

1 **Four years of Co-creation with stakeholders: What did we learn about its added value in**
2 **Urban Planning?**
3 **Insights from CLEVER Cities Milan three Urban Living Labs.**

4
5 **Israa Mahmoud**

6 Politecnico di Milano

7 DASTU - Dipartimento di Architettura e Studi Urbani

8 E-mail: israa.mahmoud@polimi.it

9
10 **Eugenio Morello**

11 Politecnico di Milano

12 DASTU - Dipartimento di Architettura e Studi Urbani

13 E-mail: eugenio.morello@polimi.it

14
15 **Abstract**

16 Since 2018, the Horizon 2020 project CLEVER Cities has been promoting an inclusive co-creation pathway in order
17 to support urban greening regeneration strategies towards a more participatory approach and the achievement of
18 shared governance routines in local decision-making processes. Throughout the development of the methodological
19 framework of the project, a special attention was given to social inclusivity and engagement of different stakeholders:
20 public and local governments, the private sector, academia, and citizens.

21 Supported by the four years long evidence-based experience from the Milanese urban context and three different
22 Urban Living Labs (ULLs), this research article develops a further understanding for the shared governance processes
23 within co-creation processes with consideration to citizen participation and its collateral added values in urban planning
24 methods and practice. The project since its' initiation has also proven multiple added values in adopting Nature-based
25 Solutions (NBS) within public participation processes and raising awareness about their evident environmental benefits
26 as well as collaborative governance, spatial and financial challenges.

27 Based on a social monitoring methodology during the pre-greening phase, an in-depth understanding is further
28 elaborated about the shared governance mechanisms and mainstreaming challenges of adopting NBS in the areas of
29 interventions. Through an ex-ante verification of NBS ownership, stakeholder engagement, challenges of
30 mainstreaming NBS co-creation in urban planning policies, this article sheds the light on the co-creation pathways
31 added values in medium-long term urban regeneration processes.

32
33 **Keywords: co-creation, nature-based solutions, collaborative urban design**

34
35 **1| Introduction. Why to use co-creation in urban planning and especially for urban greening?**

36 **1.1| What is co-creation – in relation to urban planning, a possible definition.**

37 Co-creation approaches have been gaining attention in the urban planning field within the last years by
38 emphasizing the important role of citizen engagement in the decision-making and policy shaping throughout
39 the longer-term urban regeneration processes (Barquet et al., 2022; Mahmoud et al., 2022; Mahmoud &
40 Morello, 2021). However, little has been measured about its added value in urban planning processes,
41 especially on the assessment criteria on the possible implications from co-creation processes in real case-
42 study applications in cities (Ramírez-Agudelo et al., 2022; Sowińska-Świerkosz & García, 2021).

43 In this research article we aim to evaluate the adoption of a complete co-creation approach (Mahmoud &
44 Morello, 2018) on the implementation of Nature-based solutions (NBS) from the experience of the
45 municipality of Milan as part of the CLEVER Cities – H2020 project, see also (Mahmoud & Morello, 2020).
46 In particular, the delivery of urban NBS benefits from the implementation of co-creation approaches in two
47 ways based on the relevance that nature plays for people:

48 Firstly, nature is a quintessential element for people; ancestral sense of survival linked to the provision of
49 food and resources; more in general, health and psycho-physiological need to have contact to nature (Labib
50 et al., 2020); as well as cultural and spiritual significance of nature based on the latest IUCN¹ publication
51 (Verschuuren et al., 2021), see also (Xiang et al., 2020). Secondly, nature requires care, is a living and growing
52 feature; hence, people develop a strong sense of belonging and ownership to the places where they live with
53 nature (Bayulken et al., 2021; Nesshöver et al., 2017).

54 **1.2| Challenges to implement co-creation in urban planning and longer-term urban regeneration.**

55 In dense urban environments, we have partly lost this strong relationship to nature and the possibility of
56 being actively engaged with nature, not limiting to merely having access to and enjoying it; but emphasizing
57 on the possibilities to design urban nature as well as participating to the co-management and co-monitoring
58 of health and growth of urban nature. In that sense, urban regeneration processes related to citizens

