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Co-Creation Dynamics in Urban Living Labs

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Abstract: Citizens and urban policy makers are experimenting with collaborative ways to tackle wicked urban issues, such as today's sustainability challenges. In this article, we consider one particular way of collaboration in an experimental setting: Urban Living Labs (ULLs). ULLs are understood as spatially embedded sites for the co-creation of knowledge and solutions by conducting local experiments. As such, ULLs are supposed to offer an arena for reflexive, adaptive, and multi-actor learning environments, where new practices of self-organization and novel (infra-) structures can be tested within their real-world context. Yet, it remains understudied how the co-creation of knowledge and practices actually takes place within ULLs, and how co-creation unfolds their impacts. Hence, this paper focuses on co-creation dynamics in urban living labs, its associated learning and knowledge generation, and how these possibly contribute to urban sustainability transitions. We analyzed empirical data from a series of in-depth interviews and were actively involved with ULLs in the Rotterdam-The Hague region in the Netherlands. Our findings show five distinct types of co-creation elements that relate to specific dynamics of participation, facilitation, and organization. We conclude with a discussion on the ambivalent role of contextualized knowledge and the implications for sustainability transitions.

Keywords: sustainability transitions; urban innovation; participatory design and planning practices; co-creation; experimentation; Rotterdam

1. Introduction

Nowadays, citizens and urban policy makers are experimenting with new collaborative approaches to tackle persistent urban issues, such as climate change adaptation, quality of life, and urban inequalities [1,2]. Regular policy-centric approaches fail to address the root causes of such complex persistent problems; practices in the existing urban regimes are not able to give answers to the new demands and needs arising from these problems. Hence, new approaches are explored that help to ensure that the city is and remains a healthy place to live, providing a high quality of life, without depleting natural resources. In search for more effective action plans, citizens, public institutions, private sector, and knowledge institutions are increasingly teaming up in formal and informal networks. Such networks address various urban development topics, aimed at weaving different types of knowledge together while differing in their socio-spatial contexts and respective purposes. The emergence of these new urban networks is driven by two major trends. On the one hand,

for decades, public bodies have been opening up towards different participation practices, described as governance through communities, 'third way' approaches [3], public-private-partnerships [4], or public-private-people partnerships [5]. On the other hand, the various urban actors outside the government have become more vocal and assertive. They do not only want to contribute to tackling social problems, but also expect and demand to be heard and take action themselves if they are dissatisfied with policy responses. In many cases, citizens, social entrepreneurs, and other societal actors do not wait for help or consensus of public bodies, but they take matters into their own hands and act. These emerging societal responses to urban challenges are characterized by the engagement of various public, knowledge, and non-governmental organizations, and citizens and social movements directly, and offer potentially effective and fruitful contexts for the development and implementation of products, services, plans, or policies [6]. Several examples of urban activism are arising around the world, as illustrated in the contexts of urban regeneration, do-it-yourself urbanism, public space and housing [7,8], place-making [9], and civic ecology practices [10].

The strong need for collaboration across institutional boundaries is highlighted by the actors' willingness to combine different types of knowledge to better deal with complex issues, exploring visions, possibilities, and finding agreements between the different parties involved [11,12]. However, urban actors from different societal domains and sectors still do not necessarily meet, understand each other, or cooperate immediately. They often engage only with those actors from their own social networks, professional backgrounds, institutional settings, or spatial contexts. These social and spatial disconnections have been identified as a key barrier to new collaborative forms of developing urban futures. Some scholars state that suitable spaces and transition arenas for collaborative forms of urban governance are required, where the connections among actors can be established and the boundaries between sectors, interests, and contexts are subject to further exploration [13,14]. An emerging form of such arenas are the Living Labs in cities [15], also known as Urban Living Labs (ULLs).

ULLs currently proliferate across European cities, and they are claimed to be a particular form of spatially embedded sites for learning, as well as for the co-creation of knowledge, products, technologies, and service innovations in local experiments [16]. Experimenting in urban laboratories is seen as an instrument for urban and territorial innovation, being able to offer space for adaptive and multi-actor learning environments. Within this real-world context, new practices of self-organization and (infra-) structures can be tested [17–19]. Moreover, ULLs are intended to promote the collaboration between a variety of actors and, with their experimental sites, are also considered to have value for long-term sustainability transitions [20]. Despite recent theoretical and empirical explorations of the ULL concept, some aspects are still understudied, such as its theoretical underpinning, the mechanisms and procedures of ULLs to facilitate effective interventions that create impact in cities and beyond, as well as their potential to become co-creative transformative arenas. More precisely, the role and characteristics of co-creation, as an inherent element of these three understudied issues, needs more attention. Hence, this paper addresses the essential role of co-creation in ULLs as multi-actor processes of developing and experimenting with new strategies, agendas, and actions towards sustainable cities. First, the paper unravels five elements that characterize co-creation and illustrates them by examining six different real-life cases of ULLs. The goal is to reflect upon co-creation and the related issues within ULLs, and to better understand how they can potentially be effective instruments and become mechanisms for systemic and institutional change.

We will continue this introduction with a literature review on ULLs and co-creation, combining different domains and disciplines. Section 2 presents our methodological approach and the empirical data of six different ULLs that were studied in the Rotterdam-The Hague region, in The Netherlands. Section 3 presents the analysis of the data in relation to the co-creation dynamics presented in Section 2. Section 4 highlight crucial points of reflection and identify directions for future research.

1.1. The Concept of (Urban) Living Labs

Over the last years, several scholars have been active in identifying the potential and the challenges of Urban Living Labs (ULLs) [18,21]. ULLs [22] have been understood as geographically embedded, context-driven environments, in which user-centered research and development activities are carried out in an open innovation ecosystem, with the aim of experimenting and learning based on multi-stakeholder partnerships that are framed within a specific socio-spatial boundary (e.g., a city or a neighborhood context) [14,20]. ULLs can be both collaborations settled with the purpose of experimentation, as well as collaborations arising from new forms of urban insurgent activism (i.e., social entrepreneurs, civic volunteers, grass roots initiatives).

