



Co-creation Pathways to Inform Shared Governance of Urban Living Labs in Practice: Lessons From Three European Projects

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Over recent decades Urban Living Labs (ULLs) have become a common space for co-creation processes' experimentation, whereby new approaches for sustainable urban development are highly connected to support evidence-based policy generation. Europe seems a particular 'hotspot' for this approach whenever it comes to public policy and specifically planning for urban transition. Systemic changes related to urban governance and different public participatory mechanisms, as in the case of ULLs, demand a growing interest from the stakeholders and deliberation in decision-making mechanisms. In this research paper, we analyze co-creation pathways and different shared governance mechanisms in three ongoing European projects: CLEVER Cities, Sharing Cities, and SUNEX projects from a practice perspective. This comparative study investigates stakeholder engagement (1) scales, (2) mechanisms, (3) methodologies of engagement, and finally the co-creation pathway challenges and pitfalls. From the analyzed ULLs' experiences, we identified key principles that suggest relevant clues to enable the consolidation of a forthcoming ULL 2.0 model and related innovation pathways for co-creating urban planning policies. We lastly reflect on the enablers and catalysts of co-creation processes to inform shared urban governance as major takeaways from our research.

Keywords: shared governance, co-creation, inclusive urban planning, urban transition, urban living labs

INTRODUCTION

Shared urban governance is an emergent trend, for its attention to urban sustainability, societal transformations, and innovative pathways toward urban transitions (Evans and Karvonen, 2011; Davidson et al., 2019; Davies and Laforteza, 2019). In this research, we tackle the urban transition from a policy-making process in which decisions (mainly related to climate change actions) are made with particular attention to social justice and community participation widely aiming to leverage synergies of social inclusion across cities (Urban Transitions Alliance, 2018; ICLEI, 2019; Hughes and Hoffmann, 2020). The shared governance approach toward urban transition is not new, and the disciplines and areas of interest that contribute to make the shared governance approaches work locally are certainly numerous. The management and governance of cities in

transition toward carbon neutrality, are undergoing a phase of policy and practice experimentations within the context of sustainable cities and communities (for instance, responding to the SDG 11 or the 2030 Agenda). Moreover, shared governance is often characterized by broad concepts for policy makers such as: collaboration between stakeholders, engagement in Urban Living Labs (ULLs) and collaborative pathways for the implementation of solutions. In real world laboratories (RWL), see Schöpke et al. (2018), very few experiences are reported as successful involving ULLs that actually led to a policy change or transition; this is mainly due to lack of an outline on what is the notion of ULL, and how they relate to urban transition in specific and societal challenges learning in general.

Some EU Horizon 2020 funded projects focusing on urban transition dedicated their attention toward establishing and adopting co-creation approaches and pathways in delivering policies and services to the research and innovation world, mainly in the urban and public domains [see (INSIGHT, 2013; Correia et al., 2016; Klimatek Project, 2017; TeRRIFICA, 2019)]. Meanwhile many nature-based solutions and carbon neutral policy projects are in the race to address climate change risks and hazards; the practicality of their co-creation processes still needs to be domesticated. Within this framework, new governance arrangements, business models, financing mechanisms, and forms of citizen engagement are under investigation to make the premise of effective urban transition to carbon neutrality and green cities a reality.

The European Environmental Agency (EEA) emphasizes the role of transnational network governance to promote urban transitions within cities and regions (European Environment Agency, 2017, 105). Examples are many; however, it appears within urban transition studies that diverse approaches are taken such as: city-led initiatives, international councils for local environmental agencies, climate leaders' groups, and academic-led initiatives. This diversity draws attention to a more generic importance of urban governance capabilities at city-level to influence transition. This is the case of "systemic intermediaries" that mainstream research outcomes into co-creation pathways in order to enable cities to facilitate their ULL innovation processes and finally embedding these into their daily planning and governance routines.

In this research, we discuss three main concepts related to urban transition, namely urban governance strategies, co-creation pathways, and the most recent approaches to ULLs (and conceptually ULL V2.0); for this we draw on the experience and lesson learnt from three EU funded projects, i.e., CLEVER Cities, Sharing Cities, and SUNEX. These three projects are different in terms of urban scales, specific aims of environmental transition, applications, policy guidelines and scopes within the urban context in order to work for more sustainable urban development approach. However, all of them embed co-creation concepts in their methodological framework toward environmental adaptation. Moreover, they all developed different

co-creation pathways in order to respond to the emerging need for transposing research from shared governance into practice. Different tools are adopted in each project based on the area of interest, the specificity of place-based context ULLs, and the targeted policy in action. Furthermore, the pathways of co-creation processes were not all equal, and they varied between backcasting and forecasting of urban visions and strategies. This led to different stakeholder engagement processes and, as a consequence, a relational pathway of implementation. In sum, there seems to be no single common formula to establish a certain shared governance process that embeds all stakeholders within the DNA of the decision-making mechanism, that is related to ULLs.

The first concept we investigated is governance strategies. Municipal governments are important for addressing urban sustainability. Yet our work suggests that they cannot act alone. The capacity to address urban sustainability challenges relies on multilevel governance structures, as well as the development of different modes of governance (García, 2006; Davidson et al., 2019). This means that municipal governments need to work together with stakeholders and local communities to create the partnerships, attract resources, devise plans and demonstration projects to accelerate the uptake of long-term sustainable measures (Evans, 2019; McCormick, 2020, 11; UN-HABITAT, 2020).

That taps into our second concept, i.e., co-creation processes. In literature, a co-creation process stands out for the engagement of stakeholders and end-users throughout the whole process of decision-making and implementation. Co-creation is also considered an innovative process for stakeholders by taking over to achieve a complete shared governance model, and sense of identification and belonging with the proposed solutions (Agrawal et al., 2015; Burkett, 2016; Ramaswamy and Ozcan, 2018). In urban governance, this concept translates into a challenging approach of embedding citizens and stakeholders in an iterative closed loop process, whereas citizens are amongst the main decision makers of the process itself and not just service beneficiaries. Within this understanding, the co-creation pathway extends beyond stakeholder and citizen engagement; it refers to the complete co-production of knowledge and sharing of solutions, from ideation to implementation and management (IDEO, 2015). Embedding innovation of the pathway in this sense concerns the local administration that succeeds in breaking the silos within its organization and engaging the city users with all their varied spectrum of categorization. Nevertheless, co-creation attempts seem to be rather weak in recent applications. In fact, we can speak about failures in co-creation processes where these are not truly and effectively impacting on decision-making toward a complete and mature shared governance.

The last concept we tackle is ULL. Over the last decade, ULLs have become a common type of co-creative container of experimentation, offering the opportunity to research and innovation on a wider variety of challenges in everyday settings and test hypotheses and elements concerning pathways for transitions toward urban sustainable living. Particularly, Europe has become the role "hotspot" for this approach, powered by a strong promotion of dedicated research funding (JPI Urban

Abbreviations: CALs, CLEVER Action Labs (also contextualized as ULL); FEW, Food-Energy Water Nexus; UIP, Urban Innovation Partnership; ULL, Urban Living Lab; TOC, Theory of change.

Europe, 2019b). In fact, ULLs are emerging as a format for collective urban governance and experimentation to address sustainability challenges as well as opportunities created by urbanization (Bulkeley et al., 2016). ULLs have different goals, they are initiated by various actors, and they form different types of partnerships. In most cases ULLs work as an advanced and explicit form of intervention in delivering sustainability goals for cities by running (social, ecological, and technological) experiments. However, in this paper, we investigate the concept of ULL as the container or medium of intervention in the urban arena, whereas the shared governance process happens to address a particular sustainability challenge into a new concept of ULL as a “constitution of enabling environment” generated by the governance of innovation itself, see also Mahmoud and Morello (2021). Our perspective, that creates a new conceptual version of the ULL v2.0.; henceforth, remodeling the face of policy making and participatory governance tools for sustainable urban development.

Hence, we pose the questions on the viability of the co-creation process and the extent to which ULLs support transformation and act as urban transition catalysts. Accordingly, we question what are the features and approaches that best describe the effectiveness and success stories of co-creation processes. What are the defined pre-sets to establish such a process in a more comprehensive or inclusive way? And what are the successes and pitfalls of co-creation processes? And more, which co-creation mechanisms do work best in practice in achieving inclusion and better shared governance?