¹ International Union for Conservation of Nature, see <https://www.iucn.org/>

59 engagement as well as greening measures in specific, are recognized to be challenging to manage and adopt
60 due to its complexity and place-based contexts variability to change (Hanson et al., 2020; Kabisch et al.,
61 2022). Having recognized the importance of shared governance approaches towards implementing urban
62 green strategies, and by applying the citizens-oriented regeneration approach to achieve better results in
63 green stewardship is a main challenge (Kiss et al., 2022). Therefore, co-creation approaches offer a possible
64 solution to people for re-establishing deeper attachment to the urban natural capital.
65 On one hand, implementing co-creation is purely a shared governance² challenge that needs an integrative
66 framework for collaborative context to flourish (Emerson & Nabatchi, 2015; Mahmoud & Morello, 2021).
67 On the other hand, urban transformations of long-term commitments in cities need a spatial ground in
68 order to allow an evidence-based experimentation for success or failures, and sustainability of results
69 (Kabisch et al., 2018), in this case what is scientifically and commonly considered Urban Living Labs (ULLs),
70 see also (Bulkeley et al., 2016; Chronéer et al., 2019; Menny et al., 2018; Puerari et al., 2018).
71 From the latest research streams on co-creation processes, either specifically on NBS (Herrmann-Pillath et
72 al., 2022; Moniz et al., 2022), or generally on creating a collaborative context for facilitating an embedded
73 shared governance process with citizens in urban regeneration projects (Grace et al., 2020); several attempts
74 have been promising to create a possible “unified” co-creation methodology. Nonetheless, due to its nature
75 to be variable with its spatial context and financial-social-governance constraints in ULLs, as well as its
76 necessity to be rather flexible to allow co-creation to absorb stakeholders input at any time of the process,
77 we could conclude that there is no “one-size fits all” on such a concept, see (Mahmoud, Morello, Ludlow, et
78 al., 2021, p. 15). The crucial issue for co-creative approaches turns out to be developing longer-term trust
79 and reliable networks of collaboration between stakeholders to necessarily “walk the talk” (Kabisch et al.,
80 2019). Furthermore, because of this challenge, there is a pressing need for research on added values for co-
81 creation approaches and processes that evaluate and support the reflection on its measurable added value
82 in urban transformation. Hence, the research question we pose is: is a comprehensive and unique
83 representation of shared governance mechanisms possible, having in mind the complexity of NBS, in terms
84 of types, spatial scales and temporal implementation?

85 **2| Methodological approach: Embedding co-creation in urban greening regeneration processes:** 86 **the experience of Milan**

87 In the following part of this research article, we introduce the methodological approach that was adopted
88 in the CLEVER Cities³ project towards accentuating a flexible collaborative context (co-creation process)
89 in specific ULLs as a spatial context. CLEVER Cities has developed its own co-creation methodology
90 towards emphasizing an inclusive approach for more vulnerable populations in larger urban regeneration
91 processes. The framework is based on a complete co-creation with a set-out procedure in 5 phases and 16
92 steps: Urban Innovation Partnership establishment (UIP), co-design, co-implementation, co-management,
93 co-development (Morello et al., 2018). The implemented co-creation pathway by the project Frontrunners
94 cities is intended to be flexible and adaptable to multiple spatial contexts, multi-actors, multi-temporal of
95 the processes as well as allowing a multi-level of stakeholders’ engagement within the same ULL
96 intervention, see more on (Mahmoud, Morello, Ludlow, et al., 2021). In CLEVER Cities, the ULLs are
97 hence considered CLEVER Actions Labs (CALs), whereas the Spatial context takes place. Another
98 CLEVER Cities concept was established to allocate the collaborative context layout, which is the Urban
99 Innovation Partnership (UIP) whereas the alliance between local stakeholders in form of public-private
100 partnership (PPP) takes place. These two main concepts are the fertile grounds whereas the co-creation
101 activities and dynamics take place.

102 However, the success of co-creation process after four years of experimentation needed another layer of
103 validation in the initial methodological approach previously established with the co-creation guidance⁴. In
104 the next part, we discuss which added values emerged from implementing co-creation approaches within a
105 collaborative context and a spatial context as in the Milan case study, these two dimensions help identify a
106 possible assessment framework for embedding co-creation in ULLs. The application case study from Milan
107 enhanced both the realization of the complete co-creation pathway on one hand, as well as allowing a
108 possible assessment framework for the mechanism of shared governance implementation within the ULLs,
109 see Figure 1.

² In this article the shared governance definition is based on IUCN guidance, see Verschuuren, B., Mallarach, J., Bernbaum, E., Spoon, J., Brown, S., Borde, R., Brown, J., Calamia, M., Mitchell, N., Infield, M., & Lee, E. (2021). Cultural and spiritual significance of nature: Guidance for protected and conserved area governance and management (Issue 32). Shared governance: Trans-boundary governance (formal and informal arrangements between two or more countries); collaborative governance (through various ways in which diverse actors and institutions work together); joint governance (pluralist board or other multi-party governing body).

³ See more on <https://clevercitiesguidance.wordpress.com/>

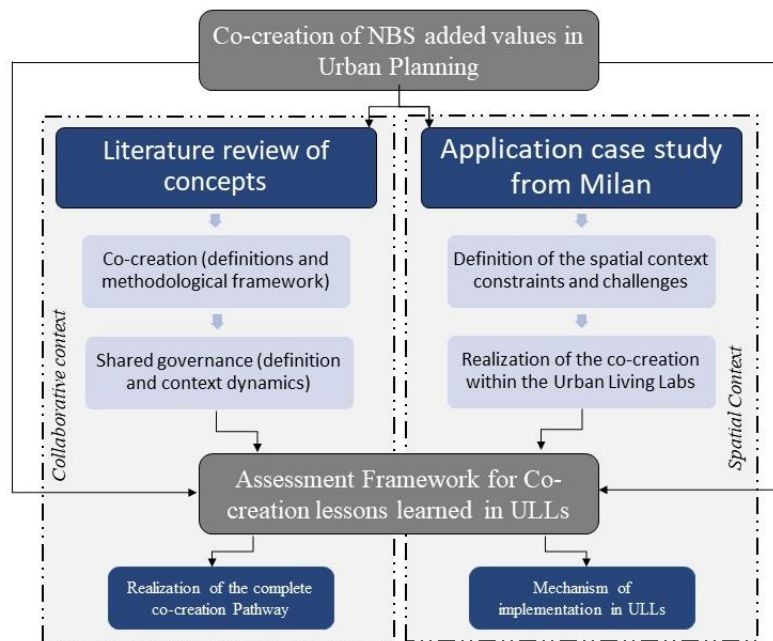


Figure 1 | Methodological conceptual framework for this article. Source: the authors.

