented, analyzed and assessed, exhibit varying degrees of success in revitalizing public spaces within their respective communities, contributing to the overall achievement of the "Piazze Aperte" objectives. All interventions were capable of promoting a transformation of urban spaces, reclaiming underutilized and neglected areas, finding strategies to express their transformative potential. Each intervention has its strengths and weakness, emphasizing the complexity of urban revitalization and the importance of considering diverse community needs. The evaluation conducted showed how urban acupuncture interventions can be effective in assessing local needs enhancing the capacity of revitalization intervention to engage communities.

Project 1 effectively combined the transformation of an intersection in a vibrant square with community activation strategies showing positive performances in almost all criteria considered for evaluation. This shows the power of collaborative efforts between all the actors involved. The project showcased versatility and adaptability, hosting a wide range of activities throughout the year. The intervention adaptability, integration of educational aspects and the diverse usage patterns contribute to its success.

In terms of physical transformation, when compared with the situation before the intervention, the intersection looks completely different with cars and public transport moving around the newly created square delimited by urban furnishing. This increased the useability of the area and its recognition as a gathering space, increasing the sense of safety in the neighborhood. Furthermore, limiting the traffic in the square increased security for pedestrians and for children when entering and



Fig. 8. Results of the analysis according to MAVT model (elaboration by authors).

exiting the Cerisola school.

On the other side, the intervention was successful in bringing together local stakeholders, such as NPOs and other informal groups of citizens that could express their interests in the project, contribute to the design of the intervention and offer valuable resources for the management of the intervention. Although, it must be noted that these results are only possible because of a civic activism attitude and the capacity to work in network reported by the involved organization during the interviews. The ability of the intervention to engage different stakeholders is also reflected in the scores related to identity, education and inclusivity. In fact, the implementation of the urban acupuncture intervention was an occasion to foster this collaborative spirit in promoting new projects and activities in different fields, including educational projects with the local school, contributing to the characterization of the area as a gathering space, used in some cases for community engagement activities.

Project 1 achieved a cumulative score of 0.69 reflecting positive outcomes especially in the physical transformation of the space; although the acknowledgment of limitation in the digital realm suggests opportunities for further improvement.

Project 2 showed a different way of using urban acupuncture to collaboratively work on the re-development of a chaotic parking lot into a welcoming gathering space. The entrance to Parco Trotter has been for long time neglected and used only as a transit space, suitable only to park cars. The intervention did not only create a physical connection between the park and the neighboring roads, but it offered an opportunity to extend the work that NPOs and cultural organizations were already conducting in the park outside its premises. This contributed to enhance the vibrancy and inclusivity of the area, enriching the number and typology of activities organized and expanding the network of organizations and informal groups active in the area. As such, it reached high scores in the criteria related to identity of the place, well-being and quality of life, active participation and cooperation.

Differently from the other interventions, Project 2 was capable of creating new opportunities for economic activities managed by local residents as the area of intervention was suitable to host new commercial activities. This shows how urban acupuncture interventions can also have economic effects in cases in which the area of intervention can host new temporary or permanent economic functions. Furthermore, differently from Project 1, the attention to resilience and environmental sustainability during the planning phase made this intervention reach higher performances in those criteria. Its actual attention to environmentally sustainable practices, thanks to introduction of a permeable stone pavement and green elements, and the collaboration between local community and municipal authorities contribute to the great results of the project. Despite its proximity with schools and the actual capacity to host activities, Project 2 was not effective in activating collaboration for education activities or training.

These considerations are reflected in the cumulative score of 0.54, meaning that the project had optimal performances in some indicators but not in others. The intervention has also fostered a sense of community and improved safety, especially for children who now perceive the public space as an extension of the nearby park. However, the intervention falls into a medium impact category, with room for improvement in digital usability and highlights the need to address evolving technological needs and conjugates them with sustainability and green transition.