The concept of ULLs is derived from the broader Living Labs concept. Living Labs were designed to open up the innovation process, mainly within the corporate sector, to involve other actors. The focus of these early Living Labs was on how end users experience products and services in their daily life context. Their aim was to make their design a user-centric process, as opposed to a product-centric process. Living Labs emerged from a need for new methods, as well as new settings, that allowed further integration of the work of some frontrunners; those that were exploring open innovation theory [23], the 'prosumer' concept as a key actor of the markets in the Web 2.0 era [24], and the 'lead users paradigm' [25]. The idea of Living Labs was originally developed at the end of the 1990s at the MIT Media Lab by computer science scholars. The concept complemented user-driven, human-centered, and participatory approaches to design challenges. For example, Living Labs were employed for exploring human-computer interactions in the implementation of technologies based on the involvement of users (firms, organizations, and consumers) in the design process. These early applications of the concept stimulated a variety of reviews of the different design methodologies used within Living Labs [26–28].

Nowadays, several definitions of the concept of Living Labs exist, but commonly they are understood as using several methodologies and tools aimed at the co-creation of innovative solutions (i.e., products and services) in real world environments with users, who meet in real life contexts and share experiences, while envisioning their own future [27,29]. Often the concept of Living Labs refers to a "multi-stakeholder platform as a (voluntary or statutory) body, comprising different stakeholders, who perceive the same problem, realize their own respective interdependencies, and come together to agree on the best action strategies for solving it" [30] (p. 133). Living Labs consider people not only as users or consumers in a narrow sense, but as direct contributors to or co-creators in an innovation process. The aim is to move from Triple Helix [31] to the Quadruple Helix [32] co-creation, where public and knowledge institutions collaborate not only with private bodies, but also with civil society to innovate services and products. The actors within Living Labs test innovative solutions on a daily basis, allowing for observation of innovation processes in self-organized [33] real-world environments where people play different roles. Some authors focus on the role of different actors in co-creation processes to identify different types of Labs, referring to the principal promoter or to the most active participant [27].

Svensson et al. [34], in line with the European Network of Living Labs (ENOLL), consider a Living Lab not only as a methodology, but also as an organization, an environment, a system in itself, where innovation might take place. Recently, the concept of Living Labs is expanding, from research contexts at knowledge institutions or in private sector research and development, towards complex socio-spatial contexts [24]. The recent attention for Living Labs in urban environments comes from the fact that within Living Labs, collaboration happens in a real-life setting and expected outcomes (e.g., products, processes, learning) are emerging within the participants' daily life. In this sense, they are considered potential triggers of innovation in urban environments. It has been demonstrated that Urban Living Labs contribute significantly to the production of local knowledge in relation to the development of relational capital [35], which is of importance for experimentation with new practices, relationships, and governance arrangements. Hence, ULLs stimulate processes of reflection and questioning, triggered by "experimentations [that] may induce changes in individual and collective

mental models, transforming the feedback and results of the trials into sources of behavioral change and learning for systemic change" [36] (p. 761). In this way, ULLs may create changes that are valuable for a group of people and pressure existing regimes, but it is not yet demonstrated how and if they contribute to changing the overall system. Mulder and Stappers [24] pointed out that Living Labs could make far better use of the promised ecological validity of a community-driven innovation approach. This is especially relevant for the understanding of ULLs. However, research that describes actual co-creation practices in ULLs is still hard to find, even though scholars do address this issue and mention co-creation as a typical value of ULLs.

For Bergvall-Kareborn and Stahlbrost [37], co-creating sustainable values is the aim of a Living Lab. They regard it as a user-centric innovation milieu built on every-day practices and research that facilitates interaction, engaging all relevant partners in real-life contexts. Here, co-creation is not only a methodology to achieve (product, service, or process) innovation, but a way to create values that are shared between participants. Hence, (Urban) Living Labs are not only places where people come together that share the same values, but also a means for the co-creation of shared values [38] that might activate innovation and broader systemic change. Due to the complexity arising from the social infrastructure within different multi-helix consortia, different co-creation dynamics emerge, which we will describe in this article based on observations made in ULL in Rotterdam, The Netherlands. This introduction continues with an exploration of the term co-creation and its key elements.

1.2. The Concept of Co-Creation

A widely accepted generic and literal definition of co-creation is 'making something together'. However, when the term is specified in more detail, a common conceptual agreement is not apparent [39]. The understandings range from a business and customer centric logic [40,41], focused on mutual value creation through specific interactions, to a focus on creating partnerships in public service delivery with citizens [42] as well as relations of joint responsibility [43]. Considering the context in which this research is done, the latter direction seems more fitting. However, the body of literature coming from the field of business and marketing has produced a variety of methods and understanding of co-creation that are equally valuable. Hence, both bodies of literature are taken into account in this section.

Nowadays, co-creation has become an almost 'magical concept' [44] that is assumed to be able to achieve a variety of positive effects. It is said to be able to reform the public sector [42] to enable creativity and stimulate innovative solutions [45–48], as well as to make change processes more effective and meaningful [49,50]. Co-creation is currently used in several sectors, such as urban and regional planning, public management, transition studies, design, and innovation. Given this diversity of application contexts, there is a differentiated understanding of the constituting elements of co-creation and a need to find appropriate ways of how to study their dynamics in practice. In this section, we identify five common elements of co-creation based on a review of the comprehensive literature on the subject. These are (1) the purpose of the co-creation; (2) formal and informal co-creation; (3) the ownership of the co-creation process; (4) the motivation and incentives for co-creation; and (5) the places/spaces of co-creation.