110

111

112

113 **2.1| The first value: how do we embed co-creation in urban regeneration processes and what is the role of**
 114 **stakeholders in the process: drivers, catalyst, initiators, leadership delegation, etc.**

115 The initiation of the process in the city of Milan dates back to November 2018, the municipality was fully
 116 committed in developing the process of co-creation of NBS “with citizens and for citizens”. Starting by
 117 establishing a local innovation partnership of stakeholders, namely UIP, that would be fully involved in the
 118 process from the start till the end. In addition to the commitment from within the municipality itself to
 119 ensure an added value of the financial investment by the European commission grant agreement. In
 120 conjunction with the aim of realizing the NBS interventions in Milan while ensuring a collaborative context
 121 at the same weight; the co-creation framework, then, shifted from a shared governance approach towards
 122 an integrative collaborative governance approach (Emerson & Nabatchi, 2015, p. 27). In this sense, the
 123 added values are based on the drivers themselves as well as the collaboration dynamics themselves. During
 124 and after the formation of the collaborative context, such as the CALs, is represented by the dynamics:
 125 engagement, motivation, and capacity to action. Meanwhile the stakeholders develop a collective purpose
 126 to take part in the co-creation process by setting targets of goals, as well as a shared theory of change to
 127 accomplish those goals, which guide these collaborative actions leading to outcomes within a larger
 128 integrated collaborative context, see Figure 2 (on the left).

129 **2.2| The second value: how to measure the development of the co-creation process itself with respect to the**
 130 **shared governance mechanisms attributes: actions and outcomes.**

131 Inspired by this integrated framework for collaborative governance (Emerson & Nabatchi, 2015) and other
 132 references (Frantzeskaki, 2019; Santiago & Komendantova, 2022; Wamsler et al., 2020), we attempt a new
 133 interpretation of the shared governance mechanisms attributes for implementing NBS in urban regeneration
 134 processes, by analyzing the Milanese case study. Shared governance dynamics then consist of three
 135 interacting components: 1) principled engagement, 2) shared motivation as well as 3) the capacity for joint
 136 actions, which contains procedural and institutional arrangements, leadership, knowledge, and resources.
 137 These components work together dynamically to produce actions, outcomes, and adaptation within the
 138 collaborative context on the end side of the co-creation process, see Figure 2 (on the right).

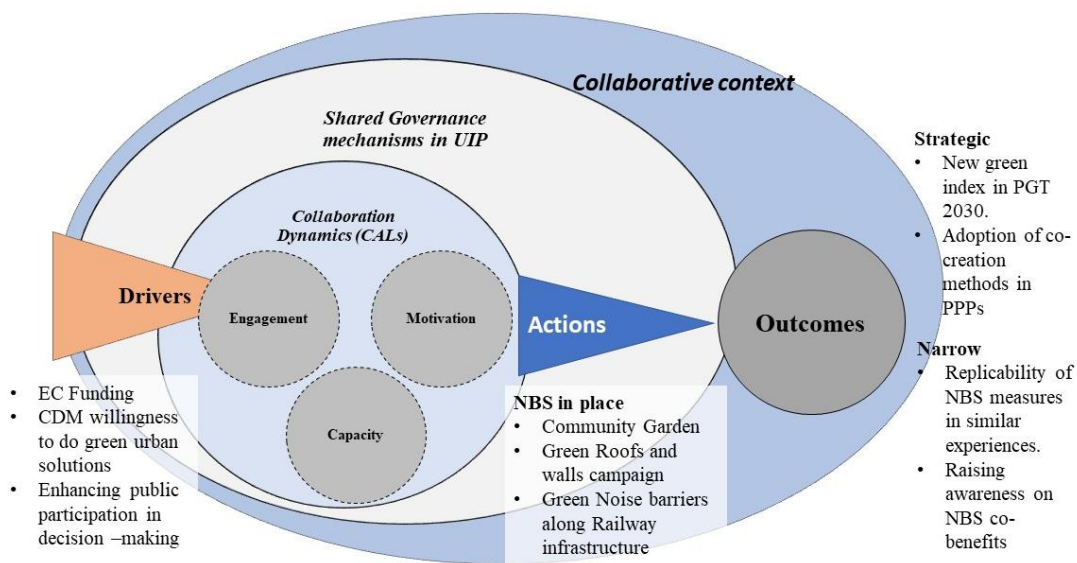


Figure 2 | Integrated framework for Collaborative Governance for the collaboration dynamics in CALs and shared governance mechanisms in UIP. Source the authors: inspired by (Emerson & Nabatchi, 2015).