Project 3 took place in a neglected area close to Project 2 premises. The intervention area, as mentioned, is an intersection under a railway bridge, a place that have been reported by local residents involved in interviews as an unsafe area subject to vandalization and criminality. The intervention focused on aesthetic enhancements through murals and street art, showing relevant criticalities in terms of economic impacts and level of community engagement during the planning phase. The low cumulative score of 0.27 indicates some shortcomings in the intervention, despite its success in valorizing an unused urban space

surrounded by residential buildings. The temporary nature of murals allows for versatility, although the space is still perceived as a transit area rather than a gathering space, when compared with project 1 and 2. The characteristics of the space, situated in a suburban area dominated by residential buildings, have hindered the expansion of commercial activities and limited its impact from an economic standpoint. Furthermore, the provision of spaces for graffiti and wall art has been successful in attracting artists from Milan and other cities, but it limited the chances to involve local organizations, informal groups and residents limiting the capacity to activate the space and to foster inclusion and collaboration at the local level.

The intervention has not significantly affected the quality of life of the surrounding community, given its focus on beautification and the lack of provision of urban furniture or complementary services and activities for residents. Additionally, the proximity to a school area has not led to the development of synergies for educational and training activities, as it happens in Project 1. Addressing limitations such as the absence of a digital strategy, seeking additional community feedback and exploring innovative solutions to address space are essential to elevate intervention's impact and adaptability to local needs.

Project 4 took place in Piazzale Loreto, one of the nodes in Milan's inner ring road. Over the years viability has been restricted to the inner part of the intersection to host a cycling lane in its outer side. The intervention aimed at increasing cyclist safety and enhancing aesthetic appeal of the area, left as an empty slab of asphalt. Given the low cumulative score of 0.27, it is evident that the intervention, as it stands, only partially reached its objectives and presents some downfalls.

The absence of social innovation elements, minimal bioclimatic strategies, limited community involvement and the lack of digitalization underscore the main limitations of the interventions to fully reach its potential. In fact, despite the use of public art, the intervention did not provide any specific tools to engage residents in the different stages of the project, nor it was capable to stimulating cooperation and active participation at the local level. The introduction of plants and small trees can be evaluated in a positive way in terms of enhancement of aesthetic appeal of the area, although they did not generate any benefits in terms of environmental sustainability and resilience. Furthermore, the overshadowing presence of piazzale Loreto poses a challenge, suggesting strategic adjustments to overcome the existing limitations and to unlock the full potential of the public space. Outcome in terms of social innovation were minimal, and the space remained predominantly a transit area. Even in this case, no sensitive economic effects have been registered as a result of the intervention.

All interventions proved successful in enhancing the quality of the space and their aesthetic appeal thanks to a physical transformation of neglected or underutilized urban areas. In some cases, interventions as such proved to be adaptable and sustainable, with high level of community participation and cooperation among local stakeholders (Project 1 and 2), while others fell short in both domains. In moving forward, a comparative analysis suggests several overarching recommendations that could benefit all interventions. The integration of a robust digital strategy emerges as a common theme. Even though urban acupuncture interventions are generally limited in time and adopt a low-cost approach, it would be important to take into consideration the digital dimension also as a tool to engage communities both inside and outside the space and stimulate their adoption of the intervention. By enhancing digital accessibility, each intervention could better cater to modern expectations and improve overall user experience. This includes the implementation of digital platforms for community engagement and the incorporation of technological devices to foster inclusivity.

Secondly, a continued emphasis on community involvement remains crucial. Regular communication channels, community forums and collaborative decision-making processes can ensure that the intervention stay attuned to the evolving desires of the residents. Although in none of the cases, the interventions activated new local networks, being able to collaborate with existing networks and experimenting new forms

of collaborations with local organizations and informal groups is an added value for urban acupuncture interventions. This is key to ensure ownership of interventions and allow for future transformation of the space. These spaces are not just meeting hubs, but they can represent a ground to share knowledge and skills enhancing possibilities to create educational outcomes.

