land

MDPI

Article

(Un)Likely Connections between (Un)Likely Actors in the Art/NBS Co-Creation Process: Application of KREBS Cycle of Creativity to the Cyborg Garden Project

Manuel Alméstar [1,2,*], Sara Romero-Muñoz [3], Nieves Mestre [1], Uriel Fogué [1], Eva Gil [1] and Amanda Masha [4]

[1] Escuela Técnica Superior de Arquitectura de Madrid, Universidad Politécnica de Madrid, 28040 Madrid, Spain; mariadelasnieves.mestre@upm.es (N.M.); uriel@elii.es (U.F.); eva@elii.es (E.G.)
[2] Climate-KIC Holding B.V., 46980 Valencia, Spain
[3] Escuela Técnica Superior de Ingeniería de Montes, Forestal y del Medio Natural, Universidad Politécnica de Madrid, 28040 Madrid, Spain; sara.romero@upm.es
[4] Instituto Mutante de Narrativas Ambientales, 28040 Madrid, Spain; amanda.masha@network.rca.ac.uk
* Correspondence: manuel.almestar@upm.es; Tel.: +34-646571955

Abstract: NBS provides the technical basis for adaptation to climate change, and co-creation is the vehicle for the co-production of knowledge and innovation, both forming a strong binomial for the UE Green Infrastructures Strategy. Nonetheless, one of the main challenges for the implementation of effective co-creation strategies is the incorporation of knowledge from diverse social systems. Knowledge production has been approached through different methodological models, such as the quintuple helix innovation by Carayannis, or the diffuse/expert knowledge model by Manzini. These theoretical models are based on linear knowledge transfers, without sufficiently depicting alternative knowledge flows among (un)conventional actors. In view of these limitations, the research proposes a third strategy: the KREBS cycle of creativity defined by Oxman is a conceptual map capable of describing knowledge transfers across the four modalities of human creativity (i.e., science, engineering, design, and art). Providing sufficient "creative energy" in a co-creation process would guarantee the successful production of knowledge. Thus, the research seeks to illuminate different co-creation strategies to promote "creative energy" in the design of the Cyborg Garden (CG) in Madrid, giving a novel application to Oxman's methodological framework based on the Carayannis's and Manzini's models.

Keywords: KREBS cycle; co-creation; creativity; knowledge; QHIM; art/science; NBS

Citation: Alméstar, M.; Romero-Muñoz, S.; Mestre, N.; Fogué, U.; Gil, E.; Masha, A. (Un)Likely Connections between (Un)Likely Actors in the Art/NBS Co-Creation Process: Application of KREBS Cycle of Creativity to the Cyborg Garden Project. *Land* **2023**, *12*, 1145. https://doi.org/10.3390/land12061145

Academic Editors: Thomas Panagopoulos and Vera Ferreira

Received: 28 April 2023
Revised: 21 May 2023
Accepted: 27 May 2023
Published: 30 May 2023

1. Introduction

> *"Why a Cyborg Garden? Planting trees won't solve the problem?"* (Extracted from the first working session of the Cyborg Garden project (30 May 2018)).

In June 2013, the *European Commission* (EC) launched the *Green Infrastructures Strategy* (GIS) [1] with the aim of promoting the use and development of *nature-based solutions* (NBS), defined as actions inspired by, supported by, or copied from nature, to address environmental, economic, and social challenges linked to climate change [2]. From then on, the programme has invested more than EUR 926 million in one hundred thirty-six projects [3]: one hundred and ten NBS-related projects, seventeen GI projects and nine linked to both (Appendix A). These projects explore and validate their direct benefits such as CO_2 compensation, or regulation of urban microclimates, as well as indirect benefits such as contributing to health, well-being, and job creation, among others [4]. These projects are characterised by their ability to integrate multiple stakeholders, as well as integrate knowledge from multiple disciplines, based on local contexts [5]. This allows NBS implementations to be tailored to social needs, increasing citizen ownership, fostering empowerment, and building stronger and more collaborative long-term relationships [5,6].

Following this social trend, the *New European Bauhaus* (NEB) was created in September 2020 to boost the cultural dimension of the sustainable transformation of cities and towns across Europe [7]. Under the principles of sustainability, inclusion, and beauty [8], the program promotes the production of transdisciplinary and creative knowledge through co-creation processes [8] designed to strengthen social cohesion and community engagement, cultural values associated with nature, their potential for education and interpretation, as well as the capacity to co-create collective narratives to raise awareness about climate change [4,5,9].

In this way, NBS and co-creation are a strong couple for GIS implementation (Appendix B), with NBS providing the support basis for climate change adaptation, and co-creation being the tool for a joint production of knowledge and innovation. One of the main challenges is to implement effective co-creation strategies that integrate knowledge from all social systems and produce new knowledge for successful GIS.

Knowledge production has been approached through different methodological models in the scientific literature of social innovation. Elias Carayannis's model synthesizes the interaction among education, political, economic, environmental, media-based and culture-based systems in the *Quintuple Helix Innovation Model* (QHIM) [4,10–12]; on the other hand, Ezio Manzini proposes the entanglement of two types of agents—referred to as designers—providing either expert or diffuse knowledge [13]. However, these theoretical models are based on linear knowledge transfers (synergies and complementarities), while not sufficiently depicting alternative or discontinuous knowledge flows among (un)conventional actors and organisations within the ecosystem.

In view of these limitations, this article proposes a third strategy. The *KREBS cycle of creativity* (KCC), proposed by Neri Oxman [14], is a conceptual map able to describe the perpetuation of creative energy and knowledge exchange across the four modalities of human creativity—science, engineering, design, and art—with the role of art being "questioning human behaviour and creating awareness of the world around us" [14]. Providing sufficient creative energy in a process of co-creation would ensure the successful production of knowledge.

Therefore, this article seeks to bring to light different co-creation strategies for the promotion of "creative energy" through art-driven NBS processes, giving novel application to Oxman's methodological framework. To this end, the *Cyborg Garden project* in Madrid (CG) is enabling the following targets: presenting and discussing the art/NBS co-creation strategies implemented; identifying the critical factors and lessons learned from the co-creation process; and depicting the knowledge transfers between stakeholders, as well as their tensions and synergies during the art/NBS co-creation process. All of these are fundamental elements for the model's replicability in other contexts.

The article is organised into six sections: Section 2 describes both the materials and the theoretical frameworks that feed the research, including the research methodology and the criteria for solving the posed questions; Section 3 presents the systematisation of the CG case study; Section 4 presents the main findings, Section 5 the discussion, and finally, Section 6, the main conclusions.