In the Milanese context, the actions developed were more likely to be the actual implementation of the NBS in place: A green roofs and walls campaign “*Rinverdiamo Milano*” in CAL1, A community Garden “*Giambellino 129*” in CAL2, and green noise barriers along a new railway infrastructure “*Tibaldi Train Stop*” in CAL3, see Table I. The social context of these CALs was so different among themselves since the spatial scale was rather diffused than concentrated on the overall territorial planning of the municipality (PGT2030). Henceforth, a pre-greening social monitoring campaign was carried out in order to assess a wider public acceptance and willingness to participation in the co-design, co-management, and co-maintenance of the NBS interventions (Mahmoud, Morello, Vona, et al., 2021).

3 | Results: Challenges of NBS co-creation and solutions for mainstreaming through governance mechanisms and urban planning rules

Diffusing and densifying the natural capital in cities are gaining new attention of citizens and policy makers (Beute et al., 2020; Faivre et al., 2017). The reasons are various. Firstly, in the current post-pandemic times, after the rigid lockdown effects and sanitary emergency in Milan, the accessibility to green spaces (“closer-to-home”, or even “at home”) is perceived by people as extremely important, as recently intercepted by the real estate market. For instance, a noticeable change in the perception about the priority of green interventions is emerging in residential areas, even with smaller scale NBS types, such as pocket parks. Secondly, new models of green building technologies are getting more popular; the iconic ‘Bosco Verticale’, the tree-equipped skyscraper by Stefano Boeri, created a new imaginary and reinforced the concept that natural capital can be fully embedded in the built environment, and made it desirable to people and, consequently, to the real estate market.

In Milan, throughout CLEVER Cities CALs activities, we explored multiple channels for promoting co-created urban greening solutions, as summarized in Table I. Some measures are easier to adopt and widely debated, some are punctual and foresee the engagement of few actors:

3.1 | Co-creation for different NBS types, size, and locations

To different measures correspond different shades of NBS co-creation modalities and opportunities, and as many NBS types and scales of application. For instance, when it comes to design, build, and manage a green noise barrier or an escarpment in reinforced earth close to the railway tracks, people involvement is challenging in terms of accessibility to green and safety. Hence, not all the phases of co-creation do apply to all NBS types. Therefore, mainstreaming NBS through urban planning rules, policies and governance mechanisms call for differentiated procedures.

175 When it comes to co-create the NBS as part of a larger Green Infrastructure, like the Giambellino 129 park,
176 each NBS asks for a specific pathway, mobilizing different stakeholders and resources. Hence, not only the
177 size of NBS, but the spatial layout where NBS are implemented, matters.

178 **3.2| Introducing Co-creation in urban design and urban planning routines**

179 Introducing co-creation in well-established routines of local governments requires a new culture of
180 openness and sharing in decision-making. This requires applying new skills, such as facilitation and
181 management of a complex timeline receiving input from different actors with different speeds. Finetuning
182 the strict timing of public works procedures with co-design timing requires new rules for more flexible
183 design variants during the process. This is true when it comes to the traditional design for a public park, and
184 even more in an expensive public work for a new train infrastructure.

185 • Hence, embedding co-design in public infrastructure bids and procedures, by leaving space for design
186 variants because of confrontation with a wider public

187 • Finding mechanisms to leave space for indeterminacy in the public bid procedures, by dividing the work
188 in two phases (hardscape infrastructure and, after co-design, detailed design)

189 **3.3| Fostering participation in urban greening policies**

190 • Linking the design of new parks to complete co-creation, from co-design to co-management

191 • Linking retrofitting interventions on buildings to co-design as the experience of CAL1 shows

192 • New PPP collaboration agreements for the co-management of the LPT nodes (including co-branding) -
193 RFI and CDM under discussion

194 **3.4| Assessing co-creation effectiveness and impact**

195 Moreover, investing in co-creation development is expensive for cities and relies on public money. Hence,
196 understanding the effectiveness of a participatory process is a priority. Nevertheless, measuring the success
197 of co-creation is difficult and the impact can be assessed in the long term.

198 • Co-creation process indicators to be assessed (monitoring and evaluation of the process)

199 • Social monitoring for public acceptance through surveys (impact, before and after greening
200 interventions)

201 **3.5 | Strategically planning shared outcomes throughout the co-creation process**

202 According to the integrated framework of collaborative methodological analysis (see Fig. 2), the
203 collaborative actions vary depending on the context purposes; in the case of Milan the outcomes related
204 mainly to two levels:

205 *1. Strategic development on a particular urban greening policy:*

206 • The municipality adopted a new index for Greening Buildings (Index of Climate Impact Reduction,
207 *Indice di Riduzione dell'Impatto Climatico*) within the new Territorial Governance Plan of 2030 "*Piano Governo*
208 *del Territorio 2030*" as a follow-up from CAL1.

209 • The adoption of the co-creation methods in collaboration between public and private partners for the
210 co-maintenance of the small green areas as a follow-up from CAL3.

211 *2. Narrow development of a particular replication of another project*

212 • A replicated green wall on ATM public building adopting the call for the green roofs and walls campaign
213 from CAL1.

214 • A wider social campaign on the diffusion of co-mapping green roofs and walls across the city to increase
215 the public awareness on NBS health and wellbeing co-benefits.