This paper puts in perspective the shared governance processes within these three projects’ experience of co-creation pathways based on comparative analysis of the ongoing ULLs. From the following analysis and discussion, the authors aim to delineate which key criteria and procedures permit achievement of sound shared governance dynamics through co-creation pathways and established ULLs. Moreover, the aim is to present a set of principles that establish co-creation guidelines for cities, municipalities, and local authorities in general, to be used for an enhanced implementation of long-term urban regeneration processes. We particularly focus on co-creation pathways that rely on citizens’ engagement and participation, whereby ULLs start transitioning toward a ULLs V2.0, see **Figure 1**.

DEFINITION OF KEY THEMES AND THEORIES: SHARED GOVERNANCE, CO-CREATION PROCESSES, AND URBAN LIVING LABS

Urban governance refers to how government at multiple scales (i.e., local, regional, and national) and stakeholders decide how to plan, finance, and manage urban areas. It involves a continuous process of negotiation and contestation over the allocation of social and material resources and political power (Avis, 2016). The expectation for government (including local, regional, and national) is to play the leading role in policy allocation. Collaboration is critical to overcoming barriers to implementation across sectoral boundaries and establishing

financing (Kronsell and Mukhtar-Landgren, 2018; McCormick and Kiss, 2019). We understand that urban governance plays a critical role in shaping the physical and socio-economic character of cities and influences local governments in engaging citizens in decision-making as well as responsiveness to citizen demands.

Shared Governance definition:

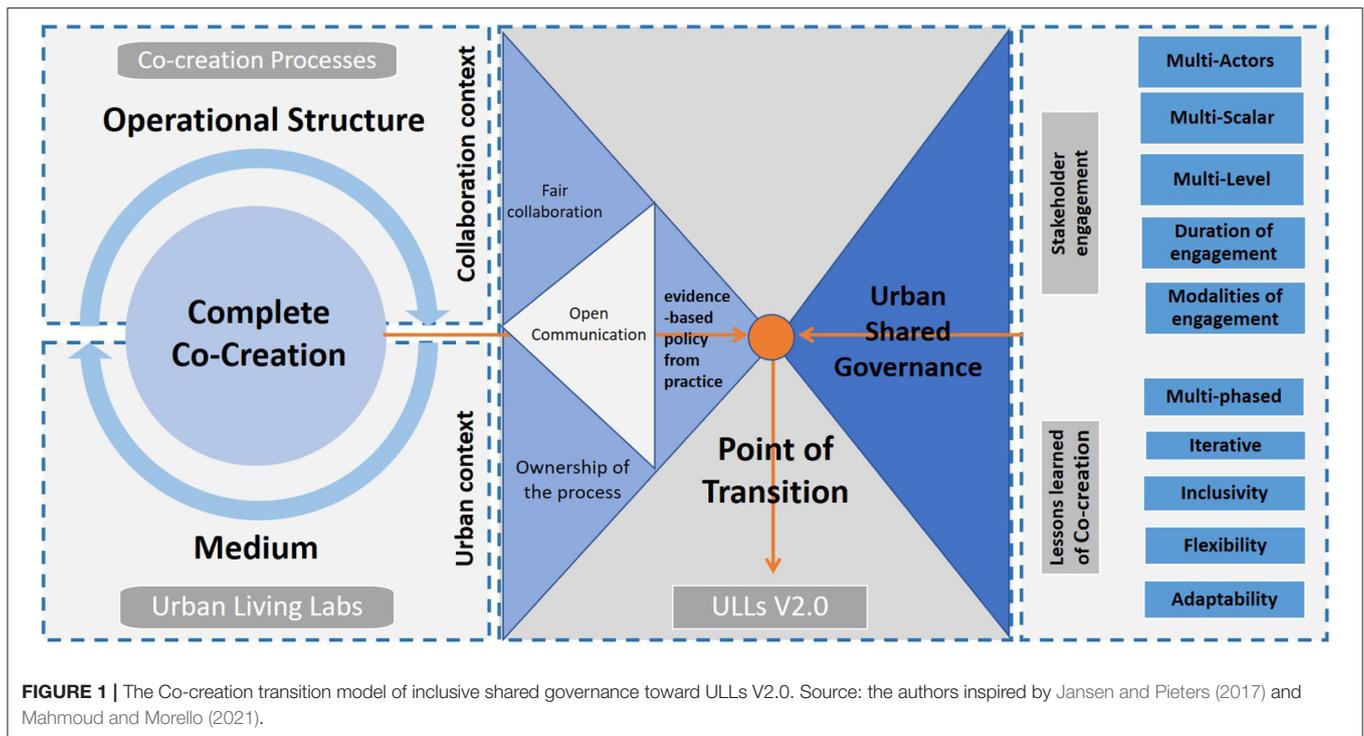
Governance is a negotiation mechanism for formulating and implementing policy that actively seeks the involvement of stakeholders and civil society organizations besides government bodies and experts. It is a model of decision-making that emphasizes consensus and output and that claims to be participatory (García, 2006).

The notion of shared urban governance in cities arises nowadays as an emergent trend, given a growing attention to urban sustainability, societal transformations, and innovative pathways for urban transitions (Brink and Wamsler, 2018). Shared Governance mechanisms usually differ by context, topics, and evidently the citizen engagement level, from being informed to being empowered according to the ladder of engagement (Arnstein, 1969; Dall’O’ and Bruni, 2020), especially for particularly challenging climate related actions (Voytenko et al., 2016; van der Jagt et al., 2019; Puskás et al., 2021). A recent shift toward empowering the community, rather than just consulting or documenting it, is reflected in an increasing use of public participation from community in residence where local knowledge is not extracted by outsiders, but instead shared by its community that is involved in the problem-solving processes from the start (Rock et al., 2018). The co-management and governance of cities in transition to carbon neutrality, including sharing cities or green transitions, are still undergoing a phase of policy and practice experimentation within the context of sustainable cities and communities (Loorbach et al., 2016; Davies and Laforteza, 2019).

The role of shared governance has been recently investigated in few EU funded projects including many aspects of empowering citizens and building sustainable engagement and behaviors within local communities, such as EKLIPSE and BiodivERSA. However, the need for inclusive shared governance mechanisms entails a stronger co-creation approach and pathways. Such co-creation methodologies embed a more flexible and resilient approach in their phases and stages (Davies and Laforteza, 2019). The novelty of embedding the co-creation process in urban planning practice lies in catalyzing resources toward the transposition of research into practice through policy and planning tools for local authorities and decision-makers.

In this research paper, the urban challenges faced by each project are considered invariable factors for the pragmatism of the analysis, and the final aim is rather to investigate shared governance experiences through co-creation pathways carried out in ULLs. In addition, ULLs in this research context are expected to have a place-based impact either through policy or replication of their learning outcomes in regeneration processes.

Managing cities and urban regeneration dynamics in highly consolidated and layered environments collaboratively are



among the main crucial challenges in the contemporary debate on urban transition. That ongoing debate halts wherever the discussion deepens on the role of scientists, policy-makers, urban planners and citizens to converge in a melting pot, whereas all of them have to work with each other, and collaborate to co-produce knowledge that responds to the socio-ecological challenges that cities face nowadays (Ahern et al., 2014; Raymond et al., 2017). By opening up this process to multiple actors, scientific discovery and transferring knowledge, a social process of co-creation is generated that democratizes science and bridges gaps between citizens and their city leaders. Hence, co-creation brings together a multitude of actors with different scales and different agendas to reflect, learn, and examine different social processes with new norms of transdisciplinary research (Kabisch, 2019).

Durose et al. (2018, 32) reflect on the role of advocacy between stakeholders and professional researchers in many real-life projects, to incentivize the co-production of knowledge in research that is relevant to assess its impact on society and support long-term partnerships. These new forms of showcasing outcomes and lessons learnt from mainstreaming urban policies and co-creation through experimentation in the format of urban transition have become popular as a dialectic form of real-life ULLs (Agrawal et al., 2015; Nesti, 2018).

Co-creation definition:

“Co-creation changes the game of innovation from designing for people to designing with people”(Correia et al., 2016).

Puerari et al. (2018, 4), define co-creation as “making something together”; other literature on wider urban planning policies refers to co-creation as “systematic process of creating new solutions

with people -not for them; involving citizens and communities in policy and service development,” see Bason (2013) and Mahmoud and Morello (2021). Co-creation refers to any act of collective creativity which means that creativity is shared by two or more people. Indeed, it is an approach that enables a wide range of people to have a creative contribution in the formulation and solution of a problem (Gudowsky and Peissl, 2016). In further systematic theoretical works, citizens engaged are often considered as co-implementers in throughout co-creation and co-production of services (Voorberg et al., 2015; Lember et al., 2019). Ultimately, co-creation helps to enhance organizational knowledge processes by involving the customer in the generation of meaning and value by co-designing and co-implementing solutions. Nonetheless, if used in public policies combined with effective active participation, the co-creative approach yields better sharing of urban regeneration processes and improves the know-how for decision-making mechanisms.