The first element of co-creation described in the literature is the purpose of the co-creation. In the urban planning domain, already described in Friedman [51], participation (or co-creation) and empowerment became goals to be attained, rather than methods to be used [6]. According to communicative planning perspectives, participation is at the roots of planning [52–55]. To plan, according to this view, is to communicate, argue, debate, and engage in discourse for the purpose of aligning attention and defining the possibilities for action [12]. Co-creation can have two distinct goals here. The primary purpose of the co-creation can be *making* together [56], a situation where people work together towards a goal or output of a product, service, or process innovation. Or it can be *learning* together, a situation where people collaborate towards building knowledge, learn from one another, and create networks between people. Frequently, both goals are sought after simultaneously,

though often one of them prevails. In addition, the innovation subject of making or learning can vary. The innovation spectrum is categorized by different levels in various fields. In systems engineering, often four levels are identified: The system, subsystems, element, and component [57]. In the context of the Transition management framework, it is distinguished between the landscape, system innovations, process innovations, and product innovations [58]. In the design domain, the levels can be referred to as the societal system, socio-technical system, product-service system, and product-technology system [57]. When *making* is the primary purpose, often a specific innovation goal or output is sought after. In the service marketing or product development literature, this is also referred to as the envisioned value creation. In the case of *learning* as the primary purpose, co-creation is more focused on creating knowledge and innovation and changes on the levels of the socio-technical or societal system. This can be connected to the purpose of the co-creation being participation itself. However, the link between knowledge production and learning, as well as the link between the purpose of ULLs and their effects on the different systems, is not obvious and needs to be explored in practice.

Second, the literature describes forms of formal and informal co-creation. This is also related to the intensity of engagement: Heavily engaged versus short-term engaged [59]. Formal co-creation refers to processes that are deliberately set up by the initiator(s), which can be one stakeholder or a group of stakeholders. Such co-creation processes are characterized by defined procedural steps, timing, participants, and audiences. This also encompasses the often-discussed selected or non-selected forms of participation. With formal co-creation, the participants are often selected, since it considers specific people (e.g., lead-users, frontrunners) valuable for co-creation activities [60,61]. On the other hand, informal co-creation refers to processes of collaboration that emerge out of shared goals or the necessity to work together. These can, but do not necessarily have to, turn into formal co-creation processes. Selecting participants requires extra effort to identify and invite the right people, and is challenged with questions of broader legitimacy [62]. Informal co-creation processes are often characterized by less official planning, non-selected participation, short-term engagement, as well as practices and rules that unfold over time. Non-selected participation considers everyone as potential valuable participants [63,64]. It requires less efforts of identifying and selection, because broad samples of stakeholders can be addressed. However, it can be challenged with change-averse perspectives and legitimacy resistance [65]. Additionally, there is often a greater need to find stimuli to motivate participants to contribute and to be involved, since they are not specifically selected for certain motivations, ideas, or shared values [66,67]. In the urban context, this relates to the city as a complex system that reaches a level of internal organization that is always (with different degrees) beyond people's direct control [68]. It has emergent and unintentional characteristics that are the result of processes of self-organization [69,70]. Hence, those self-organization processes might give rise to interactions and co-creation process that are not the result of planned procedures, but the result of unplanned action. Therefore, co-creation in cities will always consist of a certain degree of informality [71].

The third element of co-creation is the ownership of the co-creation process. Conducting processes of co-creation requires specific skills, such as defining different roles, stepping in and stepping out of these roles and processes, and providing the right tools at the right moment to the right people [72]. Depending on who is providing these roles, the co-creation process will differ in set-up and thus has consequences for the practices. If there is a clear initiator group, this group will probably dominate the practices and rules of the co-creation process. If the group of initiators wants to open up the procedure to a broader group, to share ownership, more deliberation is needed along the way to create consensus on how co-creation will be practiced [73,74]. This requires additional co-creative steps in which it is discussed how each and every one envisions the co-creation, as well as more time for aligning the views of the different participants.

Fourth, is the element of motivations and incentives for co-creation. Co-creation processes involve several types of costs (i.e., time, monetary investments, management etc.). To be engaged in such processes, individuals compare these costs to the benefits they get in return [75]. Participants'

motivation to engage relates to their goals, resources, and expectations of the value of the outcomes [76]. This includes motivations beyond the monetary ones [77]; social, cultural, technical, and psychological factors also all play a role [78]. One common distinction in motivations is between intrinsic and extrinsic motivation [76]. Intrinsic motivation refers to the motivation to engage in an activity primarily for people's own sake, without obvious external stimuli. In contrast, extrinsic motivation is activated by the intention of obtaining a desired outcome or avoiding an undesired one. It is associated with external incentives, such as monetary compensation, or recognition by others, separate from the activity itself. In co-creation processes, incentives can be very concrete and clear for all parties, but there are also situations where the benefits are less tangible, unclear, or not equal for all participants. In the policy making arena, this is acknowledged as plurality of interests. When the interests or benefits (especially the extrinsically motivated ones) are characterized by plurality, it might be difficult to motivate those groups of people for whom the benefits are less clear. For example, when co-creation is practiced as a form of feedback or test situation, when there is no shared ownership, or no direct apparent change for all participants. In these cases, it is not uncommon that the initiator (often a firm or government actor) provides a compensation, discount, or offering to lower the threshold for participation [79].