Table 1 | Three Urban Living Labs (CLEVER Acton Labs – CALs) in Milan and the links to shared governance challenges, mainstreaming opportunities and NBS types and scales.

	CAL 1 Promoting green roofs and walls in Milan	CAL 2 A new park for Giambellino 129	CAL 3 A new train stop in viale Tibaldi
Description of NBS interventions	Small and building scale applications of - Green roofs - Green walls	The Green Infrastructure is a new urban park, integrating: - A community garden - A Green wall - An Orchard and a butterfly garden...	A train stop, integrating: - Green wall - Escarpment in reinforced earth - public green garden
Ownership	Owners of the whole building, flat owners of Multi-Property Buildings	The Municipality of Milan	RFI, the Italian Railway Network
Stakeholders	Experts in NBS design selected through the public bid, other local groups of interest in case of public buildings (e.g., NABA Academy)	Local civic associations, local citizens, and residents from the Giambellino social housing area	Local citizens living close to the station; local players (e.g., Bocconi University)
Target audience	All citizens to get involved in greening the city starting from buildings	The local community of Giambellino, enjoying the new park	The local community around the stations and the commuters of the area
Shared governance mechanisms adopted by CLEVER Cities	- Public call for green roofs and walls incentives in private and public buildings - Public bid for an official list of experts in green roofs and walls, involved in the co-design phase - Co-design of green roofs in the buildings selected through the public call - A public Award for green roofs and walls and a co-mapping experience	Co-design lab with local community and the Giambellino urban living lab	Light co-design, i.e., consultancy of alternative design solutions, features, and urban furniture for the public green areas in front of the station
Co-creation phases carried out	co-design	co-design co-implementation co-management co-development	co-design co-management co-development
Challenges of NBS co-creation we encountered	Supervising co-design processes is demanding for local government	Finetuning the strict timing of public works procedures with co-design timing requires new rules for more flexible design variants during the process.	NBS in the railyard infrastructure are not accessible to people, hence co-management is not feasible.
		Including people in the design phase requires breaking routines of established procedures by the local green management office	
		Social monitoring of outcomes and co-creation process is complex and expensive.	
Mainstreaming NBS co-creation in shared governance mechanisms	Linking public incentives to a co-design process	Finding mechanisms to leave space for indeterminacy in the public bid procedures, by dividing the work in two phases (Hardscape infrastructure and, after co-design, detailed design)	Embedding co-design in public infrastructure bids and procedures, by living space for design variants because of public confrontation
		Linking the design of new parks to complete co-creation, from design to management	New PPP collaboration agreements for the co-management of the LPT nodes (including co-branding)
Mainstreaming NBS co-creation in urban planning rules and policies	- Milan City Plan (PGT) introduces a rule for diffusing NBS in buildings - PAC - PTM	- Milan City Plan (PGT 2030) promotes 20 new parks by 2030 - PAC - PTM	- Sustainable Urban Mobility Plan (PUMS)

220 4 | Discussion and conclusions

221 In this article, we attempted a modular evaluation for the possible shared governance mechanisms that may
222 affect and be affected by the implementation of co-creation pathways in large urban regeneration processes.
223 The adopted integrated framework of collaborative governance gives insights on (1) the dynamism of the
224 collaboration drivers on a spatial context of ULLs such as engagement methods, motivation to participate
225 and capacity to develop the actions; as well as (2) on the collaborative context of shared governance process
226 to develop actions of certain NBS in place, such as the cases of the CALs in Milan.

227 Meanwhile, this research emphasizes the need for mainstreaming outcomes from co-creation pathways to
228 promote those approaches in the urban planning practice, especially on the strategic level, specifically aiming
229 at the following measures:

230 - The integration of co-creation of NBS to urban planning public procedures; this aspect mainly adopts the
231 newly approved *Piano Territoriale Metropolitan (PTM)*⁴ that prioritizes NBS as a main climate change
232 adaptation and mitigation measure to be implemented with local stakeholders through PPPs, for instance,
233 as in *Obiettivo 10 – Potenziare gli strumenti per l’attuazione e gestione del piano*, P37). As Noted as well from the
234 *PTM*, P26, *La Carta di Bologna per l’ambiente* encourages the involvement of citizens in the territorial planning
235 and NBS planning processes towards an effective sustainable land-use policy-making planning process for
236 an increase in environmental and social cohesion.

237 - Linking co-creation in practice to possible financial incentives can appeal a wider public interest. Hence,
238 mainstreaming of tools, and instruments of public participation and co-creation, in public tenders for
239 financial incentives to citizens, for instance for the integration of adaptation measures with NBS in
240 buildings. The experience from CLEVER Cities in CAL1, calls out to a major integration with experts and
241 neighborhood residents experience on co-design to deliver socially accepted green roofs and walls in private
242 buildings’ retrofitting processes. Adopting shared governance mechanisms for decision-making in multi-
243 property buildings is especially important to accelerate transformations of the existing buildings stock to
244 meet 2030 and 2050 targets of climate neutrality in cities.