Gaps Between Theoretical Frameworks of Co-creation and Urban Shared Governance Toward Urban Transition in ULLs

Followingly, the known gaps between theoretical frameworks of co-creation and practical experience pave the way to the development of more innovative pathways toward transitions in ULLs. Nowadays, shared governance overlapping frameworks with co-creation innovative pathways propose a new form of urban governance that is “open, supporting evidence-based policy making and collaboratively shaped” by new technologies (Brink and Wamsler, 2018, 83; Davidson et al., 2019; Meijer et al., 2019).

Hence, we discuss the importance of embedding co-creation principles -as easy as it may sound but rather difficult on the practical side- toward creating more participative and realistic pathways in successful ULLs (Neuens et al., 2013; Puerari et al., 2018). According to Jansen and Pieters (2017, 4) co-creation calls on some principles for better results such as togetherness, ongoing, productive, transparent, supported and value driven. In this research, due to the focus on urban planning and ULLs implementation, we identify four main gaps on implementing co-creation in practice as follows:

Complete Co-creation Is Based on Collaboration Between All Relevant Stakeholders

The success of shared governance experiences in urban regeneration processes relies substantially on the inclusion of stakeholders throughout the whole process of the planned projects. The success of tools of co-creation planning and co-implementation depends on the model's specification of stakeholders' level of participation (inform, involve, consult, collaborate, empower, see **Table 2**) as well as on their appropriate involvement in the process timeline, for example the RASCI Model,¹ see also Hightower (2009). ULLs aim at empowering multiple stakeholders in the experimental approach at the same time bringing science, policy, business and civil society together (Bulkeley et al., 2016).

Open Communication With Different Stakeholders

Consistent implementation in public projects, policies or services requires establishing clear communication channels between the cities' local administration, stakeholders, and citizens in general. Transparency and responsive feedback in communicating regeneration processes and projects make these more attractive for people to participate, as well as enabling achieving maximum relevance in the delivery of outcomes for end-users. Moreover, overcoming the silo boundaries of communication for the co-production of knowledge between policy-practice-society nexus is relevant for the success of co-creation pathways, see Scholl and Kemp (2016). Cultivating a common language for communicating objectives and concepts, possibly with a shared glossary of terms, is also quintessential for assuring the baseline of alignment among stakeholders and avoid misinterpretations.

Ownership of the Process and Long-Term Commitment

In urban planning, more transparency from the public administration encourages citizens to engage in the process and take ownership of the co-creation activities in general. Nevertheless, shared governance processes are frequently abandoned by stakeholders. This depends on different factors, see also Fors et al. (2021). Firstly, abandonment emerges as a result of the long-term temporal frame of urban regeneration

and implementation processes, which requires a strong and continuous coordination of co-creation pathways to keep interest of stakeholders alive. In fact, conducting processes of co-creation requires specific skills such as facilitation, organization and planning of activities, follow-up and monitoring of outcomes. Secondly, commitment and sense of ownership by stakeholders is linked to the specific time along the process in which they get involved. ULLs sometimes get initiated in already established processes, which can eventually spark the interest of facilitators and encourages stakeholders to get engaged but can also risk be weakening the involvement if the process is already advanced. Hence, involving stakeholders from the very beginning to the far end is crucial to generate sense of belonging. In fact, ownership of the co-creation process is highly debatable if not related to post-co-creation engagement as well, in a sense that co-development and upscaling of the solutions is also part of the pathway ownership. Often, the upscaling of solutions is driven by stakeholders and is a sound indicator for the up taking of solutions.

Supporting Evidence-Based Policy From Practice on Co-created Solutions

Co-creation is a cumulative process that enhances scaling-up of urban transition projects through ULLs, according to a hands-on-experience process that leads to shared results. As co-creation is often experimental and entails flexible design approaches to test and promote long-term strategies, which are often radical and contain innovation potential. This makes difficult to attain in the short term an evidence-base necessary to confirm that a new co-created solution (e.g., a planning policy, a new design or service) will be successful in the long term and should be promoted or even embedded in everyday practice (Fanzini et al., 2020). Henceforth, the success of co-created solutions can be deduced from the shared and inclusive process that generated them, as a true expression of democracy.

Urban Living Labs' Dynamics as Form of Co-creation Dynamics Context

In the authors' understanding of ULLs, by drawing both on theory and practice, co-creation fosters transition in ULLs, through which cities (intended as logical loci for action) aim to develop gamechanger solutions in urban sustainability and sustainable development in general, see Mulder (2012) and Nesti (2018). However, recent debate concerning studying, exploring, testing and applying a highly tested living lab methodologies allowing urban transition of cities is still emerging in academic studies after practice experiences (Bulkeley, 2019; Nesti, 2020; Hölscher and Frantzeskaki, 2021; Rizzo et al., 2021; Scholl and De Kraker, 2021; Veeckman and Temmerman, 2021). Nonetheless, the broader literature definition on urban and environmental governance identifies three key dimensions of ULLs: (1) geographical embeddedness (the context), (2) experimentation and learning approach, and (3) participation and end-user involvement as partnerships, see also (Neuens et al., 2013; Bulkeley et al., 2016). ULLs can also be viewed as spaces designed for interactions between a context and a research process to test, develop and/or apply social practices

¹Responsible, Accountable, Supporting, Consulted, and Informed. RASCI is an acronym derived from the five key criteria most typically used: **Responsible, Accountable, Supporting, Consulted, and Informed**. A RASCI matrix can be used to clarify responsibilities during the preparation and the implementation of a project, in the context of stakeholder. See <https://clevercitiesguidance.files.wordpress.com/2019/09/tool-11.1-cal-co-implementation-scheme.pdf>

and/or technology to a building or infrastructure due to their focus on co-creation through experimentation through explicit geographical embeddedness (Franz, 2015; Voytenko et al., 2016, 46–47; Van Montfort and Michels, 2020).

The Joint Programming Initiative (JPI) Urban Europe, which is the main funding agency for living lab related projects in European cities, introduced the term “urban living lab” and defines it as “a forum for innovation, applied to the development of new products, systems, services, and processes, employing working methods to integrate people into the entire development process as users and co-creators, to explore, examine, experiment, test and evaluate new ideas, scenarios, processes, systems, concepts and creative solutions in complex and real contexts” see JPI Urban Europe (2019a).

The European Network of Living Labs (ENOLL European Network of Living Labs) defines them as “user-centered open innovation ecosystems based on systematic user co-creation approach, integrating research and innovation processes in real life communities and settings.” In this research we look at ULLs as the “medium” or the spatial context container through which the co-creation pathways are encouraged to take place whether physically, virtually or by any mean of engagement, see **Figure 1**. In other similar European projects, ULLs are also considered both as an arena (geographically and institutionally) as well as an approach for exploratory collaboration between academia, citizens, and local authorities (McCormick, 2020).

Another challenge in co-creation pathways of innovation in practice is time, and in particular temporal dynamics and changes of ULLs. In EU-funded projects, and typically in urban regeneration pathways, a ULL will run for as long as the project (usually from 3 or 5 years), and after this period data is collected, results are drawn together, a summary is written and, eventually, impact is achieved and changes in the wider urban context occur. However, mounting concern is evident from practice, innovators, and research that this last monitoring step is too rare, and, after the project funding stops, there is little systematic integration of any of the practical outputs. Hence, the intended and potential contribution by ULLs toward urban transformation in the long run remains largely unfulfilled (Wolfram, 2016; Haase et al., 2017). Urban spatial planning is therefore considered the key driver of transition, including the definition of appropriate pathways for critical intervention in city-regional development, to realize that ambition for societal transformations related to urban transition (Rivolin and Faludi, 2005; Edwards-Schachter et al., 2012).

To conclude, the conceptual understanding of ULLs role within the urban context, see **Table 1**. Requires a set of criteria to be established at the project launch. In some cases, the continuity between different projects is also a required aspect, in order to ensure cohesion of practices and maintenance of long-term results, especially in some contexts where social cohesion is rather compromised.

APPLICATIONS AND CASE STUDIES

In the following, we describe the three selected projects to analyze their ULLs as a comparative version of the set-up, co-creation processes and timeline for their development. To note that in

TABLE 1 | Running ULL dynamics within co-creation processes.