Fifth, is the element of spaces and places for co-creation. Co-creation does not take place in a vacuum, but always occurs within socio-spatial contexts. Hence, this element closely connects to the literature on place-based innovation. The concept of place-based innovation is related to the development of industrial clusters and districts, as well as to the literature on regional development and policy innovation [80,81]. The connection between innovation and its spaces became a case for the analysis of the specific conditions for innovation to appear. In the studied cases, proximity is the relevant condition that facilitate the interaction and access between actors that bring innovative ideas and resources [82]. However, spaces and places are also catalysts of interactive learning and innovation [83]. Place-based innovation is claimed to lead to "the wide adoption of ideas developed as resources and behavioral guidelines by and from situated communities of innovation" [84] (p. 2194). Creating the physical (and mental) spaces for learning and experimenting is a necessary condition for fundamental change [85]. Spaces and places facilitate visionary collaborations for making and learning together through co-creation practices [86]. They enable collaborating actors to systematically and deliberately explore solutions across sectorial boundaries. Moreover, they constitute interventions within socio-spatial contexts themselves. Spaces and places of co-creation are found to affect their socio-spatial environment, e.g., by providing meeting places, creating visibility for local sustainability issues [87], or by becoming "vehicles for innovation in urban planning processes" [88] (p. 89).

To conclude, taken together, these five elements influence the overall dynamics that are associated with co-creation. The five individual elements do not completely stand alone, they interact, relate, and influence each other. They should be regarded as a basis for understanding co-creation in practice, as will be done in this paper for the specific case of ULLs. In the next section, our methodological approach and empirical data are presented.

2. Research Context and Method

The context of this research is the city of Rotterdam, the second largest city in the Netherlands. To promote experimentations within the city, the Rotterdam local government has taken various actions, while following broader European policy directions and funding schemes [22].

For example, the last coalition agreement within the municipal cabinet [89] promotes experimentation as a valuable strategy to enhance participation and to stimulate innovation in policy-making towards (social) sustainability. The contextual conditions allow several Urban Living Labs to emerge, being active in different domains and on various topics [90]. Within six of these ULLs operating in the city, the elements of co-creation were studied. The six ULLS were selected for representing a richness and complexity of the context (as they are dealing with a variety of urban issues), while maintaining a manageable amount of cases allowing a significant analysis of the co-creation

elements. In addition, the selection of these ULLs is based on representing different dynamics of the five elements of co-creation.

A series of in-depth, semi-structured interviews was conducted with key stakeholders of the five selected ULLs. The sixth ULL was studied through active participation of one of the authors (P.M. Karré); he is one of the coordinators of the urban knowledge lab 'Kenniswerkplaats Leefbare Wijken'. The interviewees were representatives of different societal domains: Civil society (*n* = 5), social enterprises (*n* = 3), knowledge institutes (*n* = 2), and civil servants (*n* = 4). The interviews were carried out in Rotterdam between December 2016 and May 2017, and were structured around five main topics: (1) The objectives and motivations of the Lab; (2) the type of collaboration and participation taking place; (3) the main challenges that they had/have; (4) problems and resistance that they had/have; and (5) their relation with the physical and social environment. The interviews lasted between 45 and 90 min each. All interviews were recorded with consent of the interviewees and fully transcribed for further data analysis. Data was then analyzed with a mixed method approach that included the primary data sources from the transcribed interviews and secondary data provided for the Labs. The analysis of the data focused on the five elements for characterizing co-creation. First, the authors collected quotes from the interviews in relation to the five elements of co-creation. Then, they described each ULL in relation to the five selected elements. Afterwards, a comparative analysis of these descriptions was developed in relation to each element of co-creation. The existing dynamics of collaboration in the ULL were decoded, as well as the issues and challenges related to them.

2.1. The Case Studies

Following, we describe the six selected ULLs (See Figure 1) according to their set-up, process, and timeline of their development, as well as the main theme they refer to and the problem they respond to. After that, we will describe the results of the analysis of the co-creation elements within these six selected ULLs.
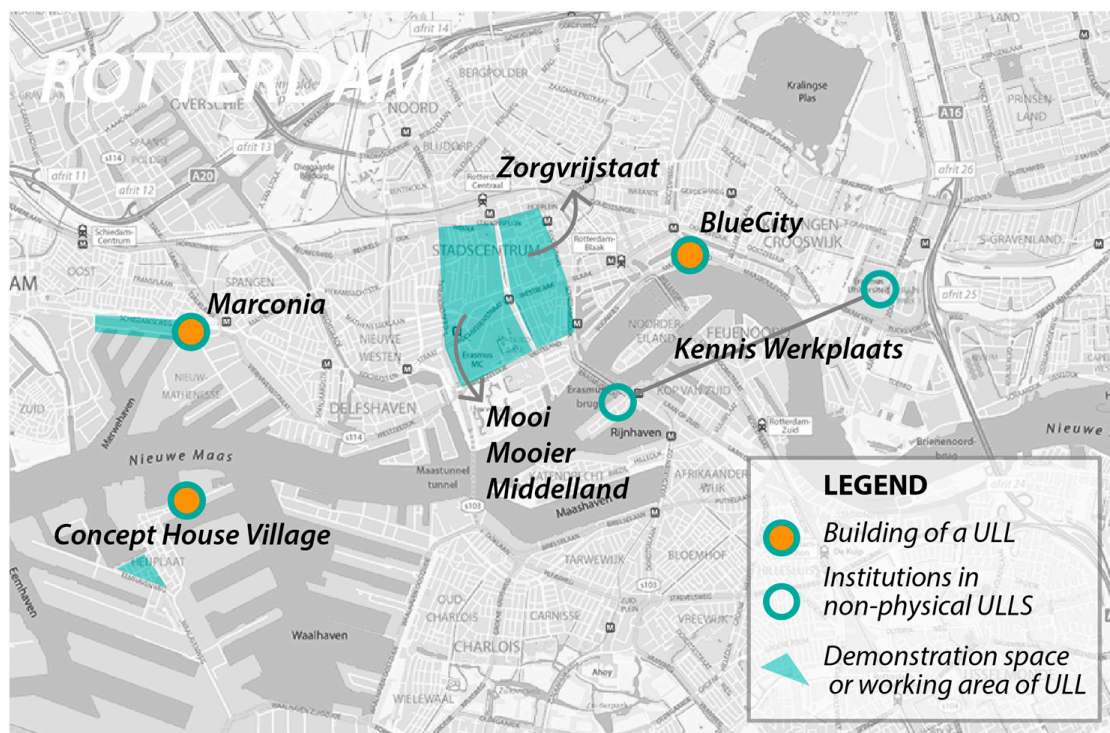
Figure 1. Map of the city of Rotterdam with the six Urban Living Labs (ULLs) mapped.