245 - From the general lessons learned in CLEVER Cities project, to raise specific attention to financial
246 mechanisms of NBS with citizens, several activities are required to happen at the same time. Economic
247 feasibility studies to promote climate adaptation strategies are complex, since no revenue is generated by
248 NBS, and only avoided costs for inaction can be used as a lever (avoided flooding, extra energy costs to
249 climatize buildings in winter and summer), beside environmental concerns (e.g., increment of biodiversity).
250 Besides, communicating successful stories of best practices of NBS integration in buildings is a qualitative
251 demonstration of the multiple co-benefits that nature can generate in cities, beyond purely financial aspects.
252 To account these co-benefits, sustainable social return of investment schemes (see also (Nicholls et al.,
253 2012) result the most difficult and hindering project activities.

254 - Beyond incentives for the ‘green’ retrofitting of buildings in the private sector, embedding co-creation in
255 public bids for public works would represent a crucial step for accelerating the shared governance in large
256 projects. For instance, introducing the public consultation and collaboration in the timeline of public works
257 from the very beginning of procedures would enable an effective timing for conducting a complete co-
258 creation pathway. As a quintessential part of the project management of a public work, co-creation could
259 be integrated in the consequent in-depth phases of the project, thus informing and supporting the detailing
260 of solutions and without delaying the realization of the works.

261 On a narrower scale of analysis, the integrated framework for collaborative governance gave insights on the
262 possibility to develop mitigation actions to the co-creation process within the small group of partners, such
263 in the case of CLEVER Cities, as below:

264 - Rise of a new figure of co-facilitator and co-creation officer in projects led by public administration
265 divisions. That reflection comes in hand with the local team experience on the co-design phase from a wider
266 perspective. Establishing a co-creation division or responsible person in the public government body of a
267 city, flanked by a professional facilitator, hired (preferably by a third party) to follow the whole process,
268 would allow cities to consolidate co-creation experiences and capitalize on the lessons learned for future
269 projects. In fact, a co-creation management based on spot pilot projects (as in the case of EU funded
270 projects) does not allow the culture of participation to be rooted in the planning routines of cities.

271 - Enhancing multi-stakeholder co-management policies of green spaces and emphasizing the importance of
272 social values created around the public spaces of ULLs is crucial. From a very detailed urban planning
273 perspective, this outcome works in hand with the public administration local authorities to allow a more
274 bottom-up approach to green strategies implementation. The more the *public* is involved in the participation

⁴ See https://www.cittametropolitana.mi.it/PTM/iter/PTM_vigente/index.html

275 process, the more the sense of ownership and belonging to the space increases, and hence, co-management
276 gets enhanced with local citizens jumping in for help in maintenance and long-term “care taking” of NBS
277 actions in place.

278 Lastly, the case study from this research article is mainly contributing to the debate on the effectiveness of
279 using a co-creation approach for embedding NBS in urban planning. The practice of this experience from
280 Milan in CLEVER Cities showed that hindrances on public authorities to embark on mainstreaming co-
281 creation in shared governance mechanisms is mainly due to two aspects: firstly, the absence of culture of
282 collaboration in decision-making, due to a lack of trust in getting input from others, together with the
283 distress of not controlling and even slowing down processes; secondly, the lack of collaborative planning
284 policies and procedures, especially in public works, that govern public participation and provide
285 collaboration windows as part of the overall co-creation pathway of design and construction, management
286 and budget allocation, hence enabling a smoother integration to cope simultaneously with the flexibility and
287 uncertainty arisen from the dynamism of such co-creation processes and their place-based context
288 embeddedness.

289

290 **5 | Authors Contributions**

291 The first author is responsible of Part 1 and 2, the second author is responsible of Part 3 and 4. Both authors
292 revised and improved the whole final manuscript collaboratively. Both authors have been involved in the
293 research activities of CLEVER Cities project.