2. Materials and Methods

The study has been conducted by five researchers involved in the implementation of the CG project between May 2018 and July 2019, and includes the perspectives of an external observer. The discussion has received feedback from several stakeholders from the EU's EIT Climate-KIC *Madrid Deep Demonstration Platform* (MDD) [4,15], amplifying the creative potential of the aforementioned case study [16]. The participants of this research project have reviewed and validated the final version of this paper. The following sources were analysed for triangulation purposes: (1) key documentation related to project activities: project proposals, terms of reference, working documents, and project reports; (2) direct and indirect observations: workshops, notes and audios of the meetings, and project reports; and (3) continuous monitoring and feedback with facilitators of the CG project and MDD platform (Supplementary Information).

2.1. Materials: Theoretical Framework

The theoretical framework guiding the analysis of our case study contains various approaches to co-creation from the fields of social sciences and social innovation, specifically: (1) the four main principles of co-creation as defined by Stott, namely, inclusion, reciprocity, innovation, and added value [17], and further contributions from the field of arts; (2) the quintuple helix innovation model [4,10–12] defined by Carayannis to identify knowledge exchange between the five systems interacting in the sustainable development of society; and (3) the KREBS cycle of creativity defined by Oxman [14], a tentative mapping for descibing the perpetuation of creative energy and knowledge across the four modalities of human creativity.

Co-creation is a process of collaboration and active participation among different actors with the objective of generating value. It implies a relationship of equality based on transparency, dialogue, and trust [18]. The conceptual difference of co-creation, with respect to other strategies presented in the Appendix C, is that the co-creation provides for people to transcend their traditional roles as mere subjects and become true partners, giving them the status of co-designers [19,20], through any creative process conducive to novel experimental services or products [7,20–23]. This paradigm shift involves a new form of governance, one where multiple stakeholders contribute to public services, fostering improved customer choice and enabling experimentation with various services and products [20]. This transformation is driven by a process of collaboration and active participation among diverse actors coming from different backgrounds [18]. Their common objective is to generate value through a relationship of equality, which is established on the pillars of transparency, dialogue, and trust [18]. By embracing this inclusive approach, society is paving the way for a more dynamic and participatory future [19].

Co-creation processes are vital tools for understanding community expectations and perceptions, co-exploring alternative solutions, and generating added value for all participants [17]. Stott systematised these concepts in the four principles for co-creation: (1) inclusion, related to the integration of different user groups as partners in the whole process, the support given to the participation and empowerment of stakeholders, and the incorporation of social, economic and environmental approaches to the project; (2) reciprocity, related to the recognition that all stakeholders bring knowledge, mutual benefit and shared learning; (3) innovation, related to the changes proposed by the co-creation process regarding the product, the process, its paradigm, the learning developed and the capacity to test and experiment; and finally, (4) added value, related to the impact of the co-creation process, its capacity to foster dialogue and cooperation among stakeholders, the systematisation of the methodology applied, and the promotion or alignment with governmental policies [17] (See Figure 1).

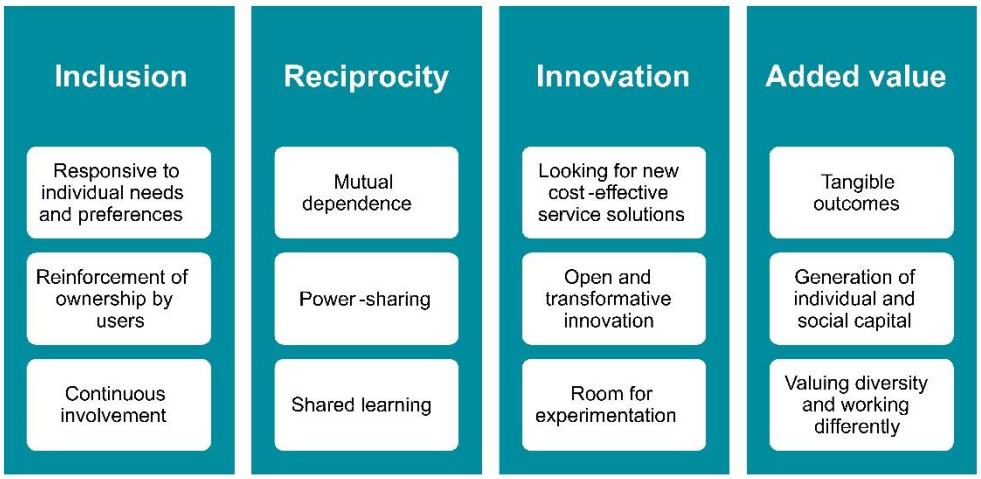


Figure 1. Four co-creation principles, based on Stott [17].

The social dimension of co-creation has also been described from the specific context of artistic practices and artistic collaboration. Maria Lind [24], similarly to other authors, describes collaboration as "an open-ended concept that predominantly offers two ways for participation: in the case of cooperation, the partners obtain a mutual benefit; with participation, members may only shape the unfolding of a situation, the framework of which is predefined by the artist or someone else" [24]. In the same thread, Claire Bishop [25,26] outlines three main motivating sources for co-creation in artistic practices: (1) to introduce social or political empowerment of the subject; (2) to question authorship by introducing collectivism; and (3) to foster community responsibilities in times of endangered social relations. Curators such as Paul O'Neill [27] connect such practices to an "educational turn", a tendency in contemporary art since the second half of the 1990s, moving the emphasis from the object-based artwork towards alternative pedagogical methods that allow for knowledge exchange through art.

The implementation of co-creation processes should be developed through enabling strategies or methodologies, and guided by agents able to foster collaboration and governance, contribute to the construction of a shared vision, promote dialogue, and address the eventual communication issues between stakeholders. These agents are the facilitators or intermediaries [28–30]. The scientific literature has made progress in identifying different types of intermediaries, synthesising their various functions as well as the dynamics of their intermediary ecosystem, and conceptualising the potential influence of intermediaries beyond one-to-one relationships, looking to higher levels of the system [31]. However, while there is consensus on the importance of the roles of intermediaries, there is a lack of clarity on when an interaction can be classified as intermediation, where it starts, and where it ends [30].

The QHIM model describes the circulation of knowledge and its transformation into innovation and know-how among five systems [4,10–12,32–37]. These systems are: (1) the education system: the main producer of knowledge [10], and associated with academia/universities (e.g., scientists, teachers, and higher research) and schools [4]; (2) the political system: associated with state/government knowledge (See Figure 2), it has the function of developing innovation systems at different scales to support the other systems [10]; (3) the economic system: focuses on the "economic capital", and is associated with industry and corporate interests [33]; (4) the media-based and culture-based system: the social knowledge attached to territorial and cultural realities which implies the democratisation of knowledge, making it more accessible and closer to citizens [32–34], it is associated with society, media, creative industries, culture, and art; and finally (5) the environmental system: associated with ecology, environmental protection, the critical challenges for the preservation, survival, and vitalisation of humanity, and its capacity to be a driver of knowledge and innovation [11,12,33,35–37].