2.1.1. Kenniswerkplaats Leefbare Wijken

The Urban Knowledge Lab (a literal translation of the Dutch word kenniswerkplaats) was established in 2012 as part of a strategic partnership between Erasmus University Rotterdam (EUR) and the municipality of Rotterdam. The lab acts as a knowledge broker between municipality and university and works through the co-creation of knowledge with real-life problems as a starting point. Its aim is to help the municipality to develop evidence-based policy concerning quality of life issues in urban neighborhoods (i.e., social cohesion in ethnically diverse residential areas, new ways to tackle crime). The Kenniswerkplaats is run by a steering committee, formed by representatives of both municipality and university that sets the research agenda of the lab. They are supported by a program committee, a broader group of civil servants from various municipal departments, and researchers from various academic disciplines.

2.1.2. Marconia

Marconia is a cooperative that is located on a 30,000 m^2 old marshalling yard close to a harbor area of Rotterdam. In 2013, a small group of pioneers and entrepreneurs developed a plan to set up a lab for experimenting on this piece of land; experimenting for different social, as well as urban, development structures for public use. The municipality apportioned the terrain to the cooperative for a period of 10 years. The cooperative then called out to individuals or groups of entrepreneurs, civil servants, knowledge institutes, and citizens (the whole quadruple helix) to come and experiment on this rugged piece of land: To use it as a test bed, to build structures, and to inspire for future developments in the whole of the Netherlands.

2.1.3. Zorgvrijstaat

Zorgvrijstaat is an association that aims to give health assistance, mainly psychological and psychiatric, based on neighborhood structures. The association was founded in 2013 in response to a public reform of the health system that shifted the management of health services from national to local provinces and city councils. The association was founded by a core team of four health professionals that slowly grew. Now, the association collaborates with many professionals active in psychiatric and psychological assistance, but most of them participate in informal ways. They collaborate with knowledge institutes that study the innovation of psychiatric systems and practice. Additionally, the core team tried to officially involve some private insurance companies, but failed. They also work with a selection of people at the political level and some local civil servants, but this is mainly on a voluntary or informal basis.

2.1.4. Concept House Village Lab

Concept House Village Lab operates as a test-bed for sustainable building technologies and innovative approaches to building retrofitting in the area of Heijplaat in Rotterdam. This Lab is a place where innovative houses, products, and systems are tested together with and by the (temporary) occupants, while experimenting with new approaches of urban development. The occupant is seen as key in co-designing the neighborhood development and using the technologies in the prototype houses. The Lab tests and experiments with concept houses, which incorporates the full sustainable building construction and demolition cycle, within mixed-use neighborhood settings. Two universities, the building industry, branch organizations, the local community, and the municipality of Rotterdam joined into the Lab in order to construct and experience newly built prototype houses, and to learn about new ways of renovating some of the existing houses. The lab emphasizes the role of shared (lab-based) education and research to become a platform for sharing and speeding up innovations in the sustainable building sector.

2.1.5. Mooi Mooier Middelland

In the neighborhood of Middelland, a group of citizens actively criticized the policy (specifically safety regulations) that the local government carried and developed for their neighborhood. This group of activists challenged the municipality and a new approach was sought that would be a co-creative development between all stakeholders in the neighborhood. This resulted in Mooi Mooier Middelland: An experiment with co-creation between citizens and the municipality, financed with seven million euros for a period of three years. The goal of the program is to improve the quality of living, through physical improvements of public places and spaces, as well as building social structures in the neighborhood. The program operates with specific working groups on different topics, including both citizens and entrepreneurs in the area, as well as civil servants. Later in the process, a knowledge institute was also involved to perform an intermediate evaluation.

2.1.6. Blue City Lab

Blue City Lab is a Lab located at an iconic site, an abandoned swimming pool in the city of Rotterdam, since 2015. The building now functions as a platform for co-creation, events, and experiments with blue and circular economy initiatives. The lab activities emerged from the engagement of several start-up entrepreneurs that were testing new approaches to reuse food waste. The iconic building acted as a beneficial platform to leverage and engage other start-ups that were testing new approaches to reduce and reuse different types of waste. The building itself is now a symbol that promotes the circular and blue economy within the city, aiming to create a broader network of circular economy startups. The re-use of such an iconic building was possible thanks to a philanthropist investor who purchased it in 2015 and made it available for startups active on circular economy issues.

3. Results

In the following paragraphs, the results of the comparative analysis carried out by the authors are described using the five elements of co-creation described by the literature as conceptual lenses.