294

295 **6 | References**

- 296 Barquet, K., Segnestam, L., & Dickin, S. (2022). *MapStakes: a tool for mapping, involving and monitoring*
297 *stakeholders in co-creation processes* (Issue May). <https://doi.org/10.51414/sei2022.014>
- 298 Bayulken, B., Huisinigh, D., & Fisher, P. M. J. (2021). How are nature based solutions helping in the greening
299 of cities in the context of crises such as climate change and pandemics? A comprehensive review.
300 *Journal of Cleaner Production*, 288, 125569. <https://doi.org/10.1016/j.jclepro.2020.125569>
- 301 Beute, F., Andreucci, M. B., Lammel, A., Davies, Z., Glanville, J., Keune, H., Marselle, M., O'Brien, L.,
302 Olszewska-Guizzo, A., Remmen, R., Russo, A., & de Vries, S. (2020). *Types and characteristics of urban*
303 *and peri-urban green spaces having an impact on human mental health and wellbeing. Report prepared by an EKLIPSE*
304 *Expert Working Group.* [https://eklipse.eu/wp-](https://eklipse.eu/wp-content/uploads/website_db/Request/Mental_Health/EKLIPSE_HealthReport-Green_Final-v2-Digital.pdf)
305 [content/uploads/website_db/Request/Mental_Health/EKLIPSE_HealthReport-Green_Final-v2-](https://eklipse.eu/wp-content/uploads/website_db/Request/Mental_Health/EKLIPSE_HealthReport-Green_Final-v2-Digital.pdf)
306 [Digital.pdf](https://eklipse.eu/wp-content/uploads/website_db/Request/Mental_Health/EKLIPSE_HealthReport-Green_Final-v2-Digital.pdf)
- 307 Bulkeley, H., Coenen, L., Frantzeskaki, N., Hartmann, C., Kronsell, A., Mai, L., Marvin, S., McCormick, K.,
308 van Steenbergen, F., & Voytenko Palgan, Y. (2016). Urban living labs: governing urban sustainability
309 transitions. *Current Opinion in Environmental Sustainability*, 22, 13–17.
310 <https://doi.org/10.1016/j.cosust.2017.02.003>
- 311 Chronéer, D., Ståhlbröst, A., & Habibipour, A. (2019). Urban Living Labs: Towards an Integrated
312 Understanding of their Key Components. *Technology Innovation Management Review*, 9(3), 50–62.
313 <https://doi.org/10.22215/timreview/1224>
- 314 Emerson, K., & Nabatchi, T. (2015). *Collaborative governance regimes* (B. A. Radin, Ed.; Public Man).
315 Georgetown University Press.
- 316 Faivre, N., Fritz, M., Freitas, T., de Boissezon, B., & Vandewoestijne, S. (2017). Nature-Based Solutions in
317 the EU: Innovating with nature to address social, economic and environmental challenges.
318 *Environmental Research*, 159(September), 509–518. <https://doi.org/10.1016/j.envres.2017.08.032>
- 319 Frantzeskaki, N. (2019). Seven lessons for planning nature-based solutions in cities. *Environmental Science and*
320 *Policy*, 93(December 2018), 101–111. <https://doi.org/10.1016/j.envsci.2018.12.033>
- 321 Grace, M., Scott, A. J., Sadler, J. P., Proverbs, D. G., & Grayson, N. (2020). Exploring the smart-natural
322 city interface; re-imagining and re-integrating urban planning and governance. *Emerald Open Research*,
323 2(May), 7. <https://doi.org/10.35241/emeraldopenres.13226.1>
- 324 Hanson, H. I., Wickenberg, B., & Alkan Olsson, J. (2020). Working on the boundaries—How do science
325 use and interpret the nature-based solution concept? *Land Use Policy*, 90(October 2019), 104302.
326 <https://doi.org/10.1016/j.landusepol.2019.104302>
- 327 Herrmann-Pillath, C., Hiedanpää, J., & Soini, K. (2022). The co-evolutionary approach to nature-based
328 solutions: A conceptual framework. *Nature-Based Solutions*, 2(October 2021), 100011.
329 <https://doi.org/10.1016/j.nbsj.2022.100011>
- 330 Kabisch, N., Frantzeskaki, N., & Hansen, R. (2022). Principles for urban nature-based solutions. *Ambio*.
331 <https://doi.org/10.1007/s13280-021-01685-w>

332 Kabisch, S., Finnveden, G., Kratochvil, P., Sendi, R., Smagacz-Poziemska, M., Matos, R., & Bylund, J.
333 (2019). New urban transitions towards sustainability: Addressing SDG challenges (research and
334 implementation tasks and topics from the perspective of the scientific advisory board (SAB) of the
335 joint programming initiative (JPI) Urban Europe). *Sustainability (Switzerland)*, *11*(8).
336 <https://doi.org/10.3390/su11082242>

337 Kabisch, S., Koch, F., Gawel, E., Haase, A., Knapp, S., Krellenberg, K., & Zehnsdorf, A. (2018). Urban
338 transformations: Sustainable urban development through resource efficiency, quality of life and
339 resilience. In *Urban transformations: Sustainable urban development through resource efficiency, quality of life and*
340 *resilience*. Springer. <https://rd.springer.com/book/10.1007/978-3-319-59324-1>

341 Kiss, B., Sekulova, F., Hörschelmann, K., Salk, C. F., Takahashi, W., & Wamsler, C. (2022). Citizen
342 participation in the governance of nature-based solutions. *Environmental Policy and Governance*.
343 <https://doi.org/10.1002/eet.1987>

344 Labib, S. M., Lindley, S., & Huck, J. J. (2020). Spatial dimensions of the influence of urban green-blue spaces
345 on human health: A systematic review. *Environmental Research*, *180*(October 2019), 108869.
346 <https://doi.org/10.1016/j.envres.2019.108869>

347 Mahmoud, I. H., Morello, E., Lemes de Oliveira, F., & Geneletti, D. (2022). *Nature-based Solutions for*
348 *Sustainable Urban Planning* (I. H. Mahmoud, E. Morello, F. Lemes de Oliveira, & D. Geneletti, Eds.; 1st
349 ed.). Springer International Publishing. <https://doi.org/10.1007/978-3-030-89525-9>

350 Mahmoud, I. H., Morello, E., Ludlow, D., & Salvia, G. (2021). Co-creation Pathways to Inform Shared
351 Governance of Urban Living Labs in Practice: Lessons From Three European Projects. *Frontiers in*
352 *Sustainable Cities*, *3*(August), 1–17. <https://doi.org/10.3389/frsc.2021.690458>

353 Mahmoud, I. H., Morello, E., Vona, C., Benciolini, M., Sejdullahu, I., Trentin, M., & Pascual, K. H. (2021).
354 Setting the Social Monitoring Framework for Nature-Based Solutions Impact: Methodological
355 Approach and Pre-Greening Measurements in the Case Study from CLEVER Cities Milan.
356 *Sustainability*, *13*(17), 9672. <https://doi.org/10.3390/su13179672>

357 Mahmoud, I., & Morello, E. (2018). Co-Creation Pathway as a catalyst for implementing Nature-based
358 Solution in Urban Regeneration Strategies Learning from CLEVER Cities framework and Milano as
359 test-bed. *Urbanistica Informazioni*, *278*(Special issue), 204–210.