The QHIM model is complementary to Ezio Manzini's [13] proposal on design process, with agents providing expert knowledge and diffuse knowledge. Manzini takes the premise that "everyone has the ability to design, but not everyone is a competent designer, and few become a professional designer" [13] (p. 47). He therefore proposes two profiles, that of diffuse design, which is implemented by "inexperienced" people who make use of their natural knowledge, and on the other hand, that of expert designers, who have competent knowledge based on a specific culture, and the management of a set of tools that helps them to understand the state of the art in order to support the design process [13]. For Manzini, knowledge comes from different sources of knowledge, as it does for Carayannis, who proposes an interdisciplinary model positioned between the different systems of society; therefore, both frameworks of analysis recognise people as assets for knowledge generation, the value of working differently and with different actors, and the promotion of reciprocity and shared learning. Nevertheless, these theoretical models are based on linear knowledge transfers (synergies and complementarities), without sufficiently depicting alternative or discontinuous knowledge flows among (un)conventional actors and organisations within the ecosystem.

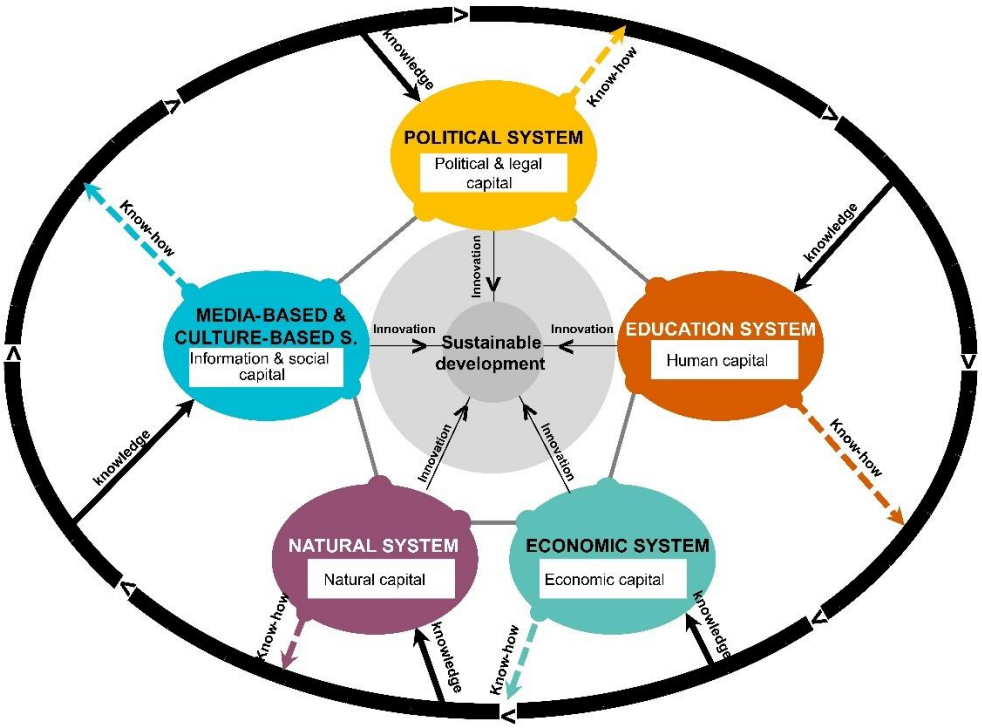


Figure 2. QHIM Model by Carannys [33].

In view of these limitations, *KREBS cycle of creativity* (KCC) by Neri Oxman [14] proposes a conceptual mapping to describe the perpetuation of creative energy and knowledge across the four modalities of human creativity based on Rich Gold's matrix [38]: science, engineering, design, and art. Oxman's hypothesis builds on the metabolic cycle proposed by Sir Hans Adolf Krebs in 1937 to explain the chemical reactions implied in cellular respiration of aerobic cells, including energy stored in the form of *adenosine triphosphate* (ATP) [39]. In this analogy, the four modes of human creativity replace the carbon compounds of KREB by developing a function in four successive iterations: science explains and predicts the world around us, thereby transforming information into knowledge; engineering applies knowledge to the development of solutions, thereby transforming knowledge into utility; design creates solutions that maximise function and enhance individual experience, thereby transforming utility into behaviour; and finally, art questions human behaviour and creates awareness of the world around us, thereby transforming behaviour into new perceptions of information [14] (See Figure 3). Oxman's map establishes that this "creative energy" within one domain allows for an easy transition to another, whereby "knowledge can no longer be ascribed to or produced within disciplinary boundaries, but is totally entangled . . . here one domain can incite (r)evolution within another" [14]. Ass to this creative energy, Oxman calls it *creaATP*.

Both the QHIM model and the KCC map are based on innovation and creativity as catalysts for knowledge exchange. The circulation of knowledge continuously stimulates the production of new knowledge so that all systems influence each other and promote the continuity—or perpetuation—of knowledge through further innovations [33]. On the other hand, in the Oxman map, knowledge can have multiple sources, such as science, engineering, design, and art. Oxman claims the validity of non-applied knowledge, which is equivalent to Manzini's diffuse-design knowledge [13].

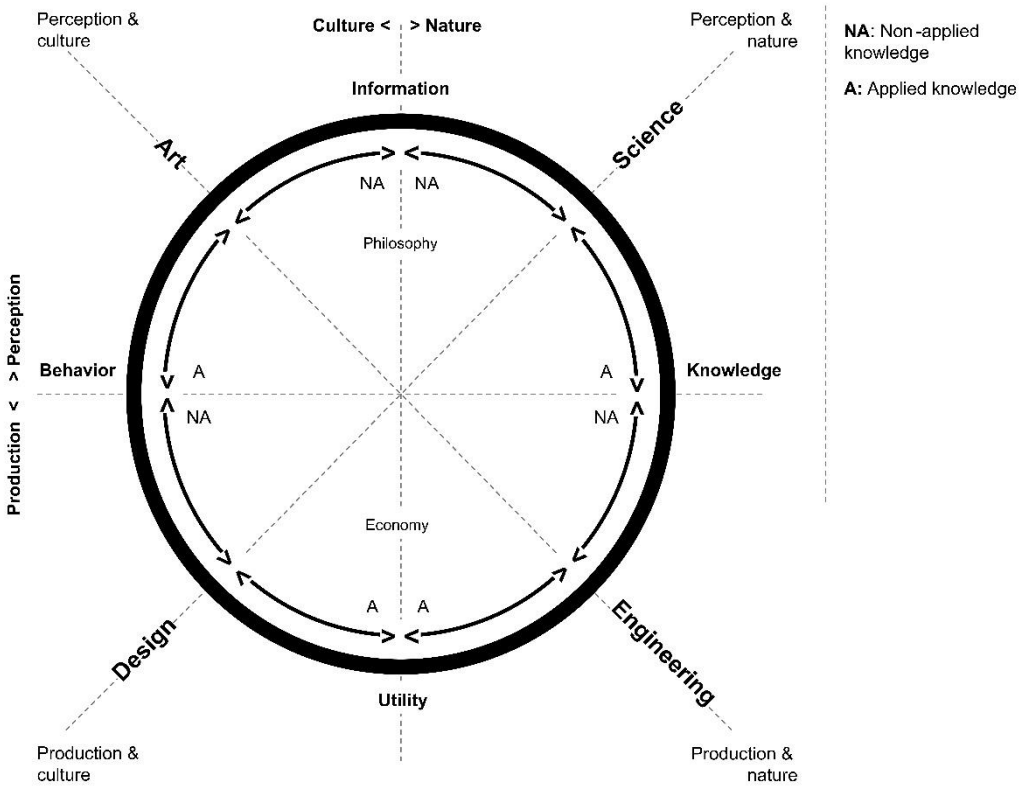


Figure 3. KCC map by Oxman [14].