3.1. Purpose of the Co-Creation

The six Labs show clear differences in their purpose of value creation or innovation. Figure 2 shows the six ULLs mapped according to their innovation purpose. The purpose of some of the Labs is more focused on *learning* together (Kenniswerkplaats, Zorgvrijstaat, and to some extent Mooi Mooier Middelland and Blue City Lab), here the value creation is more focused on innovation of the societal systems. These learning and knowledge development processes generate different values across the case examples. For example, learning can be a means to acquire credibility and to demonstrate that an alternative model is sustainable and feasible (Zorgvrijstaat); a means to expand research and education networks (Concept House Village); or the purpose for which the stakeholders come together (Kenniswerkplaats). Finally, it can be the way to include new actors within the cooperative, and also to reach the people and institution that could help to improve the experiments and to reduce bureaucratic issues in the future (Marconia, Mooi Mooier Middelland, and Blue City Lab). In other Labs, the value creation is more focused on creating product and technology systems, here the purpose of co-creation is primarily *making* together (Blue City Lab, Concept House Village, Marconia, and to some extent Mooi Mooier Middelland).
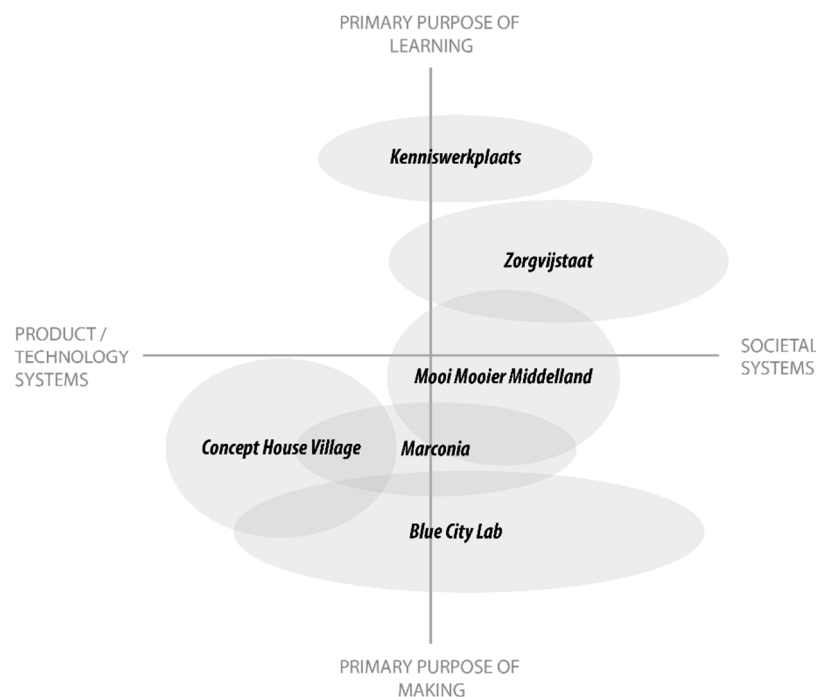
Figure 2. Primary purpose of co-creation and subject of the innovation or value creation.

3.2. Formal and Informal Co-Creation

For all the ULLs taken into consideration, participation takes place in both formal and informal ways, but to different extends. We identify different forms of formal and informal co-creation between three types of groups involved: The core group, the inner circle, and the outer circle (from left to right in Figure 3). Within the core-group, which are mostly the initiators, co-creation is usually formalized and settled by legal responsibilities in relation to the particular Lab. Second is the 'inner circle', represented by the devoted people around the core-group, where semi-formalized forms of co-creation take place. For some of the Labs, the formal co-creation between the core group and the inner circle are at the core of their co-creation practices (Concept House Village, Kenniswerkplaats, Blue City Lab). People from the inner circle are selected and non-selected, but often formally invited by the core-group as users, experts, or entrepreneurs in different kind of settings, such as tenant, part of an advice group, or participants in a workshops (lead-users, as Von Hippel [60] would call them). The people who operate in the inner circle take an active role within the organization, but do not always have specific legal and formal responsibilities or direct influence on the Lab's strategy. Third, there is the outer circle, with whom mostly informal co-creation takes place. This outer circle consists of people that are not strongly nor officially connected to the ULL. This informal co-creation often takes place when the core group tries to involve people from the 'outer circle', and to increase the participation of the outside community (Marconia, Blue City Lab) or between all three groups of people (Zorgvrijsaat, Mooi Mooier Middeland). These informal ways of co-creation take place when people visit the Labs (not necessary on a regular basis), when people participate in the open events organized by the Labs, or through people of different institutions that played a role in the rise or survival of the experiment. Co-creation in this form can be considered more passive. However, for many of the Labs, these events and the people that attend are crucial in expanding their 'inner circle' and forms of more formal co-creation (Marconia, Mooi Mooier Middelland, Zorgvrijstaat, Blue City Lab). However, the results also show that for some of the labs, the target and effort of the co-creation with the outer circle and the actual co-creation taking place with the outer circle was not matching (see Figure 3).
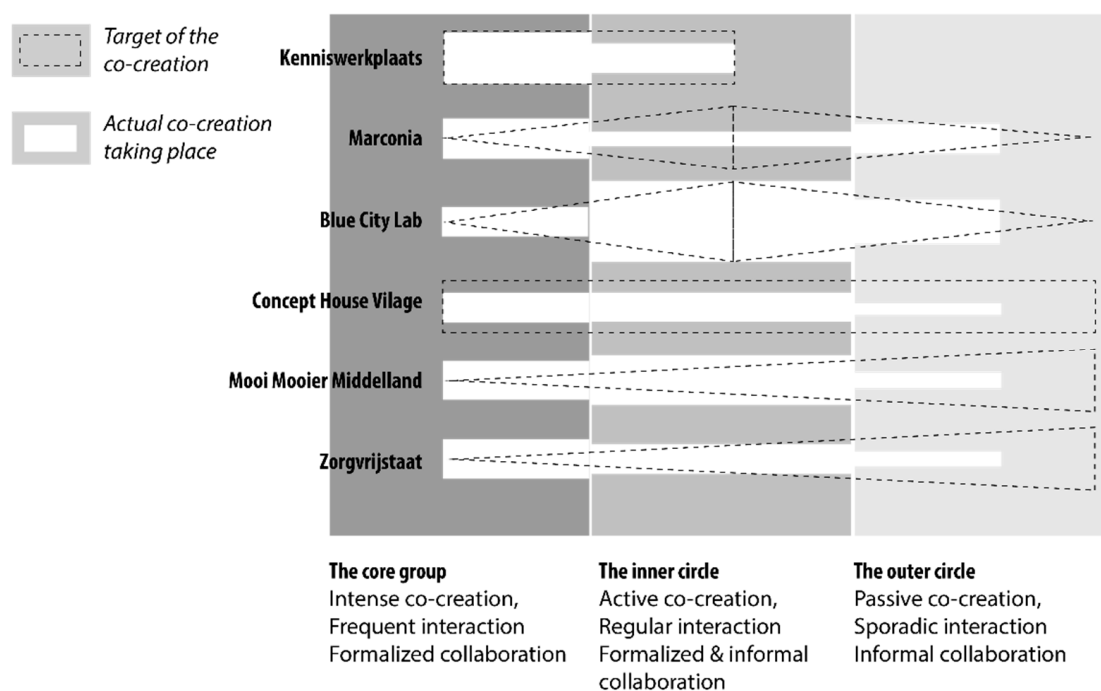
Figure 3. Target of the co-creation focus and actual reach in relation to the cases.