All interventions can benefit from prioritizing sustainability and environmental considerations. Green elements, permeable pavements, bioclimatic strategies, as observed in Projects 1, 2 and 4, contribute not only to the aesthetics but also to the overall well-being of the community. Although, with the partial exception of Project 2, none of the cases were capable to generate benefit for residents or to counteract the effects of heatwaves or climate change from which a city like Milan suffers. Increasing the focus on sustainability and promoting the adoption of nature-based solutions could enhance resilience of interventions and allow urban acupuncture project to achieve the overall sustainability aims of the “Piazze Aperte” program.

In terms of economic impact, Projects 1 and 2 have shown partially positive outcomes, emphasizing the importance of fostering commercial activities within revitalized public spaces. Encouraging local businesses, supporting entrepreneurship and creating spaces that attract diverse economic activities can contribute to the long-term success of those interventions. Although as emerging from the evaluation, the capacity of interventions to increase commercial attractiveness of the areas is relatively low. Furthermore, the configuration of space is another limiting factor for the installation of new economic functions in the project area if no designated areas are provided.

6. Discussion and conclusions

Urban acupuncture interventions are characterized by a high degree of informality and flexibility leveraging on community engagement and the creation of social capital rather than on technical skills. For this reason, we adopted a lens of social innovation to contextualize such interventions in the theoretical debate about how social innovation strategies can be implemented at the urban level. This lens allowed us to select a set of criteria capable of capturing dimensions that go beyond traditional urban planning assessment, offering a new way to look at urban planning by focusing on processes rather than on projects (Moulaert & MacCallum, 2023; Radywyl & Bigg, 2013).

The four cases that we studied highlighted the successes of the interventions in bringing together communities and in leveraging on social capital to overcome possible conflicts among interests or objectives of the different stakeholders. As presented above, all cases received a high score on dimensions related to active participation and cooperation among stakeholders showing also a sense of ownership of the interventions by the local communities. This is in line with the overall program objectives to enhance participation in the design and management of interventions, showing how structured models of community engagement through the use of co-planning and public arts is an added value of urban acupuncture interventions. This aspect strongly contributes to the characterization of the area as meeting space that is suitable also for discussion and conduction of recreational and educational activities that might influence the perception of the safety of the area and, thus, individual well-being (Careva et al., 2017; Daugelaite et al., 2018; Salman & Hussein, 2021).

Effects related to “well-being”, “education and training” and “identity”, on their side, are not only dependent on characteristics of the project, but rather rely on capabilities of involved stakeholders. In fact, in cases where cooperation among actors is higher, we observed the presence of formal and informal activities organized by actors in the location of the interventions that contribute to the generation of outcomes (Careva et al., 2017; Lydon & Garcia, 2015). Networks such as those identified in Projects 1 and 2 pre-exist the intervention and are the foundation of strategies to generate long-term changes. On the contrary, where networks do not pre-exist as in Projects 3 and 4, outcomes as such

have not been identified.

In terms of sustainability and resilience, results were not as strong as expected by the “Piazze Aperte” program showing that urban acupuncture interventions are not characterized by innovative bioclimatic strategies and they have limited responsiveness and adaptability capacity from an environmental perspective contrary to findings from previous studies (Houghton et al., 2015; Porębska & Rizzi, 2017). It is worth of noticing that Project 2 received the highest score in the criteria environmental sustainability thanks to the intervention for the permeability of the soil, although, even in this case, no strong performances in terms of resilience are shown in the evaluation. This confirms the transitory nature of urban acupuncture and its current incompatibility with long-term bioclimatic and climate change adaptation objectives set by the “Piazze Aperte” program.