2.2. Methods

This research project conducts a case study of the CG project within the MDD platform [4,15]. According to Yin [40], case study research is often adopted to understand complex social phenomena based on a variety of data sources [40]. Therefore, the study makes a triangulation of a range of data sources to corroborate the findings in a robust manner [40]. On the other hand, this study is also framed as a collaborative research project, or action-case study [41]. This is particularly appropriate for researching systemic partnerships that are sustainability-focused. While the formation of partnership arrangements is rigorous and complex in the academic literature, the long-term understanding of partnering in the field is frequently lacking [41–43].

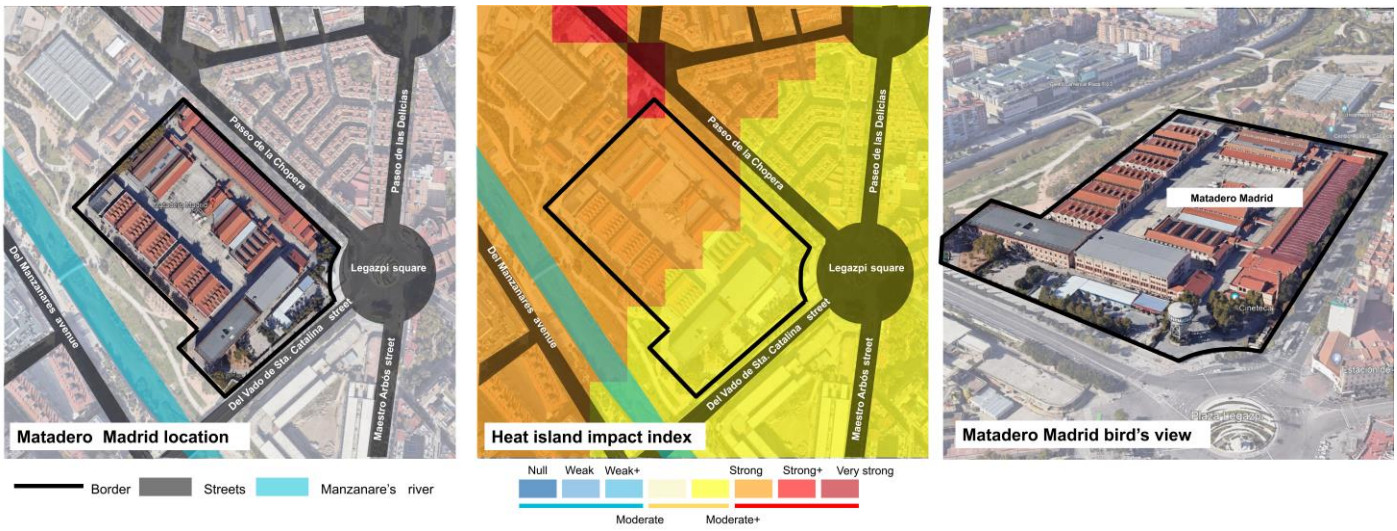
This article identifies the co-creation methodologies implemented and analysed, based on the co-creation principles by Stott. Additionally, the study depicts a graphic analysis of the knowledge exchanges established by the actors during the NBS co-creation process by correlating the QHIM model and the KCC map. These maps, developed for each of the co-creation sessions, show the participants (with expert or, alternatively, diffuse knowledge, as based on Manzini), their respective systems (based on the QHIM model), the knowledge transfers (i.e., weak, strong, directional, or bidirectional) between actors and systems, the overlap of systems in Oxman's quadrants, and the knowledge flow developed in each session.

3. Case-Study: The Cyborg Garden Project at the Madrid Deep Demonstration Platform

In April 2018, the Madrid City Council and several local partners—including Universidad Politécnica de Madrid, through the Centre for Innovation in Technology for Human Development (itdUPM) and the Center for Contemporary Creation "Matadero Madrid"—launched a collaborative platform—initially in the form of a Living Lab [44]—with the aim of accelerating municipal actions and political plans related to climate change challenges in Madrid. In October 2019, this platform was reinforced through the Deep Demonstration program (DD), promoted by the EIT Climate-KIC, and incorporating collaborative ways

of working, agile organisational methods, a portfolio of experimentation, and a series of services interconnecting the city with experiences and learning at the national and European level [15]. The MDD portfolio of projects invested in three areas of interest: mitigation through mobility projects, monitoring of CO_2 emissions, and urban greening through NBS demonstrators.

One of the areas of experimentation in the MDD portfolio was thus driven to urban greening with the aim of co-creating and prototyping scalable interconnected NBS interventions, breaking down systemic levers such as public policies, financing instruments, governance models, and new environmental narratives [4,15]. In this multi-stakeholder framework, Matadero Madrid headquarters (Figure 4) was presented as a test-bed for the design of the CG project [45]. The endeavour was to develop a series of replicable NBS prototypes developed within a co-creation process to alleviate the increasing effects of Madrid heat island at the arid public space of Matadero Madrid [46]. While developing prototypes of high technical and scientific rigour, art was positioned at the centre of the CG project to drive unconventional narratives and knowledge transfers, and to involve citizens into ecological problems, and to foster empathetic relationships with the environment.



(**a**) (**b**) (**c**)

Figure 4. (**a**) Location map, (**b**) vulnerability index [47], and (**c**) bird's-eye-view picture of the Center for Contemporary Creation "Matadero Madrid".