ULL running within co-creation processes	
Setting of the “ULL space”	Activities to be held in the project launch and planning phase
• For whom	Mapping stakeholders; profiling target audience; identifying the right personas
• With whom	Setting the ground to work in ULL with the right people to benefit from the delivered service.
• How	Co-creation tools and activities: workshops, focus groups, face-to-face meetings, site walks, plenary meetings, and so on.
Physical space	Physical structure; community hub; mobile structure (also thought as milieu for conducting activities)
Virtual space	E-participation reach out, tools and digital facilitation
Temporal continuity	Recurrence of events, continuity of engagement with local actors and stakeholders
Multiplicity of stakeholders’ partnerships	from different sectors science, policy, society and market in a so called “quadruple helix model”
Medium of engagement and tools	Availability of medium (space and place), whereby different tools (techniques) could be used for co-creating and co-designing solutions

Source: the authors.

this phase, the authors do not look at the specificity of the sustainable measure put in place by the projects, whether carbon neutrality, digital transition, sustainable land-use and urban greening, inclusive planning for urban livability, and any other policy toward sustainable development in cities. For instance, CLEVER Cities² investigates social inclusivity of urban greening and Nature-based Solutions (NBS) integration into planning policies, whereas Sharing Cities³ focuses on ICT enabled and participatory processes mainly addressing reduction of energy use in buildings retrofitting processes; lastly, SUNEX⁴ looks at the sustainable Urban Food-Water-Energy (FEW) Nexus.

CLEVER Cities: Co-creation and Open Innovation Governance Model

CLEVER Cities aims at spreading the use of NBS to address urban challenges and promote social inclusion in cities across Europe, South America and China. Three cities are on the forefront of the experimental processes: Hamburg, London, and Milan and other six cities are fellow to NBS implementation. The project mainly developed two main concepts: Urban Innovation Partnership (UIP) and Clever Action Labs (CALs) as main representation of the powerful mechanisms to implement NBS in urban fabrics. Running on different spatial scales, CALs operate as ULLs of co-created NBS. The co-creation pathway as a reflection to the operational structure of NBS implementation

²A European Commission funded project from the Horizon 2020 Innovation Action Programme under Grant Agreement No. 776604. See <https://clevercities.eu/>

³A European Commission funded project from the Horizon 2020 Innovation Action Programme under Grant Agreement No. 691895. See <https://www.sharingcities.eu/>

⁴A European Commission funded project from the Horizon 2020 Innovation Action Programme JPI under Grant Agreement No. 730254. See <https://jpi-urbaneurope.eu/project/sunex/>

is established as an operational framework encompassing six stages as follows: UIP establishment, co-creation planning, co-design, co-implementation, co-monitoring, and co-development.

In CLEVER Cities a *Co-Creation Guidance* (Morello et al., 2018) has been developed. Its aim is to better understand and coordinate the co-creation processes that shape the implementation of NBS in socially inclusive urban regeneration processes. The pathway consists of 16 steps, not necessarily consecutive nor contemporaneous. The structure is intended to be flexibly applied in different urban contexts based on necessity. The steps are furnished with a variety of recommended, optional and fundamental tools that help cities establish a complete co-creation process taking in consideration the spatial place-based context, type of NBS interventions and the governance model selected by the responsible authority. Several toolkits for the co-design, co-implementation, and co-maintenance of NBS are developed with cities to use as reference in their progressive co-creation process (Morello et al., 2018). The efficiency of the guidance is currently being monitored in the practice of nine CALs through corresponding deliverables as established by the Grant Agreement.

The co-creation pathway and guidance⁵ in the CLEVER Cities project are seen as a form of “open innovation,” in which ideas are shared, closely connected to user-generated content, and actively communicated to a wider public in order to promote originality and effective governance. Likewise, the co-creation pathway in practice is about motivating people, inspiring participation, sharing results, continuing development, and delivering results at different levels.

Sharing Cities: Human-Centered Design of Digital and Physical Measures

Sharing Cities leveraged digital technology to address the main urban contemporary challenges. From 2016 till 2021, three European lighthouse cities – London, Lisbon, and Milan – trialed a holistic strategy for improving urban mobility, increasing the energy efficiency of buildings, and reducing carbon emissions.

Operatively, the project was developed with the integration of virtual and physical environment through multiple measures. On one hand, the implementation was based on data deriving from smart technologies and sensors specified for the above applications in an online platform; at the same time, participatory approaches were informed by both citizens and relevant organizations, including municipalities and business. Local actors play the role of subject and object of investigation. The user-centered design approach enabled the partnership to design products, services and systems according to the needs of the end users. It ensured that each stage of the design process is informed by user needs, rather than according to assumptions made by designers or other stakeholders. In the Sharing Cities project, user-centered design focused on citizens, city officials, businesses, and related service providers at various stages of the project.

⁵See <https://clevercitiesguidance.wordpress.com/>

Furthermore, these actors were engaged in collaborative design processes for an effective development and implementation of the technological measures. Co-design tools and methods were adopted and developed for eliciting, capturing and elaborating knowledge at multiple levels of visibility, from explicit to latent (Salvia and Morello, 2020).

SUNEX: Sustainable Urban Food-Energy-Water Nexus

SUNEX aims to define transition pathways, specifying Food-Energy-Water (FEW) Nexus policy guidelines in the context of climate change, to be delivered by strategic spatial planning the city-region over the next 20–30 years. Central to the development and specification of SUNEX policy guidelines is optimization of FEW relations in the context of city-region political and policy objectives for sustainable development including climate change. A core SUNEX objective is to provide definition and impetus to the process of urban transformation management via the specification of policy guidelines for FEW, considered as one component of the wider socio-economic environmental reality of the city-region. The project aims to support urban sustainable development and the delivery of carbon neutral cities.

These various policy requirements are operating within the city-regional context, where there is a critical requirement to develop operational solutions for urban planning that can deliver the desired “win-win” policy co-benefits over time. Integrated assessment of the interconnected socio-economic and environmental dynamics of the city region to support decision-making and the development and delivery of policies for sustainable urban development are the cornerstone of city planning policy throughout Europe. These policy objectives are accordingly the central focus for SUNEX. The essential policy requirement is to provide integrated understanding and assessment of the highly interconnected dimensions of food, energy and water –where “Nexus effects” and optimization must be sought in a wider integration context– this is principally the context of city-region spatial plan commitments to climate change mitigation.

METHODOLOGICAL ANALYSIS

In order to answer the research questions, we propose the following investigation criteria for a pragmatic and practical comparative analysis. In the beginning, we look at different scales and types of stakeholder engagement mechanisms in the three projects as a general scope. Secondly, we analyze the main key factors of shared governance through defining engagement (methodologies of engagement, types of stakeholders, and activities of engagement carried out through co-creation process). Lastly, we compare the different co-creation pathways that the three projects have taken in order to achieve an inclusive shared governance. In these two later parts we analyze the results of these co-creation experiences by focusing on two main cities involved, i.e., Milan and Bristol.

TABLE 2 | Different “Levels” of and “scales” of stakeholder engagement (elaborated by authors from IAP2, 2014).

Level of engagement	Nature of engagement	Description
Inform	Non-participatory	A uni-directional flow of information from programme to stakeholder
Consult		A process by which stakeholders are asked for information or their opinions.
Involve	Participatory	Stakeholders are involved in discussions about the programme and can influence decisions, but are not directly involved in decision making
Collaborate		Stakeholders are fully involved, often included in decision making
Empower: full involvement, often lead on decision-making		Stakeholders are fully involved, often facilitated to lead on decision-making

The Criteria of Assessment for Shared Governance Within Co-creation Processes in Practice

In the following section we build our methodological analysis on three aspects: stakeholder engagement, co-creation scenarios, and resulting changes in ULLs.

Stakeholder Engagement: Scale and Level

Stakeholder engagement is a fundamental part of any co-creation process that includes co-design and co-implementation phases. Stakeholders can be defined as people, groups or organizations that have a vested interest in initiatives or activities being undertaken and can be affected by the issues concerned (Aligica, 2006). There can be different types of stakeholders who operate at different levels and at different scales or issues (IDS, 2013). Well-planned and inclusive engagement leads to better outcomes at all levels. Building on the work of Arnstein (1969), the International Association for Public Participation developed a five-point spectrum of public participation (IAP2, 2014). These approaches to engagement can also be categorized as participatory and non-participatory, see **Table 2**. While non-participatory methods are very one-sided, where you either impart or extract knowledge, participatory methods are more two-sided, meaning you collaborate with others to generate change. This classification has been collectively approved to be used in CLEVER Cities project and Sharing Cities.

