Research Paper

Co-Creating Sustainable Urban Futures
An initial Taxonomy of Methods and Tools

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Abstract (max 200 words)

Empowering sustainable urban futures is a key task for practitioners and policymakers alike. A focus lies today on co-creative practices to represent stakeholders' interests and encourage inclusivity and sustainability. Nevertheless, the multitude of associated concepts and tools complicates the realisation thereof. Thus, we present a taxonomy that structures existing knowledge and proposes a conceptual foundation for an applicable framework to co-create sustainable futures.

Keywords

Co-Creation, Urban Futures, Taxonomy, Participation, Collaboration

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1   Introduction

There is an urgent need to address the global climate crisis (IPCC 2014, 2021). Urban areas are not only home to most of the world's population. They also disproportionally contribute to the accelerating environmental decay, with the built environment and urban transportation sector constituting a significant part (ITF 2021). Thus, a systemic change in how we plan, design, and manage urban areas is needed.

We can observe such a system transition in Paris, a city that suffers from traffic congestion, air pollution, accidents, among many others (Gall et al. 2021a). The concept of the 15-minute city represents the current urban development agenda. Underlying is the localisation, polycentricity, and creation of habitats – comparable with the congress' Track's title of Al-Waha, the oasis: A safe haven, a strategic centre, and a place to allow future generations to prosper. The accompanying visions, plans, and approaches strongly align with the global credo of co-creating sustainable urban futures.

Many concepts and methods connect to this, ranging from Arnstein's ladder of participation (1969), Watson's collaboration and co-production of knowledge (2014), to digital approaches such as participatory GIS mapping or serious games created for decentralised co-creation of knowledge. Unfortunately, the multi-disciplinarity and wide range of approaches can constitute a challenge for practitioners and policymakers to know what exists, which objectives can be met, and where strengths and weaknesses lie. Some of the various negative side-effects are the still widespread box-ticking participatory activities, the restricted reach of target groups, or practitioner's discontent with the contribution of co-creative practices.

Thus, this paper attempts to compile and review existing frameworks, concepts, and methods from or contributing to the field of co-creating sustainable urban futures. Further, we classify the collected materials and attempt to develop an initial taxonomy. The work is primarily following principles of a desk-based review, assembling its components based on theoretical foundations, with exemplary cases from the context of sustainable urban futures.

The leading research questions are **1) What types and methods of co-creation (and/or participation) exist in the context of urban futures?** and **2) How can these be classified to structure them?**

Therefore, this paper aims at 1) providing an overview of what exists, 2) classifying its key components, and 3) proposing a framework for practical application in planning and policymaking as well as further extensions. It does so by reviewing key literature from the field of collaborative practices and futures studies to provide an initial framework. It contributes to the track's goal of providing solutions and tools to mitigate and adapt to the climate crisis by proposing a structured approach for co-creating place-based plans and policies for more sustainable urban futures.

The paper is part of ongoing doctoral research on the topic of Urban Mobility Futures and rooted at the interface of transport and mobility research, urban studies, and design science.

2   Background

This paper builds on the constantly increasing role of co-creation and its variations both in academia and practice, with oftentimes overlapping or contrasting definitions. According to Scopus, the number of mentions in abstracts, titles, and keywords was consistently under 10 until 2002 and rose to nearly 1,400 in 2020 (fig. 1, Scopus 2021). A similar concept, participation (narrowed down by its co-occurrence with 'citizen') appeared less than 100 times per year until 1997 and increased to over 1,800 in 2020 (fig. 2, Scopus 2021).
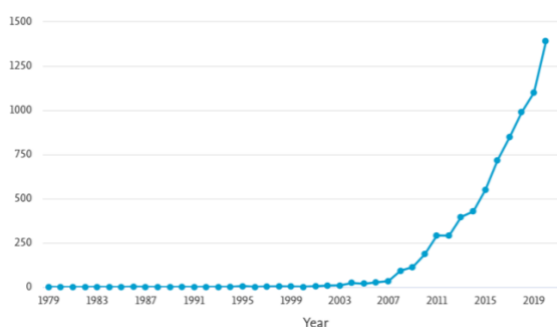
Figure 1: Occurrence of 'Co-Creation' between 1979 and 2020 in title, abstract, or keywords (Scopus, 2021)
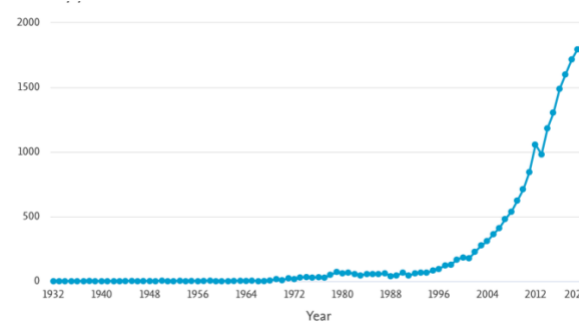