3.3. The Ownership of Co-Creation Process

In the different Labs, the initial ownership of the core-group always has a strong influence on the co-creation. However, it can be seen that for some Labs, the ownership of co-creation processes beyond the core-group did not extend as much. In some Labs, it is seen that the ownership of the process mostly lies with the core group of initiators (Kenniswerkplaats, Concept House Village), and the other two groups are invited or only informed about the process. In other Labs, it is seen that there is a small core group of visionary leaders (Blue City Lab, Zorgvrijstaat, Marconia) that aim to inspire and work to get an inner circle of people around them with the same vision. Often the focus is on getting more people to join the inner circle and work towards the shared vision, sharing and opening up the ownership. Here, it is seen that the vision-forming of the initiators and having a strong shared idea of the future is crucial for co-creation without too much struggle. For other Labs, the focus of the initiators is also to get the group of outer circle people into the co-creation process (Mooi Mooier Middelland, Marconia most prominently, but also Concept House Village and Zorgvrijstaat). Here, the ownership is not transferred or shared beyond the core-group, sometimes despite the efforts of the core-group.

3.4. Motivations and Incentives for Co-Creation

The motivations and incentives for co-creation are closely related to the purpose of the co-creation. This study shows that for the ULLs that are more concerned with societal systems (Kenniswerkplaats, Zorgvrijstaat, and to some extent Mooi Mooier Middelland), the incentive is often a collective one, with less direct benefits for a single individual, or less valuable without the network of the co-creation group around. One of the drawbacks is that the benefits and learnings of these Labs are harder to transfer to other Labs, or extend to larger parts of society. Thus, despite the fact that the outcomes are often aimed at changing societal systems, it is also hard to actually transfer the benefits of these learnings to people beyond the co-creation. However, intrinsic motivation for this larger societal and contextual goal is often a great incentive to join. For the Labs that are more focused on product-service systems or product-technology systems, (Blue City Lab, Concept House Village, Marconia. and to some extent Mooi Mooier Middelland), it is seen that there are more direct individual incentives

for the participants. Here, the participants often work on their own developments or innovation, but under a shared motivation or innovation umbrella, such as sustainability, circularity, inclusivity, etc. The different individual results are all beneficial for the individuals producing them. Also, the benefits of these innovation outcomes are often less context-dependent. The Lab, by providing the umbrella, makes the individual benefits together stronger. The results of these Labs are often easily transferred through demonstration and tangible products, possibly extending the motivation to others outside the co-creation. For most of the studied Labs, the benefits gained by individuals are also highly dependent on their intrinsic and extrinsic motivation, as well as to the commitment to a specific societal or business goal, and their feeling of fulfilment when contributing to this goal. If their commitment to these goals is high, the intrinsic motivation might be greater than when their motivation for the goal is somewhat lower. A sense of fulfillment was often heard as a motivation to start or join a certain ULL. The incentive of fulfillment is a very subjective outcome, and can be different for each individual involved in a ULL, despite similar efforts in the co-creation.

3.5. Spaces and Places in Co-Creation

The Labs that make use of existing urban buildings and constructions actively shape the place's meaning and the socio-spatial context with the activities that they are running, both at the prominent site and beyond. For example, Blue City makes use of an urban artifact, which is an old swimming pool, to establish a symbolic locality of innovation. Becoming a place where innovation manifests within a specific neighborhood is triggering the rise of new narratives about the place itself, and also about the neighborhood. Both this Lab, and the ones that develop new buildings (Concept House Village, Marconia), actively promote the collective benefits from the Lab activities for their respective neighborhoods. The Lab's activities create visibility and intend to motivate more actors to learn about co-creation within such contexts. Those Labs that do not have a fixed building or space (Mooi Mooier Middelland, Zorgvrijstaat, Kenniswerkplaats) struggle more in creating such place narratives. The narratives that they do create, at least, are not strictly related to a place, and they are not as easily recognizable as for the others. This is also causing more difficulties in reaching the outer circle of co-creation (see Figure 2), and therefore the necessity to invest more time and energy in engaging activities.

4. Discussion and Conclusions

The current study has been conducted to reflect upon the dynamics of co-creation within ULLs by studying their constituting elements. Five main contributions can be derived that on the one hand, reflect upon a more fine-grained understanding of co-creation in ULLs as multi-actor processes of developing and experimenting with new strategies, agendas, and actions towards sustainable cities; on the other hand, reflect upon the understanding of how ULLs as vehicles for co-creation can potentially be effective instruments and become mechanisms for systemic and institutional change.

First, employing co-creation within ULLs is not only useful to facilitate discussions with the purpose of aligning and defining the possibility of action in a decision-making process, as is largely discussed in urban planning literature [6]. Employing co-creation can also be a means to broaden collaboration, engagement, and empowerment of citizens [12]. Some of the cases in this work show that the co-creation processes can be instrumental in reaching strategic goals (see Figure 2), as well as that citizens' engagement can become a strategic goal in itself (see Figure 3). In addition, the above-mentioned purposes of co-creation are not mutually exclusive, and they can be strongly interlinked, serving one another. They expand the possibilities of producing solutions and common goods developed through knowledge-processes, while increasing the sense of ownership [59].