For this assignment, the project curators *elii* [architecture office], supported by the itdUPM facilitation team, implemented a series of working groups based on a collaborative methodology. The co-creation process of the CG was developed at three levels: (1) defining the itinerary of interactions, (2) composing knowledge, and (3) the technical development of the prototypes [45]. The development of the working groups was conceived as an iterative process of learning and incorporation of knowledge from many areas with the aim of answering the design brief. Over the course of 14 working tables and with the participation of 30 participants, the working groups reached a consensus on the main technical objectives of the prototypes: reduce local temperature, increase environmental humidity, improve air quality, increase biodiversity, and raise public awareness of the climate crisis. Knowing these objectives, a series of criteria were established for the selection of the artists who would lead the prototypes. The selection criteria for the artists, as developed by the MDD ecosystem, was based upon aspects such as their multidisciplinary approach, openness to multi-stakeholder collaboration, and previous works on the field. The co-creation process was enriched by stakeholder contributions developing specific sessions regarding public policy, the conditions of the Matadero as a heritage space, intellectual property, and technical development of the prototypes, among others (Figure 5).

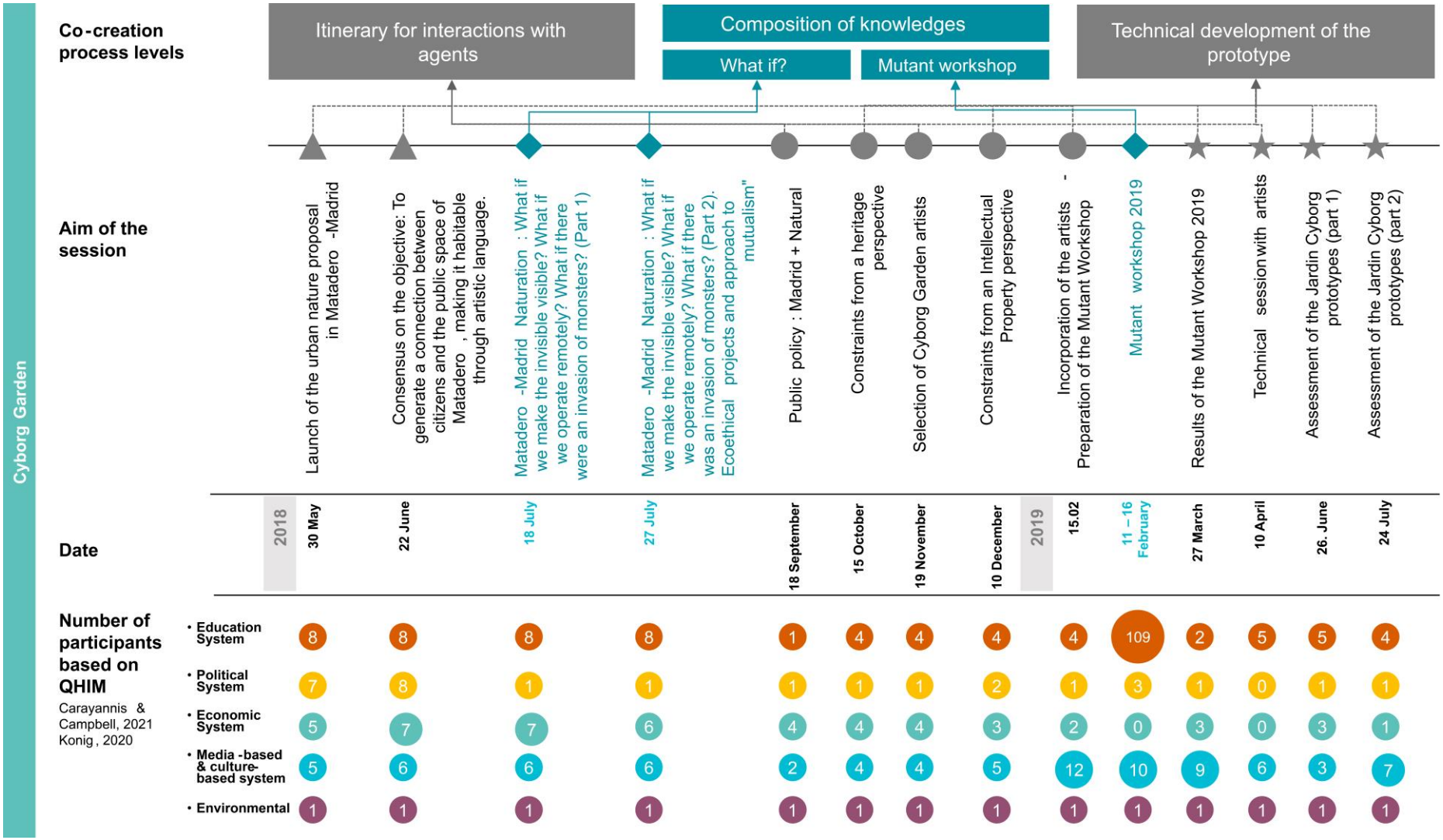


Figure 5. Systematisation of the working groups and co-creation sessions of the CG project (See meeting notes in the Supplementary Information) [12,36].

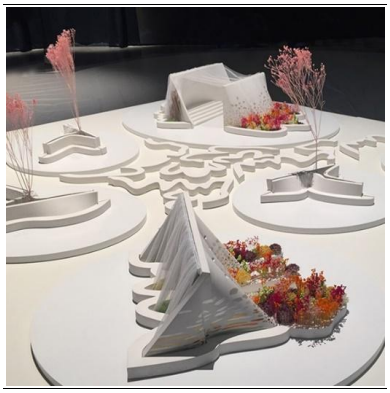
Throughout the process, two co-creation methodologies were proposed; the first was labelled as *What if*, a disruptive approach based on science fiction; and the second, called *Mutant Workshop*, planned as a 6-day event curated by a series of artists gathering students from 12 design schools in Madrid, incorporating more than 100 design students. The purpose of both methodologies was to understand the problem in all its complexity: integrating knowledge, producing transdisciplinary knowledge, and defining prototypes from a holistic approach.

The results of the co-creation process led to a broad range of proposals for the *Cyborg Garden* such as: (1) "Plants also look at the stars", led by the collective UH513, who presented a series of sculptures covered with vegetation in the form of green roofs, and vertical gardens with technological devices, aiming to expand our sensorial capacities to understand the language of plants; (2) the "Fruits of Matadero", led by a bio-designer with a doctorate in computer science, Orkan Telhan, whose cyborg fruits with probiotics helped visitors to combat the effects of summer heat, developing a different approach to the climate change issue, moving from attending the public space towards redesigning the metabolism of humans in the public space; (3) "Hidden in Plain Sight", designed by *Double Happiness* as urban green furniture addressed to insects, the "other" inhabitants of Matadero Madrid, and crucial in its ecosystem's dynamics; and finally (4) "The garden of romantic crossovers" by the team of architects TAKK, composed of a series of shaded living spaces, activating new ethological forms based on desire (See Table 1).

Table 1. Cyborg Garden Prototypes [46].