Figure 2: Occurrence of 'Participation' and 'Citizen' between 1932 and 2020 in title, abstract, or keywords (Scopus, 2021)

This increase of interest does, additional to the overall rising number of publications, highlight changing priorities for collaborative practices and the integration of different stakeholders in the decision-making process. Our focus here lies on co-creation, oftentimes used interchangeably or together with co-design or co-production. The 'prefix "co" refers to collaborative, or the simultaneous, open, and horizontal collaboration between designers, experts, and citizens' (Gall et al. 2021b). While participation is a relevant concept by itself, it can be seen as a component of co-creation but less encompassing. Co-creation may be achieved through participation, but participation does not necessitate co-creation. One of the early concepts attempting to structure different types of participation is the ladder of participation, described below. Furthermore, we can distinguish between different types of co-creation, which is attempted in section 2.2.

Sherry Arnstein published in 1969 the concept of the **latter of participation** (table 1) which divides possible types of participation in three major categories. At the bottom of the ladder is 'Non-Participation', referring to practices that actively avoid participation. At the middle is 'Tokenism' which can be understood as a rather symbolic effort or gesture to include participation in the process but restrict its impact. Finally, 'Citizen Power' as the highest category describes practices that put citizens either at the same or an elevated position compared to other stakeholders (Arnstein, 1969).

Table 1: Arnstein's Ladder of Participation (adapted and extended by authors; 1969)

Citizen Power	Citizen Control	The citizen (or affected group) is in control of decision-making, design and planning, depending on the project context.
	Delegated Power	The final power is delegated to the citizens.
	Partnership	A (possibly) equal relationship between different stakeholders and citizens exist.
Tokenism: symbolic effort/gesture	Placation	Concerns of citizens are directly addressed to appease or conciliate.
	Consultation	Citizens are consulted in the process, e.g., through public hearings or surveys. Arguably one of the most common types of participation in current design and planning practices in the urban context.
	Informing	Citizens are informed about the process and outcomes but have no say in the decision-making.
Non-Participation	Therapy	The citizens are informed and/or approached in a manner to generate public support, e.g., through partially withheld information or directed campaigns.
	Manipulation	One step further, a pre-existing opinion or resistance of the public is actively attempted to be altered to conform to the project's goals.
	Exclusion	Added by author, referring to the complete ignorance/exclusion of other stakeholders/citizens in the process.

Finally, no consensus exists around the right use of co-creation for all stages or actors. However, this is not subject of this paper. Instead, it is assumed that in certain cases, co-creation or related practices contribute positively to the process. The presented work is aimed at these situations.

2.1 Collaborative Practices

Further, we can distinguish between different sub-groups or components of co-creation. Much controversy exists across fields on the exact meaning of design, creation, or production. We propose co-creation as the umbrella term that can encompass co-ideation, co-design, and co-production (fig. 3). This choice was made as design can be understood as the whole process of changing an existing situation in a new, preferred one (Simon 1996). However, its organised and collaborative execution as referred to in this paper requires a preceding process of understanding an existing situation to be *change-worthy* and outline certain elements to start the collaborative design process. Finally, the design process may include the design of the implementation or physical production. However, the actual implementation as well as subsequent co-production of meaning, among others, falls outside of the collaborative design process as such. Thus, co-design is hereafter defined as the core component of co-creation, and not vice-versa.