Second, there is no clear correlation between a formal or informal set-up of co-creation, and the involvement of specific groups active across the co-creation layers (core group, inner circle, and outer circle, see Figure 3). The fact that formal and informal practices of co-creation can be observed within the studied ULLs confirms that ULLs are open environments [91]. Within ULLs, co-creation practices

take place in different forms, including fluid forms of engagement that are not necessarily settled 'a priori'. In this sense, the three co-creation layers mentioned in this study highlight how the core group and the inner circle participants are usually engaged in a long-term process, whereas the outer circle participants are instead aiming for more short-term goals. For an extensive illustration of the dialectic between the long-term and short-term concepts, we refer to the work by Fisher and colleagues [59]. However, the more formally set-up ULLs did not necessarily lack informal participation and/or short-term engagement. Some of the more emerging ULLs that focused on more informal and short-term engagements were often struggling more to establish these practices.

Third, the three groups active in the co-creation layers are hard to engage to the same extent (see Figure 3). Scholars, in the last years, have been discussing the creative potential in co-creation dynamics of lead-users' and frontrunners' initiatives, as opposed to considering everyone as a potential participant [63,64]. Referring to this debate, the current study shows that lead-users and frontrunners are often found in the core group, and to some extent in the inner circle. Individuals in the outer circle are usually the focus of co-creation that considers everyone to be creative and a potential participant. However, in the cases studied, this form of co-creation proved difficult to achieve. Intense links, connections, and co-creation practices are in place when a core group consists of the driving actors of the co-creation process, who are able to involve either participants from the inner circle, or from the outer circle. When a combination of the three layers is present in the co-creation, the links between the three groups are often less strong.

Fourth, the motivations in contributing to co-creation processes are strictly related to the sense of ownership of the process. How and why individuals participate in the activities taking place within the three different layers of co-creation (see Figure 3) is indeed connected to the benefits they can obtain through doing so [75]. In this perspective, our findings highlight a mismatch in the motivation of the core group participants, compared to the inner circle and the outer circle. It is hard to transfer and extend the sense of ownership of ULLs beyond the core-groups, because the broader co-creation practices in ULLs are often non-binding and largely dependent on voluntary efforts. Also, the motivation or incentive to start a ULL is often linked to a sense of personal fulfillment, which is not easy to transfer.

Fifth, the spaces and places of co-creation play an important role in stimulating the rise of co-creation processes. Transforming iconic buildings into symbols of (sustainable) innovation produces an attractive platform to facilitate co-creation. When a place is directly recognizable as a location where innovative processes are happening, it attracts a broader audience, which again can trigger further activities, even beyond the purpose of the ULL and its vision. This creates visibility for the lab and motivates further actors to learn about co-creation within the lab's context. The physical artifacts of the ULL then become a source for inspiration and a site for demonstration, possibly activating others to also initiate further making. Places of co-creation confirm to be potential drivers for the wider adoption of ideas developed by situated communities [84]. Yet, particular places of experimenting do not exclude niches from becoming accelerated or diffused to broader practices in different ways, since context dependency is not necessarily a barrier to the diffusion of innovation. Innovation can spread in multiple ways, e.g., by being adopted, translated, and adapted to other contexts. Nowadays, for example, social media networks play a major role in spreading ideas across networks [92,93]. In fact, diverse factors, besides the territorial context, matter in enabling the emergence of certain niche innovations [94] in a particular context and across locations.

These five contributions clearly highlight that ULLs themselves proofed to be potentially effective instruments to bring different actors together in experimenting with new solutions around specific issues or challenges. ULLs can both provide the platform for municipalities and public bodies to develop new capacities and skills by working with local actors in a more exploratory, co-creative manner with citizens, as well as for active citizens to become empowered and to play a larger role within urban innovation and decision making processes. However, despite the fact that innovations within ULLs are setup with a particular purpose, they might not necessarily be able to transform the

existing structures at large. Only under certain conditions can ULLs be considered instruments for a broader systemic and institutional change. The produced products, services, social connections, and/or knowledge within a ULL, of course, need to be adopted and shared by communities and citizens beyond the limited number of people directly involved in the ULL experimentations [95]. Co-creation dynamics may not only occur within a single lab, but also between ULLs. However, in the cases we studied, this is not apparent, or at least not a common and embedded practice within the city landscape boundaries.

In conclusion, as potential policy instruments, ULLs should serve as platforms to formulate policy advice that builds on the knowledge produced and the related learning processes developed during experimentations. As a consequence, the corresponding strategies and tools that ensure that such adoption will happen need to be in place. For example, the existence of physical spaces for innovation increases the visibility of the ULLs [85]. Indeed, the interactions between a ULL and its socio-spatial context could be further supported by the existence of dedicated spaces and places for co-creation. Moreover, the exploration of the existing motivation of an individual or a group to take part in a co-creation process is a crucial point [96] to be explored further by policy makers in order to develop corresponding incentive schemes aimed at sustaining such practices. Creating a city portfolio of ULLs, or an urban labs ecosystem, would not only broaden the impact and visibility of each individual lab, but would also enhance knowledge development and learning across different laboratories. This could help small experiments develop to a more advanced stage, offering alternatives to existing structures. Urban policy makers should consider ULLs more strategically as mechanisms for systemic and institutional change, in order to escape persistent and path-dependent unsustainable urban development processes. So far, ULLs are mostly seen as locally isolated initiatives, while embedding ULLs in a more systemic transition strategy would enable the scaling and institutionalization of the lesson learned. In a next step, they should be considered an effective policy instrument for developing public support, and practical evidences for desired sustainability transitions. In this perspective, ULLs could complement a broader range of instruments and approaches that nurture a more open and inclusive culture of experimentation in future urban development.

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