Prototype	Lead Artist of the Proposal and Concept
	**UH513 | Plants also look to the stars** The proposal consists of the design of an interactive garden made up of new cyborg species: large sculptures that form an optimal habitat for both plants and humans, but which also form an inter-species communication system. By means of integrated sensors, these organic-looking species measure the biochemical processes of the plants in the presence of humans, other living beings, or stimuli from the surrounding environment. All this information is processed and translated into vibrations, movements, and sounds, inviting visitors to perceive the behavioural patterns of the plants and to understand what these artists call the "language of the plant world", which could not be perceived without the help of robotic systems, due to the limitations of the human perceptual system.
	**Orkan Telhan | Fruits of Matadero** The proposal focuses on the idea of "fruit" as an opportunity to generate an encounter in the public space. Telhan proposes an oasis of palm trees that, in addition to generating shade and rest areas in the public space, produces "fruit" in the form of ice lollies for citizens, made with probiotic ingredients. For Telhan, the popsicles are cultural icons that, apart from relieving the heat, evoke memorable moments together with others, appealing to the collective nature of the climate challenge. The "fruits of Matadero" will be produced in three flavours corresponding to the different degrees of climate change foreseen in the Paris Agreement for the coming decades (current: 2.7–3.7°, promised: 1.5–2 °C, anticipated +4 °C).

Table 1. *Cont.*

Prototype	Lead Artist of the Proposal and Concept
	**Double Happiness | Hidden in Plain Sight** The proposal highlights the importance of insects as active agents of urban life. After identifying some of the most important species of butterflies and moths in the area, Double Happiness proposes a series of basic units that integrate urban green furniture with rest and recreation points, creating a habitat that will support a wide network of interdependent species, both human and non-human.
	**TAKK | The garden of romantic crossovers** The proposal consists of the development of living spaces that participate in local biodiversity, activating new ethological forms based on desire. This prototype proposes a scenario for experimenting with the relationships (material, constructive, aesthetic, etc.) of humans with other species in times of climate change. It is configured on the basis of a pergola suspended on a light structure that aims to generate a microclimate that favours the encounter of different species.

The Cyborg Garden was presented, together with the work of 40 other artists and architects, in the International Exhibition *EcoVisionaries*: *Art for a planet in a state of emergency*, from 14 June to 6 October 2019 at Matadero Madrid [48]. This exhibition was designed as a meeting space where dialogue and listening could continue, in order to build strategies around climate change. Thus, the exhibition space of the Cyborg Garden was designed as an agora in which visitors to the exhibition could participate in different dialogues led by the MDD ecosystem (See Figure 6).

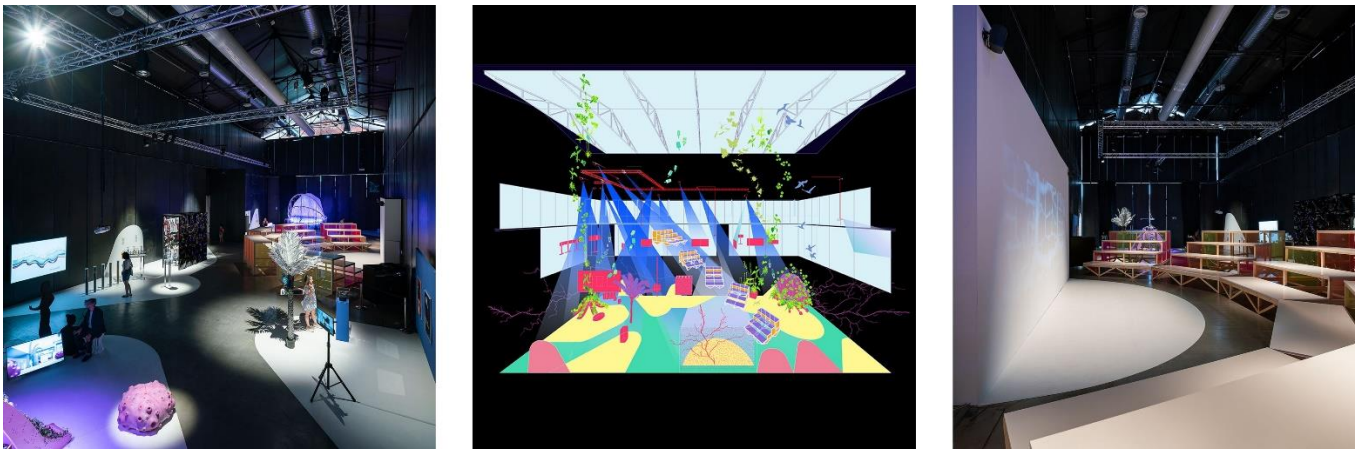


Figure 6. Setup of the Cyborg Garden exhibition space at the International Exposition *EcoVisionaries: Art for a planet in a state of emergency.* (See details on the co-creation sessions, prototypes, and images in the Supplementary Information.)

4. Results

4.1. Art/NBS Co-Creation Strategies to Enhance Creative Energy for Knowledge Production

The Cyborg Garden case study presents two novel co-creation strategies that activate participants' creativity. The artistic approach as a kick-off for the development of NBS prototypes allows participants, coming from different social systems and diverse forms of knowledge, to collaboratively build unexpected results, making for proposals that would be difficult to obtain from a linear and purely scientific approach. Below we present the two strategies developed:

- **What if:** This methodology is driven by the suspension of typical common-sense logics, searching through the development of speculative practices. It allows for the approaching of the problem far from ready-made solutions, and questioning everyday matters throughout art. The method was first employed by Joanna Russ (1937–2011), a feminist science-fiction writer, and by Samuel Delany (1942), to nudge the reader into self-questioning what is possible and impossible. In this framework, three questions were posed to the CG ecosystem of actors, as follows:
    - *What if we make the invisible visible:* Visible? Why should sight take precedence over the other senses? Are future generations invisible? Who are the invisible inhabitants of public space? Can we make visible the knowledge of the invisibles?
    - *What if we operate by remote control:* What is remote control operation and how does it affect our actions on different temporal and spatial scales? How does remote control relate to the concepts of distance, automatic, and directed in the context of Matadero Madrid? If distance implies isolation, are we an island? Who are the current and future inhabitants of the island and how do they relate to their environment? What are the implications and outcomes of rapid disconnection for becoming a self-sufficient island? What does it imply for Matadero Madrid to be a self-sufficient island in terms of resources (e.g., water catchment, soil preparation, composting, energy and food self-sufficiency)? How will the governance system of the island be carried out during the implementation of the off grid system in 5 years, and who will make the decisions?
    - *What if there was an invasion of monsters:* What is the scale of the invasion? minimal or extensive? What is the type of invasion: visible or silent? How is the invasion going to take place: little by little or immediately? The fact that Matadero Madrid is a heritage site is the real monster? How to operate from curiosity towards the "monstrous"? Where is the role of art in this invasion?
- **Mutant workshop:** The *Mutant Workshop* was proposed as a milestone to consolidate the design progress and to include new approaches. In collaboration with artists and design students, these workshops explored the possibilities of co-creation in the field of art-science. The design brief outlined the technical and perceptual possibilities of climate adaptation through the CG artistic perspectives (See Table 2).