Usually, a variety of different stakeholder types and interests are involved in any urban sustainability problems, and these stakeholders are often highly reliant upon each other for solving the problem and finding a solution. This raises several issues, such as lack of knowledge, awareness, priorities and the value orientations of stakeholders leading to less sustainable choices, or private vs. public agendas. Reconciliation of all these different interests requires new ways of working: co-design and co-creation in general, leading to a common vision of the problem

and viable solutions, instead of traditional participation, but also recognizing different power balances. As a possible solution to this complexity of the stakeholder engagement dilemma, a variety of approaches and nature of engagement methods are adopted. For instance, engaging stakeholders in different stages is often controlled by the level of engagement related to the role they can play in each stage. In other words, the level of engagement depends on the need for their participation or non-participation in the decision-making process itself.

Analysis of Scenarios’ Building Modalities Using Co-creation Through Forecasting and Backcasting Methodologies

Concerning the modalities of project scenarios’ building within co-creation activities, these differed between the three projects substantially, on one hand due to the project type with focus on urban planning policy, and, on the other hand due to the timeline and financing resources available to each case application. Broadly, within the three projects at least three co-design workshops and several participatory activities took place. The noticeable differences lie in two specific methodologies carried out by CLEVER Cities and SUNEX projects respectively, namely the Theory of change (TOC) by forecasting and backcasting activities. The TOC is a common practical tool used to define long-term goals (outputs and outcomes), see also (Reisman and Gienapp, 2004) based on backwards mapping for activities and impacts (hereafter backcasting) or by forward mapping (hereafter forecasting). The substantial difference between the two methods is that the forecasting using TOC develops multiple future scenarios from one common present, while the backcasting method develops multiple pathways to a single defined target scenario. These envisioned transition pathways are specified in policy strategies supported by expert judgement, according to, and on the basis of available technologies, current trends in time (Ashina et al., 2012, 585; Kanter et al., 2016, 72).

Analyzing the ULLs of the Three Ongoing Projects: Lessons Learned From the Co-creation Processes

CLEVER Cities: Co-creation Pathway in Milan ULLs

The Co-creation process in CLEVER Cities of Milan built up cumulatively from the start with the establishment of the Urban Innovation Partnership (UIP) in collaboration with the resilience department of the municipality administration launched in November 2018, see Mahmoud and Morello (2020). Subsequently, periodic meetings and workshops with high level governmental authorities and private partners continued to progress with the local team and provided insights into the variety of implementation opportunities for NBS within the urban context of Milan. The local team started co-planning activities with small target groups of stakeholders by using TOC workshops and several site visits to guide the possible uptake of the shared governance with local stakeholders. Several press conferences and public hearing meetings were held collectively in the three ULLs, and since the COVID-19 pandemic started, co-design activities moved to online formats using digital tools

TABLE 3 | Co-creation pathway phases, challenges, enablers, and outcomes.

Co-creation pathway	
Complete co-creation process (criteria and phases)	
• Co-design	Citizens are the main decision makers of the process.
• Co-implementation	Putting citizens in the center of implementation together with local municipalities and authorities.
• Co-management	Shared maintenance and monitoring of solutions.
• Co-development	Potential for up-scaling; replications of solutions elsewhere; business model development.
Shared governance	
• Flexibility and adaptability	The process is opened to receive new input and adapt to changing conditions (resilience).
• Openness and inclusivity	Representativeness of populations; diversity of actors.
Co-creation pathways	
• Catalysts/drivers	Municipality interest, local partnership, community interest, private investment.
• Challenges/pitfalls	Temporal, spatial, social, financial, Systemic changes, management, and governance challenges.
• Expected outcome of co-creation/Co-creation enablers	A new culture of shared urban governance permitting public administration routines through novel policy guidelines, change in governance structure and procedures in decision making, overcoming public administration silos.

and online platforms for stakeholder collaboration. Currently, the project is at the mid-phase of co-design⁶, whereby the local facilitator entity is responsible for leading the co-design workshops offline and online, as well as bringing citizens and local partners to the heart of the decision-making process.

As illustrated in **Table 3**, co-creation pathways are often challenging during the place-based implementation throughout the lifetime of the ULLs. That is mostly due to the nature of the measures put in place. However, in our comparative analysis of the nine CALs, we deduced that not all projects advance equally even with the same approach or equal phases of co-creation (Mahmoud and Morello, 2021, 270).

Sharing Cities: the Co-design of Urban Services in Milan ULL

Sharing Cities applied co-design methods for the development of multiple measures across the lighthouse cities. For this paper we focus on the development of urban services in Milan.

The aim was to foster a sustainable impact through the nexus between three Ps, i.e., People (local community), Places (urban areas), and Platform (digital means for data collection).

For this, stakeholders participated with different contributions. Residents and the local community were first informed about the aim and impact of the project; eventually they were involved in the definition of critical areas and influences of daily urban practices mainly through co-design workshops.

⁶See more on CLEVER Cities co-design timeline here <https://clevercitiesguidance.wordpress.com/toolkit/>

Representatives of the local administration, associations and third sectors were informed as well and eventually consulted about their views on the influences of urban sharing, and on the concept of a measure developed by the researchers by drawing on the results of the previous participatory activities. The proposed platform drew on shared, open and inclusive forms of governance, as it fosters the pro-active collaboration across multiple actors in a network based (rather than centralized) form.

Despite positive feedback provided by the stakeholders consulted, resources were not allocated to the development of the concept delivered by the project by other relevant stakeholders, including local administration and business association. This suggests that co-design processes require the prior allocation of financial and human resources for the development and creation of the concept delivered.

SUNEX Policy Guidelines–Co-Creation Pathway in Bristol ULL

The co-creation pathway is operationalized during the second participatory phase of the project (M12 onwards) addressing challenges in the realization of sustainable city vision, and the deployment of the process of transition management defining transition pathways to sustainable and carbon neutral cities. Backcasting forms the central methodology, which as a participatory foresight process provides a step-by-step framework to identify future adaptive FEW management strategies, integrated with broader policy strategies for sustainable cities. This qualitative assessment supporting policy guideline development proceeds via stakeholder engagement workshops in each case study city (Vienna, Berlin, Bristol, and Doha) to consider the essential facets of scenario defined visioning of FEW related interactions, and according to alternative potential drivers of change (food localization, renewable energy options etc.), as conditioned by policy objectives for strategic spatial planning of the city-region over 20–30-year timescale.

FINDINGS FROM THE THREE PROJECTS

Stakeholder Engagement Mechanisms: Multi-Level and Multi-Scalar

In **Table 4**, we discuss the different stakeholder engagement mechanisms based on multi-scale and multi-level engagement model, see **Figure 1**. For instance, **CLEVER Cities** operates on four scales:

- Consortium scale (all the partners get involved in decision making and procedural processes through steering group meetings) that is the empowerment level of involvement.
- City scale (each city involved is required to manage a local team composed of a variety of partners and responsibilities that manage the project at the territorial level), that is the collaboration scale.
- The Urban Innovation Partnership (UIP), a local alliance of stakeholders, is the most common framework to implement NBS in ULLs, which is the involvement scale.

TABLE 4 | Stakeholder engagement mechanisms (multi-level/multi-scalar/multi-modal).

Stakeholder ladder involvement (multi-level)	Importance of stakeholder collaboration and multi-actors in the process short/long-term
<ul style="list-style-type: none"> Information Consultation 	General audience of the living lab Private or public entities, associations, NGOs, NPOs
<ul style="list-style-type: none"> Involvement Collaboration 	Local citizens and public administration Participants to ULL co-creation activities, coordinated by facilitators
<ul style="list-style-type: none"> Empowerment 	Leading stakeholders
Scale of engagement (multi-scalar)	Urban and/or local partnerships change during the engagement process and at different stages.
<ul style="list-style-type: none"> Urban partnership Local partnership 	Creation of a local stakeholder alliances and partnerships through different modalities of engagement Participants to a local, project specific ULLs is also considered as a local partnership
Duration of engagement (multi-temporal)	Temporal duration and continuity of engagement in the local alliance and ULL lifetime.
Modalities of Scenario building and engagement (multi-modal)	A variety of scenario building models have been adopted such as forecasting or backcasting methodologies

Source: the authors.