Co-creation is defined as 'the active flow of information and ideas among five sectors of society: government, academia, business, non-profits and citizens – the Quintuple Helix – which allows for participation, engagement, and empowerment in, developing policy, creating programs, improving services, and tackling systemic change with each dimension of society represented from the beginning' (Agusti et al. 2014, p. 3).

Its three components are represented as a flow from left to right, from co-ideation to co-production. This is, however, not seen as a linear process. Instead, these processes might happen in parallel or an iterative manner. Nevertheless, an inverse direction is unlikely.
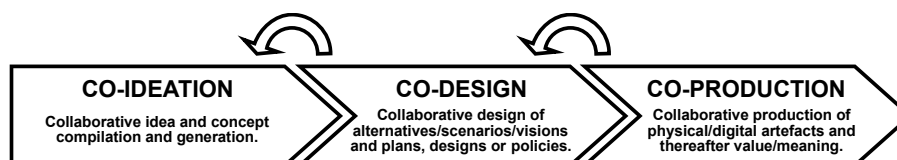

Figure 3: Three phases of co-creation

The first step is titled **co-ideation**, referring to the collaborative idea and concept compilation and generation. This can encompass various sub-processes (table 2), for example, an open feedback mechanism from a city administration to improve the urban service provision. **Co-design**, or collaborative design, has a broad definition as introduced earlier. In the context of co-creating urban futures, this might include the co-design of scenarios, visions, or all types of plans, design, or policies that lead towards one or several preferred futures. Finally, **co-production** has a dual meaning. On the one hand, it refers to physical collaborative production. A small-scale example would be co-production between citizens, city administration, and private companies in the transformation of streets or roadside parking (so-called parklets) to new, citizen-decided purposes. Secondly, the co-production of meaning refers to a process that may start already during the design phase but primarily happens afterwards. It refers to the acceptance, valuation, appropriation of space, among others (Watson 2014, Bromberg et al. 2007, Soja 2009, Dikeç 2001, Grbin 2015, Lefebvre 1991); processes that define the functioning of urban systems. An example is the co-production of meaning for a new urban square that may either be underused, and thus without meaning or a negative one, while it might be used, appropriated for other purposes (e.g., commerce, political expression), and thus gain meaning for (some) urbanites.

In table 2, we compiled sub-processes for each, from the context of co-creating urban futures.

Table 2: Sub-processes of three types of co-creation

Category	Sub-Process	Description
Co-Ideation	Data/Information	Either through the collection, or reuse of existing data, information can be deducted that informs the design process, for example, by seeing high numbers or traffic fatalities in a certain location.
	Wishes/Needs	Wishes or needs, expressed, for example through citizen feedback platforms, can contribute to the ideation and goal setting.
	Ideas/Concepts	Finally, specific ideas or concepts, for example, from activists, citizens, or urbanists, can be the starting point of a co-creation process.
Co-Design	Scenarios	One possible design process is the co-design of possible future scenarios, e.g., for specific sites (place-based), and/or thematic (mobility futures).
	Visions	The co-design of visions, e.g., Bold City Visions 2050 for cities (Tanum et al., 2019) can guide the policymaking and planning decisions.
	Plans/Designs/Policies	Finally, various artefacts can either be co-designed (e.g., a co-designed neighbourhood design), or result from co-design processes (e.g., policies to enable the co-designed plan/process).
Co-Production	Physical/Digital Artefacts	After the design process, co-production may take place physically (e.g., placemaking) or digitally (e.g., creation of a new information dashboard).
	Meaning/Value	Meaning or value can be co-produced by the affected stakeholders, for example, through the integration of created place into existing or new urban practices of residents and/or users of the urban area.

2.2   Framework of Collaborative Practices

Based on the extended categorisation of the ladder of Arnstein, and the distinction into three groups of co-creation, an initial framework of co-creation has been produced (fig. 4). On the x-axis, it shows co-ideation with the sub-groups of collecting initial data/information, wishes/needs, and ideas/concepts. The second is co-design, referring in the case of urban futures for example to scenario making, vision building, or the design of plans, (urban) designs, or policies. Finally, co-production includes the production of physical and digital artefacts (e.g., roads, busses, data infrastructures, digital wayfinding applications, among many others) and finally the co-production of meaning (e.g., the appropriation of spaces by citizens for specific mobility practices, or the valuation of available modes of transportation).