The UH513 team worked with sensors and "wearable technology", focusing on the body as a sensitive element that is able to react against specific physical stimuli. UH513 proposal seeks perspectives on the way plants react to environmental conditions, translating their reactions into knowledge perceptible by the human, including what plants feel under certain environmental circumstances. In addition, this team proposed a project for a device operated by a mathematical algorithm able to interpret the reaction of plants towards solar radiation excess and transform it into movement.

Table 2. Methodological approaches for the Mutant Workshops [45].

Artists	Approach
UH513	Novel visualisations of our immediate environment through the incorporation of sensors to amplify the limited human receptive system, thus re-signifying our immediate environment.
Orkan Telhan	A range of cosmologies (and worldviews) to generate alternative realities, working through three logics—evolution, accumulation, and computation—interrogating through a design-led language to see how (or if) they can manifest new socio-political, biological and environmental realities.
Double Happiness	An enquiry from the non-human, asking how to reconstruct the imaginary of insects and arthropods, not as pests to be controlled, but as a fundamental part of our living world; how we can design our urban spaces to include the micro-world of insects as well as their interdependent species.
TAKK	The construction of a device which, like the "cabinets of curiosities", will organise, archive, and exhibit the different research outputs produced during the workshop. This device should allow a clear reading of the collected materials, without proposing unique or closed reading modes.

The team led by TAKK presented a *Cabinet of Curiosities*, the result of an exhaustive search for different material findings, such as green elements, rubbish or remains of past actions. The team designed and fabricated an installation based on wooden slats and small glass containers that, in the manner of a taxonomizing device, enabled the classification of the set of evidence collected, offering a portrait of the urban nature of Matadero.

Joyce Hwang and Nerea Feliz, in *Double Happiness*, together with their students, explained the relevance of insects as those "other" inhabitants of Matadero, often neglected and yet crucial to the functioning of urban ecosystems. After various analyses such as site mapping and thermography-based solar incidence, the team demonstrated architectures designed for non-humans, and based on mutualistic principles.

Orkan Telhan's team presented a collection of species for a potential garden, halfway between the natural and the artificial, around a reflection on what is socially considered natural and organic, versus artificial and technological, putting the focus of the debate on ecosystemic, sustainable and environmentally friendly processes. The team thus experimented with building materials made from biological sources, such as making bricks from fungi or a cellulose solution from which a shade structure could self-grow.

As presented in the theoretical framework, co-creation must integrate four principles: inclusion, innovation, reciprocity, and added value [17]. In the following, we present the analysis of the two strategies implemented in the Cyborg Garden with respect to the four principles mentioned above.

- **What if:** Related to inclusion, this strategy established an interdisciplinary network, bringing together a heterogeneous group of agents linked to design, research, and public policy. In addition, collaborators who had worked in recent years at Matadero Madrid were incorporated, as well as both human (citizen associations) and non-human (usually neglected) collectives. An online platform to share knowledge was set up to make accessible all the generated information.

As to innovation, the design object itself proposed a typological innovation: the Cyborg Garden. The Cyborg Garden was understood as a meeting space between different species, and it would work as a complex technological, biological, and environmental hybrid. Thanks to the "what if" strategy and an iterative co-creation process, the multidisciplinary team was able to provide complex answers. In this sense, suspending the typical logic of common sense allowed the different stakeholders to exchange knowledge for the benefit of the prototypes, reaching developments that would not have been possible without this co-creation strategy. Given the experimental nature of the process, a system

of technical evaluation and implementation of improvements over time was envisioned, making successful and unsuccessful ideas enormously productive parts of the process.

Regarding reciprocity, the stakeholders participated in open working groups. The role of the facilitators was crucial to ensure the horizontality of the process. During the development, the common interests and objectives of the participants were updated. Additionally, the facilitating team ensured the interrelation between the actors to meet the technical needs of the prototypes.

Finally, related to added value, wind and solar exposure gauges were installed at strategic points in Matadero Madrid to measure conditions before and after the intervention. In addition, a specific software program was used to model the climatic conditions of the complex and to support decision-making during the design. It is important to mention that this methodology fostered dialogue and cooperation between the different actors involved in the whole process of co-creation, evaluation, and feedback. Finally, the applied methodology was systematised for replication in other contexts and by other ecosystems.

- **Mutant Workshop:** Related to inclusion, the workshops were developed in a choral way between the selected artists and the almost 100 students from 12 design schools in the city. The results were put on display at a public event in an Open Studio where attendees were able to gain knowledge about the ideas and prototypes first-hand. Throughout the different sessions, the artists and facilitators promoted the empowerment of the students by encouraging them to develop prototypes that could feed into the final prototypes of the Cyborg Garden.

As to innovation, the different positions of artists, students, experts, and attendees helped to reframe the problem of the climate crisis and the scope of the NBS. It became clear that it is necessary to reframe the ways of dealing with the climate crisis in order to adapt our daily life to a new ecological paradigm.

Regarding reciprocity, the workshops brought together a wide variety of profiles, despite the fact that all the participants were only linked to design-related specialities. The divergent points of view of the participants made it possible to address, in a complementary way, the different issues defined at the working tables.

Finally, related to added value, the results of the workshops were presented in a clear and tangible way to all stakeholders at different levels.

Both methodologies implemented and fostered a dialogue with other institutions, such as the Deputy Direction for Energy and Climate Change of the Department of Environment and Mobility (Madrid City Council), the Spanish Climate Change Office, the Official Association of Architects of Madrid (COAM), and the World Forum on Urban Violence and Education for Better Living Together and Peace.

4.2. Knowledge Transfers, Tensions, and Synergies Found through the Art/NBS Co-Creation Process

The application of the "*what if*" co-creation strategy to the case study (Figure 7) shows that the circulation of knowledge, in contrast to the original clock-based approach, is depicted as ribbon-like shapes (in the graphs, black lines). This circulation of knowledge is mainly placed among the environmental, media-based, culture-based, education and political systems occurring in the upper quadrants linked to art and design. To a lesser degree, the economic system has provided knowledge to the ecosystem through interrelation and/or overlapping with other systems, for example with the media-based system.