- CLEVER Action Lab (CAL) scale, the single project specific ULL, where all the co-design workshops and co-implementation of NBS takes place. Nine CALs are established in CLEVER Cities project and operated collectively as three in each city.

Sharing Cities is structured with three key field stakeholders fairly corresponding to three scales:

- Individual and societal scale (People), with the engagement of citizens in co-design activities.
- Urban scale (Place) through tangible implementations.
- Virtual or global scale (Platform), through the development of a common digital platform where data regarding urban performance and citizen life are collected.

Each of the three frontrunner cities has promoted the creation of their local eco-system.

SUNEX stakeholder engagement is structured according to the required skills for development and delivery of the transition plan:

- Plan specification and implementation is multi-scalar and integrated, linking local and city-regional visions and targets in a framework of policy coherence.
- As a result, stakeholder engagement is specified to address multi-scale plan requirement engaging FEW nexus stakeholders with governance at city and regional levels, within a frame of sustainable city-region development.

- Stakeholder engagement focused on involvement and collaboration with local FEW stakeholders’ expertise and city planning agencies to secure bottom-up empowerment in defining transition pathways for Bristol One City Plan at a scale of local partnership.
- Engagement modality is delivered by backcasting methodology with specific duration of engagement according to the requirements of the “One City Plan” refresh stage.

Co-creation Process Dynamics Analysis From Case Studies: Multi-Modal and Multi-Phases

Co-creation by Forecasting TOC in CLEVER Cities

CLEVER Cities adopted a Public-Private-Partnership model since the project inception in June 2018. The established UIP brings together the governance process in the heart of the co-creation pathway adopted by different groups. These different stakeholders’ groups work together to co-plan, co-design, and co-implement NBS for the city crossing both vertical and horizontal decision-making mechanisms. For each ULL, different “leading actors” were identified within the first launch activities in order to ignite the engagement with larger groups of stakeholders at different levels of the project afterwards. Each of the three ULLs established in the city of Milan for instance have different acting leaders, consequently, they all report to the local project manager hired by the municipality. In other words, transversal coordination of co-creation in all aspects is followed, see also (Mahmoud and Morello, 2018). Two TOC workshops were conducted to build the pathway to the implementation of NBS in each of the three ULLs, see (Reisman and Gienapp, 2004). Depending on the ULL itself, architects, experts on greening solutions, and citizens were involved in the co-creation process for implementing green roofs and green walls in private buildings⁷ Social experts and designers from the local municipality of Milan, as well as citizens from Giambellino 129 neighborhood⁸ were also involved in co-designing a new community park. The main idea behind TOC was to build on the narratives from the people that possessed contextual information about the areas of the ULLs, in order to forecast the change, they want to see through NBS solutions. For instance, the TOC workshops in all three ULLs included forecasting outputs, and outcomes, in order to reach a common definition for activities to be carried out by ULL leaders and local teams.

Co-creation Backcasting Methodology in SUNEX

Deployment of the normative backcasting methodology in Bristol to engage with stakeholders was considered the most effective means of engagement targeting specification of policy guidelines with focus on climate neutral cities, and with recommendations for deployment of the same method of stakeholder engagement in Vienna, Berlin, and Doha.

This normative backcasting scenarios building activity (Joint Research Centre, 2008; Robinson et al., 2011; Wangel, 2011), aims to define the critical transition pathways, and associated policy

⁷See <https://milanoclever.net/cal-1/>

⁸See <https://milanoclever.net/cal-2/>

pathways, to deliver carbon neutral policy objectives 2050 via the following process:

- Specify normative scenarios focused on policy targets e.g., carbon neutral, in terms of multiple policy objectives, as relevant to the socio-economic and environmental diversity of sustainable development. A set of future goals is agreed upon while the model is used in combination with storylines to explore what needs to change to achieve these goals.
- Deploy backcasting that starts from the endpoint of policy targets, in a process that “navigates” the “policy environment,” in which policy targets interact with socio-economic and environmental variables.
- Define transition pathways focused on the required action, costs and benefits of achieving policy targets as a basis for the definition of policy guidelines.

RESULTS AND DISCUSSIONS

In order to respond to the research question and hypothesis, the following section will discuss the results of the three projects collectively. The discussion of comparative analysis is mainly looking at results from the main three research concepts: (1) co-creation processes, (2) shared urban governance models through stakeholder’s engagement mechanisms, and (3) ULLs challenges and evolution. The results of this analysis show a need for an evidence-based policy tendency toward addressing sustainable urban transition themes especially in related societal sectors, see also (Ernst et al., 2016); in addition to new models of shared governance in ULLs.

Lessons Learned From Co-creation Processes

The creation of multi-level urban governance systems for adaptation and mitigation using NBS, smart solutions or any other sustainable urban development measures that include citizens aiming to drive improved integration into related science-policy is not an easy task. It is important because local climate resilience depends on the level of inclusiveness and flexibility of the combined set of mitigation measures employed, rather than the effectiveness of a single measure or activity in itself, see also (Faivre et al., 2017; Menny et al., 2018; DeLosRíos-White et al., 2020; Ferreira et al., 2020; Hölscher and Frantzeskaki, 2021; Mahmoud and Morello, 2021). In **Table 5**, the co-creation processes are cross-compared throughout the three projects, below a collective summary from the general lessons learned from co-creative pathways in practice.

Co-creation Pathways Are Never Linear but Multi-Phased and Iterative Processes

The overall vision of the three projects confirmed the need for co-creation processes to be iterative and open for changes on all scales from beginning to end. Hence, Co-creation approaches should not just be experimental, and collaborative only, but also aim to facilitate inspiring solutions, supporting local communities to boost urban transition in cities. The principal risk from the multidimensional nature of urban transition

processes such as co-creation pathways is that they are influenced by policies from diverse domains risking incoherence between the expected outcomes and real results attained.

Co-creation Processes Should Be Inclusive and Embed Open Communication and Dissemination Channels

No one is left behind. Everyone plays an important role as information and engagement empowers across all scales. Complete co-creation in this sense is based on fair inclusion, collaboration and enhancement of ULLs to integrate local knowledge as well as to strengthen the place-based ownership and empowerment of all stakeholders for long-term commitment. Communication as well plays a very important role in this process, ensuring transparency and success. In some cases, a separate or independent agency should be hired to ensure neutrality of communication messages; as well as consistency to keep stakeholder engagement active through medium and long-term projects’ lifetime such as EU funded projects.

Co-creation Should Be Flexible and Adaptable to Risks and Hazards

The co-creation processes of the three projects in general faced various challenges that drove the process to be more resilient and adaptable.

Co-creation Processes Require Leadership and Governance Flexibility

- 1- Continuity of leadership is a challenge in long-term urban regeneration projects. Change of team leader or management within the municipality happened in CLEVER Cities during the first year of the project. The local team had to readapt to different leadership management in the project. That is somehow expected during long-term projects lifetime as political and organizational positions change faster than the expected lifetime of the project.
- 2- Change of project timelines and expected deliverables timings. Because of the COVID-19 epidemic emergency, the previously planned activities and expected deliverance dates changed due to total lockdown in the city of Milan and the whole of Italy. The co-implementation and co-development plans are all re-adapted and expected to be delivered with a delay of about 6–12 months. That was common experience for all the three projects.

Co-creation Processes Should Foresee Procedural and Legal Flexibility

- 1- Public procurement dynamics are rather complex and bureaucratic. For instance, in CLEVER Cities, the inclusion of the co-design activity within the public work construction of the Tibaldi train station of CAL3 had a big impact on the public bidding and procurement procedures and calendar. In fact, splitting the bid for construction works in two phases was the proposed solution that enabled the co-design phase to be conducted with a more relaxed time span and provide useful input for those specific interventions that involved citizen engagement.

TABLE 5 | Resulting cross-comparative analysis from the three main research concepts.