360 Mahmoud, I., & Morello, E. (2020). Are Nature-based solutions the answer to urban sustainability dilemma?
361 The case of CLEVER Cities CALs within the Milanese urban context. *Atti Della XXII Conferenza*
362 *Nazionale SIU. L'Urbanistica Italiana Di Fronte All'Agenda 2030. Portare Territori e Comunità Sulla Strada*
363 *Della Sostenibilità e Della Resilienza*, 1322–1327.

364 Mahmoud, I., & Morello, E. (2021). Co-creation Pathway for Urban Nature-Based Solutions : Testing a
365 Shared-Governance Approach in Three Cities and Nine Action Labs. In A. Bisello et al. (Ed.), *Smart*
366 *and Sustainable Planning for Cities and Regions* (pp. 259–276). Springer International Publishing.
367 <https://doi.org/10.1007/978-3-030-57764-3>

368 Menny, M., Voytenko Palgan, Y., & McCormick, K. (2018). Urban living labs and the role of users in co-
369 creation. *Gaia*, *27*, 68–77. <https://doi.org/10.14512/gaia.27.S1.14>

370 Moniz, G. C., Andersson, I., Hilding-hamann, K. E., Mateus, A., & Nunes, N. (2022). *Inclusive Urban*
371 *Regeneration with Citizens and Stakeholders : From Living Labs to the URBiNAT CoP*.

372 Morello, E., Mahmoud, I., & Gulyurtlu, S. (2018). *Guidance on co-creating nature-based solutions PART II - Running*
373 *CLEVER Action Labs in 16 steps. Deliverable 1.1.6*.

374 Nesshöver, C., Assmuth, T., Irvine, K. N., Rusch, G. M., Waylen, K. A., Delbaere, B., Haase, D., Jones-
375 walters, L., Keune, H., Kovacs, E., Krauze, K., Külvik, M., Rey, F., Van Dijk, J., Vistad, O., Wilkinson,
376 M., & Wittmer, H. (2017). The science , policy and practice of nature-based solutions: An
377 interdisciplinary perspective. *Science of the Total Environment*, *579*, 1215–1227.
378 <https://doi.org/10.1016/j.scitotenv.2016.11.106>

379 Nicholls, J., Eilis Lawlor, Eva Neitzert, & Tim Goodspeed. (2012). *A guide to Social Return on Investment*.
380 <https://www.socialvalueint.org/guide-to-sroi>

381 Puerari, E., Koning, J. I. J. C. de, von Wirth, T., Karré, P. M., Mulder, I. J., & Loorbach, D. A. (2018). Co-
382 Creation Dynamics in Urban Living Labs. *Sustainability*, *10*(1893), 1–18.
383 <https://doi.org/10.3390/su10061893>

384 Ramírez-Agudelo, N. A., Badia, M., Villares, M., & Roca, E. (2022). Assessing the benefits of nature-based
385 solutions in the Barcelona metropolitan area based on citizen perceptions. *Nature-Based Solutions*,
386 *2*(May), 100021. <https://doi.org/10.1016/J.NBSJ.2022.100021>

387 Santiago, F., & Komendantova, N. (2022). *Approaches to Participatory Policymaking Processes: Technical Report*
388 (Issue March).

- 389 Sowińska-Świerkosz, B., & García, J. (2021). A new evaluation framework for nature-based solutions (NBS)
390 projects based on the application of performance questions and indicators approach. *Science of the Total*
391 *Environment*, 787. <https://doi.org/10.1016/j.scitotenv.2021.147615>
- 392 Verschuuren, B., Mallarach, J., Bernbaum, E., Spoon, J., Brown, S., Borde, R., Brown, J., Calamia, M.,
393 Mitchell, N., Infield, M., & Lee, E. (2021). *Cultural and spiritual significance of nature: Guidance for protected*
394 *and conserved area governance and management* (Issue 32).
- 395 Wamsler, C., Alkan-Olsson, J., Björn, H., Falck, H., Hanson, H., Oskarsson, T., Simonsson, E., &
396 Zelmerlow, F. (2020). Beyond participation: when citizen engagement leads to undesirable outcomes
397 for nature-based solutions and climate change adaptation. *Climatic Change*, 158(2), 235–254.
398 <https://doi.org/10.1007/s10584-019-02557-9>
- 399 Xiang, P., Yang, Y., & Li, Z. (2020). Theoretical Framework of Inclusive Urban Regeneration Combining
400 Nature-Based Solutions with Society-Based Solutions. *Journal of Urban Planning and Development*, 146(2),
401 04020009. [https://doi.org/10.1061/\(asce\)up.1943-5444.0000571](https://doi.org/10.1061/(asce)up.1943-5444.0000571)
402