On the y-axis are the three groups of (non-)participation, extended by exclusion. Finally, the z-axis describes four different potentially involved groups. Experts (e.g., urban planners, transportation engineers, scenario planners) are portrayed in red, stakeholders (e.g., involved local businesses or private investors) are in yellow, the immediate society (people from the local environment), and finally in blue the distant society, referring to people that are affected by the project/intervention but not co-located either due to temporal or spatial distance. These have been added mostly to take future generations into account which is difficult to achieve yet possible (Uwasu et al. 2020).

In the example below, five exemplary blocks are shown that can be found in similar shape in many public (-private) projects in western Europe, often predefined through legislation. The first describes an initial scoping of data/information and wishes/needs of the immediate society. This can take place using existing data (census/mobility surveys) or specifically designed surveys. The second describes an early stakeholder engagement to better understand their wishes and needs as well as possible first ideas and imagined concepts. Thirdly, experts might be consulted for the development of different potential scenarios and/or one vision. At the actual planning and design stage, co-creation often ceases, possible restarting in a collaborative physical/digital co-production. Finally, the results' appropriation by citizens (or users in case of, e.g., transport services) and the co-production of value and meaning finalises the process. While not comprehensive or representative of many processes, it shows the potential fragmentation of collaborative

practices across groups and process steps. The following section details some of these phases further by using examples from the urban futures field, applying them to the presented framework.
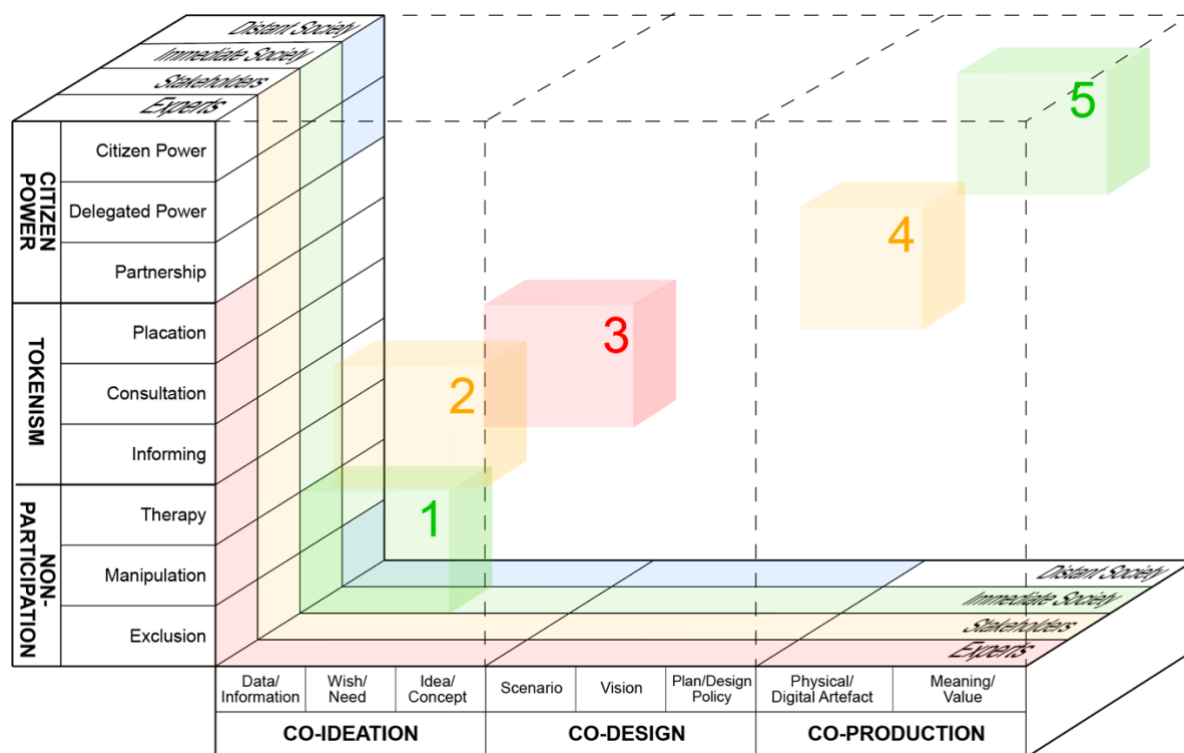

Figure 4: Initial Framework of Co-Creation

3 Methods for Co-Creating Futures

In the specific case of futures, we compiled a range of representative approaches. Despite various fields of application, they remain relevant for the field of urban studies.