It is further interesting to notice how none of the interventions included in our research provide meaningful outcomes in terms of access to digitalization that is pursued as a policy objective by “Piazze Aperte”. This shows how urban acupuncture are generally characterized by informality, relying deeply on stakeholders’ social capital for the conduction of the initiatives, advancing in-person interaction over digital ones (Houghton et al., 2015). Furthermore, the temporality of such interventions once more goes against the implementation of hard digital solutions such as smart furnishing or internet access in the project area. The integration of a digital strategy, although seen as an advantage in urban regeneration, might limit the degree of flexibility in urban acupuncture interventions and might limit possibilities for future expansion of the interventions (Houghton et al., 2015; Porębska & Rizzi, 2017).

By comparing the four cases together, we can see how the intrinsic features of the area and other context-related characteristics might play a role in the capacity of urban acupuncture interventions in effectively creating changes and outcomes at the community and neighborhood levels. In fact, Projects 1 and 2 proved to be stronger in the capacity to generate societal outcomes and, due to the characteristics of the area of interventions, also generated positive economic outcomes. Furthermore, being able of transforming intersection areas into vibrant community spaces, they enhanced connections among actors that started to look at the urban space in a different way and use it in a commons-like way, promoting alternative activities and engaging different actors in the community (Kip & Oevermann, 2022). This, coupled with social networks that pre-existed the interventions, was fundamental to create lasting transformation and impacts. While Projects 3 and 4 did not enable the creation of social capital being represented by actors as transit spaces. Thus, confirming the crucial role that pre-existing networks and social capital plays in interventions characterized by informality and adaptability such as the ones object of study (Careva et al., 2017; Porębska & Rizzi, 2017).

Concluding, using a lens of social innovation to conduct an analysis of urban acupuncture interventions allowed to analyze different dimensions of impact connected with the interventions in different areas of the city. Particularly, it allowed to ignite a reflection about the importance of social capital and networks for the success of the initiatives, particularly to maximize uses and to promote a community ownership of the projects. This contributes to enhance theoretical knowledge about transitory interventions at the urban level and how they can contribute to the achievement of overall urban planning and policies. Furthermore, it provides a guidance to public administrations in the design and implementation of policies understanding the objectives that can be reached solely by physical intervention on spaces and those that need additional input to be achieved. This can also offer a guidance to organizations and individuals involved in these projects so that they can work on creating relationships and network at the local level as a pre-requisite for physical transformation of the space.

Our analytical model could represent a valuable tool for urban planners and practitioners to understand how to better accommodate inputs to generate positive societal outcomes when promoting urban

acupuncture interventions. Although, our research is not free from limitations. The analytical method we employed can be further improved by including in each criterion a temporal dimension so that it would be possible to conduct a comparative evaluation between the situation before and after the intervention. Furthermore, we should better take into consideration how context determinants (e.g. quality of urban environment; existence of formal stakeholder networks) influence the achievement of results and might require using or not using certain criteria included in the framework.

Despite some limitations, the analytical framework developed for this research have high potentials to be formalized as a tool to support decisions in the planning, design and execution of urban acupuncture interventions, allowing a dialogue between grassroots organizations and public administrations. This can support to understand and integrate in physical masterplan and projects, the social and community determinants that can contribute to the generation of positive social, environmental and economic impact for the local community and the neighborhood.

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CRedit authorship contribution statement

Danny Casprini: Writing – review & editing, Writing – original draft, Methodology, Formal analysis, Data curation, Conceptualization. **Alessandra Oppio:** Writing – review & editing, Validation, Supervision, Conceptualization. **Andrea Di Tommaso:** Writing – original draft, Visualization, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Giulia Datola:** Writing – review & editing, Validation. **Marta Dell'Ovo:** Writing – review & editing, Validation. **Francesca Torrieri:** Validation, Supervision. **Marco Rossitti:** Writing – review & editing, Writing – original draft, Methodology, Formal analysis, Conceptualization.

Declaration of competing interest

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Data availability

Data will be made available on request.

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