Criteria of analysis	CLEVER cities	Sharing cities	SUNEX
Co-creation processes development	<ul style="list-style-type: none"> Multi-actor: academia, private sector, public authority, citizens and civil society Multi-level: The actors are engaged by using different techniques on different roles. Multi-phases: the project is divided on 5 phases in which each stakeholder have a specific role. 	<ul style="list-style-type: none"> Multi-actor: academia, private sector, public authority, residents and civil society Multi-level: ranging from the definition of smaller products, through building features and up to urban arrangements. 	<ul style="list-style-type: none"> Systematic changes in multi-temporal changes related to long-term vision for sustainability and resilience Substantive focus optimization of food energy and water nexus relations conditional on climate mitigation priority
Shared governance model	CLEVER project in Milan mainly looked to empower the citizens throughout decision-making processes. The major input is during the co-design whereas citizens participated in the actual green roofs or the Giambellino park as well as the Tibaldi station selection of NBS and eventually participate in co-management after implementation.	The design of urban service systems in Milan was shared and codesigned as per original project proposal, with the involvement and consultation of both residents and organizations.	SUNEX Bristol stakeholder engagement is structured according to the required skills for development and delivery of the Bristol “One City” transition plan. Plan specification and implementation is multi-scalar and integrated, linking local and city-regional visions and targets in a framework of policy coherence.
Stakeholder engagement mechanism	Co-design workshops, events and empowerment through questionnaires for social monitoring of NBS co-benefits in ULLs	Co-design and participatory design process based on workshops, interviews, questionnaire, big data sharing, collection and analysis	Co-design and participatory design process articulated via workshop engagement operationalizing backcasting methodology
ULLs challenges and evolution	<ul style="list-style-type: none"> <i>Temporal</i>: implementation of NBS is often long-term beneficial to the local community and wider-city scale <i>Spatial</i>: not all available land lots could be transformed into green spaces. <i>Social</i>: social acceptance values around NBS in contested contexts. <i>Financial</i>: business models and financing mechanisms of NBS are still being developed by the city municipality and private partners. The current mechanism is mainly financed by the CLEVER Cities project itself and the municipality public works budgets such as in CAL1. 	<ul style="list-style-type: none"> <i>Social</i>: engagement of citizens is not necessarily achieved or constant, as they may not find this as a priority, or it may conflict with other duties. <i>Temporal</i>: the timing of the implementation may require short term responses to meet deadlines which cannot be modified. <i>Managerial</i> or Competence: codesign processes require competence spread across partners and stakeholders when decisions and activities are fragmented, dispersed through multiple actors at different stages of the decision process. 	<ul style="list-style-type: none"> Systems co-evolve with the systems’ technologies over long periods of time, creating lock-ins resistant to fundamental change Systemic challenges are complex and multi-dimensional, viewed differently by diverse groups Systemic nature of environmental problems creates a significant governance challenge – interlinkages in complex societal systems mean that government interventions altering one part may cause failure elsewhere.

Source: the authors (for complete cross comparison, see **Supplementary Materials**).

- 2- Financial resources: In some specific ULLs, the most rewarding way to get citizens involved was through increasing by 10% the reward given by the municipality for green roofing to permit a more flexible financing mechanism.
- 3- Legal adaptability: In Sharing Cities, implementation processes have been slowed down by restrictions imposed by the law and ability to adapt to them, but although this has proved beneficial occasionally, generally resident’s engagement was slowed down.

Future Perspectives: Consolidating Shared Urban Governance and Looking Beyond Urban Living Labs From Government to Shared Urban Governance—Building Together!

While government refers to formal structures, systems or institutions by which a state, a region or a municipality is organized and governed, governance is a broader term (Breen et al., 2020). Governance refers to the act of governing rather than government in its narrow sense. It involves multiple public

and private sectors that engage in debate, and compete for gaining, and maintaining power over an issue that is being governed. At the same time, it offers opportunities to strategically integrate policy instruments and connect different sectors as well as engage multiple stakeholders in a dialogue that can enhance collaboration for sustainability (da Cruz et al., 2019). In cities, governance processes are important when steering the planning, use and maintenance of common goods like public green and blue spaces as these processes offer opportunities to find the smartest ways to benefit citizens and urban nature.

In more general reflection on the three project processes (see also Table 5), the notion of shared governance was adopted approximately in the same way with particular respect to the ladder of engagement. The degree of freedom in which the decision-making process was adopted certainly differs. However, co-creation methods and modalities of stakeholder engagement adopted pinpoints the need for change in governance structural mechanisms in cities administration and local authorities. The multi-actor, multi-scalar, multi-levels of engagement permit a more balanced contribution and allow a breakthrough through governmental silos. Evidently, public authorities need to develop

new skills and policymaking practice, supporting stakeholder interaction and organization in a multiplicity of ways allowing a leeway of organized participation in order not to dominate the process by one (or more) specific actors. On a more practical note, policy coordination and policy integration are two key strategies for achieving coherence, aligning both sectoral and cross-cutting themes to make the stakeholder engagement mechanisms work. Critically, stakeholder's identification and management along the co-creation pathways is a very critical issue and needs to be reverified once in a while. In fact, in CLEVER Cities project an iteration on the initially engaged stakeholders in the UIP since 2018 is needed after 3 years in order to make sure no one is left behind during the co-development and up-scaling of NBS.

To delve into methodological analysis, stressing different outcomes between forecasting and backcasting modalities of building transformation scenarios, yet resulting in no major differences during implementation. The focus on future scenarios by learning from the past as in backcasting, or multiple scenarios for building future outcomes as in forecasting do not necessarily reveal different results between both projects and transition pathways. The use of technological devices or online instruments as well does not reveal a substantial difference in the overall procedure and efficacy to obtain valuable input and results, notwithstanding the obvious exclusion of specific stakeholder categories, typically the weakest ones, due to the exacerbation of the digital divide, and the loss of human contact and personal connections between partners, stakeholders, and facilitators during engagement workshops themselves.

ULLs Evolution Mechanisms: Results From the Three Case Studies Toward ULLs V2.0

Throughout the analysis of the three-research projects, the evidence determined the temporal factor evidence in the ULLs mechanisms. What was clearly understood as ULL conceptualization and baseline, needed to evolve in order to make urban transition more attainable and, in other words, to be more holistic and not a sectorial process. This transition for change is only feasible by framing alliances and enhancing citizen engagement mechanisms in order to create a better urban shared governance dynamic in ULLs.

A new conceptualization of the main terms involved in the framing of the ULL V2.0, resulting from the here presented comparative analysis, is illustrated in **Figure 2**. In rethinking the traditional ULL models that reflect on (1) physical context, (2) learning and experimentation, and (3) participation of stakeholders, we add the fourth dimension related to multi-temporal changes as emergent from the comparative study analysis. The relationship between ULLs and the urban contexts plays a dynamic role in urban shared governance dynamics. Within an ULL lifetime, local authorities could change directions and leadership, thus making the temporal duration and continuity of engagement from both sides (leading and general audience of stakeholders) challenging and hard to fulfill. In addition to the risks and hazards that might be encountered such as a global pandemic or change in policies,

the temporal changes in ULL mechanisms are then proposed as a new dimension, based on the comparative analysis of the three projects.