Approaches for co-creating futures span from expert-led scenario building (currently dominating the literature in the field) to the creation of short stories in citizen participatory sessions facilitated by experts. In table 3, we examine the variety of future approaches, its outcomes, the principles at stake and the evaluation processes in the co-creative context. The following paragraphs describe some of them in more detail.

Table 3: Compilation of different co-creation activities

Reference	Stakeholder	Field	Input	Output	Method	Evaluation
Co-Creating Future Scenarios						
Spickermann et al. 2014	Expert-led	Urban mobility	Strategic issues	4 Scenarios	Consensus (Delphi process)	Not addressed
Johansen 2018	Expert-led	Defense planning	List of parameters	6 Scenarios	Morphological analysis	Not addressed
Soria-Lara et al. 2021	Mixed (stakeholders & experts)	Transport-Land use	Wild cards	6 scenarios 2050	Participatory visions/ interviews	Disruption (experts)
Molinero-Parejo et al. 2021	Experts (multidisciplinary)	Transport-Land use	6 visions 2050	Map of changes (land use, transport)	Spatial mapping	Not addressed

Reference	Stakeholder	Field	Input	Output	Method	Evaluation
Uwasu et al., 2020	Mixed	Low carbon society	CO_2 target	2050 vision & pathway	Deliberation	C02 simulator & eval. scenarios
Co-creating Visions						
ISOCARP YPP 2021	(Young) Experts	Urban Mobility, Design	Site analysis, lectures	Place-based visions	Rapid, iterative design	Jury
Bold City Visions 2050 (Tanum et al. 2019)	Mixed (Experts & Citizens)	Urban Development	Various	Bold City Visions	Multi-stakeholder, participatory process framework	Not addressed
Urban Transformation Curaçao (UNOPS 2019)	Mixed (Experts & Citizens)	Urban Development	Surveys, interviews, site analysis	Community vision, strategic vision	Community workshops, expert workshops	Not addressed
Co-creating Future Objects						
Candy, 2018	Citizens	Human activity	3 suite deck card (Future, Thing, Theme)	Future artefact	Combinatorial/ Chance	Not addressed
Co-creating Future Personas / Characters						
Vallet et al., 2020	Experts	Mobility	3 archetypal scenarios & persona profiles	Personas & scenarios	Combinatorial / Chance	Not addressed
Fergnani, 2019	Experts	Future of work	4 archetypal scenarios	Future personas: 4 personas in future scenarios	Systematic literature analysis	Not addressed
Paucot, 2018	Experts & professional writer	Mobility	Disruptive technologies	20 short stories with 2 characters	Fiction - Narration	Not addressed
Co-creating Future Serious Game						
Gugerell and Zuidema, 2017	Citizens	Energy transition	Challenges/ context	Serios Game	Co-design workshop	Not addressed
Co-creating Physical Intervention						
Co-Creathon (NLFR 2021)	(Young) Experts	Post-pandemic Design	Site analysis	Urban prototypes	Rapid prototyping, experimentation	Jury
Co-creating Budgets						
Participatory Budgeting (Cabannes, 2017)	Citizens	Urban Service Provision	(Call for) Project proposals	Partial city budget	Online/offline voting on priorities	Not addressed

Co-creating Scenarios: Spickermann et al. (2014) developed multi-stakeholder scenarios of a multimodal city of the future by scanning existing databases and literature to deduct strategic issues that are thereafter qualitatively assessed, fed into 16 Delphi projects, and thus act as basis for the co-creation of scenarios. Further, Johansen (2018) proposes a morphological analysis that shall ensure that 'consistency and relevance' of developed scenarios through a multi-dimensional parameter compilation and subsequently tested for internal and external consistency. On the other hand, Soria-Lara et al. (2021) state that future scenarios created by experts tend to show low disruptions compared to business-as-usual trajectories. They propose to use wild cards, which are low probability and high impacts processes to trigger the visioning activities. They implement the following process applied to the Henares Corridor in Madrid: (1)

Recruit 129 young citizens (18-32) for their expected disruptive thinking; (2) Conduct semi-structured interviews fed by wild cards and "what if" questions; (3) Aggregate the outcomes into seven scenarios (based on imaginable and unimaginable process); (4) evaluation of disruption level of scenarios by 21 experts. The results show that the disruptive scenarios are those generated by unimaginable processes which are highly unprobeable in short and long term. This process allowed minority views to be expressed in a disruptive manner, notably by young women who chose the wild card 'High level on insecurity in urban areas'. Molinaro-Parejo et al. (2021) provide a follow up study where the three previous disruptive scenarios are taken as inputs to participatory mapping workshops involving three groups of six urban planners and transportation practitioners. The authors conclude that narratives around future scenarios are too abstract, while the spatialisation process of mapping the effects of future scenarios are more tangible and efficient. To this end they provided the target area with 2D grid elements (250*250m) where participants were invited to co-create and represent changes in urban land use, transportation modes, green areas, mix usages and urban sprawl. The results were incorporated into digital models. This approach could be coupled with simulation models to test model calibration for the scenarios under study. Finally, Uwasu et al. (2020) advocate that (1) deliberation in citizen participatory sessions is necessary for a more legitimate decision-making process; (2) inclusion of imaginary future generations (i.e., played by citizens who are invited to travel in time to 2050 without ageing) brings more engagement and leads to more accurate scenarios. In this paper, scenarios are constituted of visions, storylines, and roadmaps. Citizen-participants are prompted to first elaborate their vision captured in a post-processed logic tree, then elaborate the vision into a pathway and check C02 target with a simulator tool. In a third step, the four scenarios generated by citizens are finally evaluated by a public crowd via an online survey (Uwasu et al. 2020, cf. Nakawa and Saijo, 2020).

Co-creating Visions: Visions can be co-created, for example, through participatory and intensive workshops, such as the ISOCARP Young Planning Professionals' (YPP) workshops (ISOCARP YPP, 2021). In this format, a group of 10-60 early-career urban planners and designers explore over a short period of time (3-5 days) a particular challenge and, under the guidance of senior professionals and in exchange with local authorities/clients, develop alternative visions for a particular area and challenge. At a larger scale, Bold City Visions for the year 2050 (Tanum et al., 2019) result from a structured approach of citizen and stakeholder engagement following a framework spanning, among others, policy development, organisational development, and project development. Thirdly, through a mixed approach of citizen and expert-led visioning, visions for urban transformation can be created (UNOPS, 2019), spanning qualitative visions led by citizen input, followed by a validation, extension and spatialisation of the visions by planning and design experts.

Co-creating Future Objects: Candy (2018) supports the idea to make the future less remote and intimidating for non-experts and advocates for '*distributed anticipation and social foresight'.* To this end, he presents the three-card game developed as a randomised combinatorial prompt (inspired by morphological thinking). It is played by teams of three to five people who select three cards, based on which they imagine an *artefact of the future.* The 'Future' card of the game is based on four scenario archetypes by Dator (2009).

Co-creating Future Personas / Characters: Vallet et al. (2020) propose an approach to combine persona development and scenario making for a more detailed distinction between possible future user groups and their integration and consideration in today's planning and design. Fergnani (2019) proposes to increase the communication and readability of existing multiple futures scenarios (e.g., four) by the systematic creation of one persona attached to one typical scenario. Participation of experts or non-experts and in the methodology are not addressed as such. The creation of personas is iterative: these are firstly depicted by basic traits (e.g., demographic, facts, values) and then enriched by explicit connections to the features of scenarios. Finally, narratives and illustration (avatars) are created to polish the persona description.

Co-creating Future Serious Games: Gugerell and Zuidema (2017) propose a co-design process to develop serios games as a mean to provide a 'safe environment' for experimentation and expression, thus deducting inputs from the participants from before and during the process of game creation.