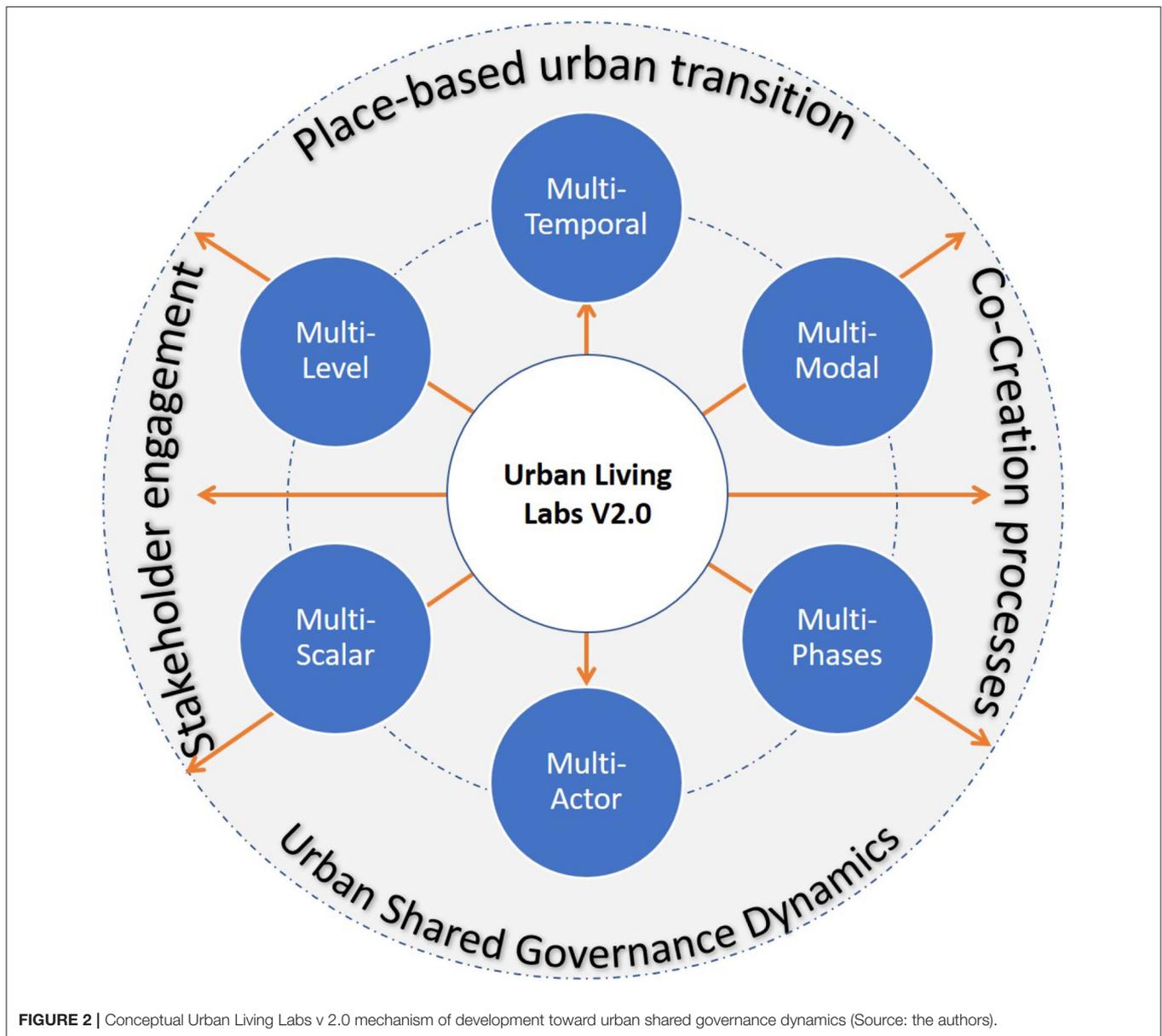
On the one hand, the co-creation process (the right-hand side of **Figure 2**) has shown development via the multi-modalities tool, and the need for using different methodologies, such as TOC or any other related to the urban planning policy to be put in practice. In addition, the multiple phases dimension is evident from three cases studies based on changes in stakeholder's engagement over time. The co-creation pathways in essence are based on ideation, design, implementation and evaluation regardless of their policy related implementation. On the other hand, the stakeholder engagement mechanisms (the left-hand side of **Figure 2**) emphasize the multi-level and multi-scalar analysis emerging from the analysis of the three projects.

To sum up, a new understanding of ULLs V2.0 is emerging beyond their conception, design, operations, multiplicity, and interrelations. The concept is still in development for integrated approach in planning practice, more support for this research study on the relationship with social justice and social equity aspects might be needed to triangulate the benefits of social urban transition and more complex ULLs. Nevertheless, the proposed model on ULL V2.0 has a prospective effectiveness that supports wider use in practice, specifically in similar projects to the ones analyzed in this research.

Key Takeaways: the Enablers and Catalysts of Co-creation Processes to Inform Shared Urban Governance of ULLs

To sum up the Results and Discussions section, we reflect on five main challenges encountered on the development of the comparative analysis of the three projects via the proposed research criteria, as below:

- 1) **Co-creation is never a theoretical linear process** covering co-design, co-implementation, co-monitoring, and co-management as often planned but rather a multi-phased process. In reality, it reveals to be rather an iterative process, sometimes needing to review previous phase outcomes, interlinking the different phases, adapting the different stages to each other.
- 2) **Co-creation should be open to all actors of different types** and encouraged to engage in the dialogue. Moreover, to be flexible and place-based, reflecting on local needs based on a bottom-up uptake rather than imposed designed plans. This is especially relevant for sustainable urban development measures that substantially rely on localization criteria, which makes the overall spatial challenge hard to deal with.
- 3) **A long-term commitment to the ULL** is only achieved through the sense of belonging and ownership constructed via the co-creation process as part of other long-term participation processes, and not standalone movements or activities.
- 4) **Co-creation needs a change in governance structure procedures** that permit multi-scalar and multi-actor approaches to involve stakeholders in all phases fairly. Easily said, but this is challenging given a quite restrictive



administrative environment, where sectors have to work together in a reliable and transparent way.

- 5) **Co-creation expertise needs to be internalized in public administrations** to become the common rule of decision-making concerning urban regeneration interventions.

Interestingly, our research themes on the dynamics of ULLs development and evolution is lately emerging in the ongoing scientific argumentation related to urban planning practice and similar H2020 projects. While in the introduction we were reflecting on the gaps of knowledge on co-creation processes, the development in ULLs in reality and practice are way forward in time. Furthermore, it is observed that in this research article the key component in the ULLs physical settings viewed as the medium for innovation did not yield much difference on the results and differences between the three projects.

Co-creation validity remains a reflection on the overall process as multi-phased, iterative, time-bounded, open to communication, flexible and adaptable in order to be inclusive. The point of transition as we see in **Figure 1**, is supported by evidence-based policy from practice in our three case studies that increased sense of belonging and ownership toward enhancing the long-term commitment of stakeholders along the pathway can be leading for urban transition (connection between stakeholder’s engagement and co-creation processes horizontally in **Figure 2**).

CONCLUSIONS

This research paper is based on a comparative analysis of the practice experience of three European projects, namely CLEVER Cities, Sharing Cities and SUNEX. The main concepts

investigated the shared governance strategies, co-creation processes and stakeholder engagement in the different ULLs conducted respectively in Bristol, United Kingdom, and Milan, Italy. The research highlighted the co-creation expected outcomes such as the urban transition in urban governance, in terms of updating decision-making routines, policy design and overcoming administrative silos. Moreover, the research highlighted the attainment of ULLs results within a multi-actor, multi-scalar, and multi-level of engagement in order to guarantee a continuity in duration of engagement in real world labs. Partnerships and urban alliances with large groups of stakeholders are mostly needed at city scales to foster the implementation of a specific policy if strategically needed; nonetheless, on the smaller urban scale, the main empowerment dimension goes to citizens and on the modality and tools by which they are actively embedded in the engagement cycle.

Co-creation processes in urban regeneration produce multiple benefits as well, if correctly embedded in into public decision-making routines. In particular, the attainment of longer-term visions by the use of different engagement modalities and methodologies for better guidance to enhance collaboration and commitment of stakeholders. Moreover, co-creation processes should be tailored based on the evidence from policy as well as context, because “no one size fits all” in urban regeneration processes. In fact, ULLs evolve as dynamically as the co-creation mechanisms themselves. In this article, we also shed light on the temporal dimension in ULLs V2.0, as a possible solution to gaps related to co-production of knowledge around shared governance mechanisms in ULLs.

The latest COVID-19 global pandemic also fundamentally compromised the traditional engagement methods and allowed more innovative and online solutions to emerge in the world of public participation, especially due to lockdowns in Italy and UK. Even though they proved to be effective in time and data collection techniques, online participation is still having to be used in combination with formal and informal techniques to achieve better outcomes and guarantee wider inclusion.

Lastly, this article also emphasizes the possibility of mainstreaming co-creation legacy into local urban planning evidence-based policy and decision-making mechanisms. Co-creation guidelines produced are increasingly used in day-to-day planning activities and have been upscaled in similar pilot projects. In other words, co-creation spillovers in urban planning and governance are also generated through enhancing public engagement and bringing new stakeholders to the ongoing discussion and decision-making mechanisms in relation to urban transition.

The last future prospective advances on the co-creation processes research themes, is probably cross-sectorial and

cross-thematic between projects and cross collaborations. In other words, using the same space and context and ULL for stakeholders' engagement on different themes of climate action, or ICT for instance, at the same time in order to prioritize citizens' needs within urban agendas and timelines. This approach is mainly related to long-term sustainable urban development policies and integrated understanding of cities as complex vehicles to catalyze urban transition in many respects.

DATA AVAILABILITY STATEMENT

The original contributions presented in the study are included in the article/**Supplementary Material**, further inquiries can be directed to the corresponding author.

AUTHOR CONTRIBUTIONS

IM and EM performed conceptualization and involved and work on the analysis of the CLEVER Cities project. GS and EM involved and work on the analysis of the Sharing Cities project. DL involved and works on the analysis of the SUNEX project. IM wrote the first draft of the manuscript. GS and DL helped with the writing and English revision collaboratively. IM and EM conducted the final drafting and revisions. All authors listed have made a substantial, direct and intellectual contribution to the work, revision, and approved the final version.

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SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/frsc.2021.690458/full#supplementary-material>

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