Co-creating Physical Intervention: In a more practical shape (extending to the co-production part), 'Creathons' (a wordplay between hackathons and creation) aim at the physical or digital production of urban interventions (NLFR 2021, cf. placemaking, guerrilla urbanism). It stands out compared to the others – with small exception of the future objects – as it results in tangible outputs that can be seen as artefacts of the future, or a partial experience of a possible future.

Co-creating Budgets: Lastly, participatory budgeting (Cabannes, 2017) is a concept found in several cities that allows citizens to directly vote for solutions in either their district and/or the city. Started in Porto Alegre in 1989, it can be found across many cities globally. According to the citizens' support, a certain predetermined budget is allocated or distributed afterwards. Paris' current mayor aims at distributing up to 25% of the total budget with the input of the citizens' opinion. In the direct context of urban futures, participatory budgeting puts the participatory element rather to the end of the process, while simultaneously impacting the future projects and indicating the support of the society for different types of investments (Cabannes, 2017, p. 195). A project is already prepared, designed, and proposed by a group of stakeholders, mostly involving a Civil Society Organisation or group of citizens, and the funding is decided on by the broader public as the last step before the realisation.

4   Discussion

A more structured approach to co-creation, its forms and phases, and the involved stakeholders allows us to understand past processes better, while also informing the process planning of future ones. The present paper describes some of the theoretical foundation, provides a framework proposition, and a range of more specific examples that fall within these categories. To build on this work, the application of the proposed initial framework to existing processes through qualitative case study research and validation through expert consultations is crucial. It would allow to either validify or expand and adapt it. This continuation in the context of urban mobility futures is anticipated as the next step.

Further, a major question untouched in this article is the 'right' level of participation or co-creation across stages or types of projects. Below (fig. 4), four different possibilities are exemplary shown, trying to represent possible current processes. On the left, a successful grassroots project is shown, with constant high involvement of the immediate society, and temporal contribution in project scope, design, and co-production from stakeholders and experts. The second from the left shows a successful co-creative project led by the public sector. The immediate society is consulted in the beginning, then only informed, or excluded until the final appropriation of the resulting artefact(s). The stakeholders have a similar involvement, with experts leading the design phase. The second diagram from the right shows a failed grassroots project that lacks its solutions appropriation and valuation in the final stage. The right-most shows a failed top-down project, with identical expert and stakeholder involvement as in the successful public-led project, but without any involvement of the immediate society. In each four cases, the distant (future) society is not considered, showcasing a common reality in planning practice with few exceptions, as well as potential field for further exploration, in the context of planning and designing urban futures. Which constellation works best? Is active participation needed in each step, for each project? What is the most resource-efficient to enable collaborative practices in the critical phases? These are some of the major questions that will be addressed in the next step of qualitative case studies.
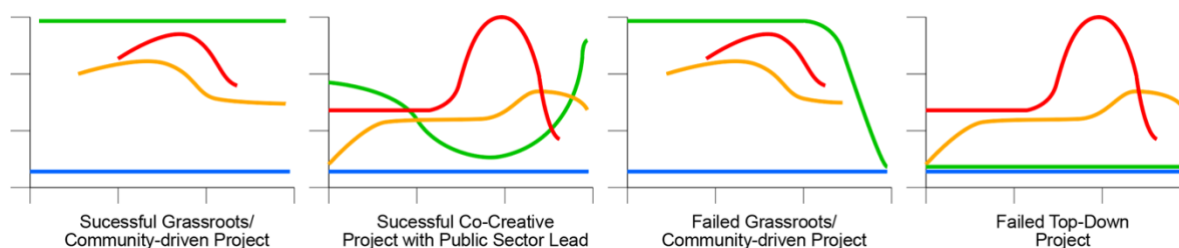
Figure 5: Different possible levels of co-creation (green: immediate society, red: experts, orange: stakeholders, blue: future society)

5   Conclusion

This paper aimed to explore what types and methods of co-creation (and/or participation) exist in the context of urban futures and how these can be classified to structure them. This resulted in an initial overview, however, with more need to conduct in-depth case studies to see how suiting the framework is. Nevertheless, we argue that the produced work can represent several key dimensions of co-creation and has the potential to contribute to analysing and planning the increasingly relevant co-creation and participation in design and planning processes for urban futures.

6   Acknowledgements

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