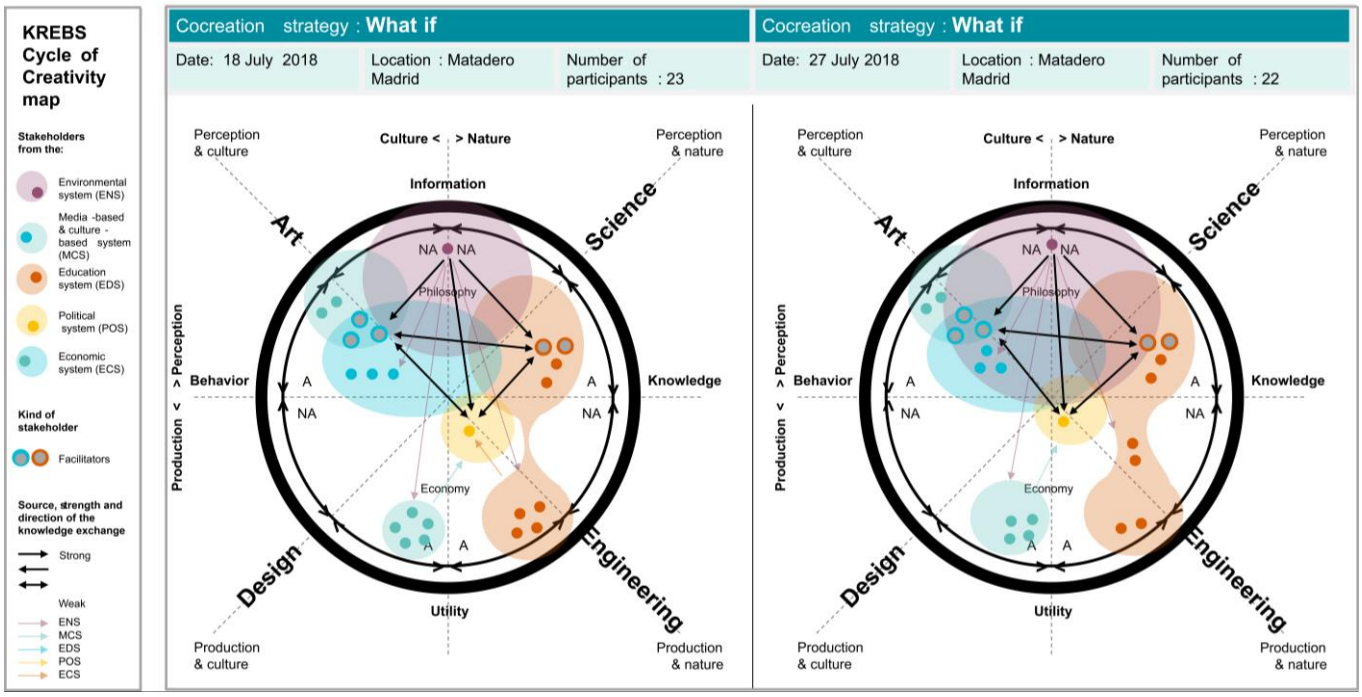


Figure 7. Transfer knowledge among actors and systems involved in the "*what if*" co-creation sessions of the CG project, based on QHIM model and KCC map.

On the other hand, the facilitators (MDD and elli) concentrated the greatest amount of knowledge transfer with other stakeholders, while the environmental system (the public space of Matadero) provided the ecosystem with unidirectional knowledge transfer, in relation to almost all systems; lastly, the political system provided knowledge about the legal and regulatory frameworks (Madrid + Natural strategy, and Madrid 360) and its potential results or prototypes. Finally, as most participants in these initial sessions held expert knowledge in various disciplines, the contribution of non-applied or diffuse knowledge is not easily identified.

The co-creation strategy undertaken during the *Mutant Workshop* is represented within the KCC map (Figure 8), showing that the circulation of knowledge is established as a bipolar pivoting shape. Since the focus group of these workshops were mainly composed of design students, knowledge circulated preponderantly between the educational (students) and media/culture-based systems (artists and facilitators), taking place in the quadrants of design and art. The political system (Madrid City Council) provided unidirectional knowledge transfer. In this context, the economic system did not provide any knowledge to the ecosystem, as it was not represented by any stakeholder during the implementation of this co-creation strategy. As during the application of the '*what if*' co-creation strategy, the facilitators represented the greatest concentration of knowledge transfers, as did the environmental system, which provided the ecosystem with unidirectional knowledge. Finally, an important amount of diffuse knowledge was provided by design school students, interacting with the artists and facilitators to a greater extent.

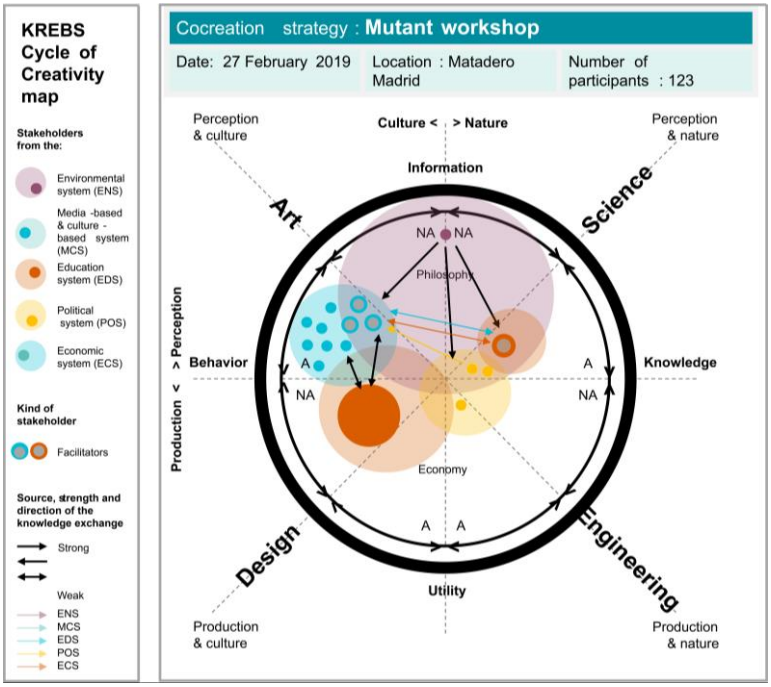


Figure 8. Transfer knowledge among actors and systems involved in the "Mutant Workshop" co-creation sessions of the CG project, based on QHIM model and KCC map.

The maps show that new knowledge is formed in the areas with a higher system overlapping, stronger knowledge transfers, and greater bidirectionality in their respective knowledge transfers. In the case of the "*what if*" co-creation strategy, this concentration of systems is shown in the upper part of the diagram, where strong knowledge transfers take place. On the other hand, in the case of the strategy used in the *Mutant Workshop*, transfers and overlaps occur to a greater degree between two systems (education system and media-based and culture-based system). Through these maps, it is identified that the creative energy that accelerates knowledge is not a "reagent" understood as a component external to the ecosystem, but the collaborative network tissue created by the co-creation process. Therefore, a fundamental factor in this analysis is the quality of the transfers (strong or weak) that ensure collaboration between the agents involved in knowledge production at the art/NBS co-creation process.

5. Discussion

5.1. Art/NBS Co-Creation Strategies to Enhance Creative Energy for Knowledge Production

The results depicted by the analysis shows that some co-creation principles would require further development to be applied. Regarding innovation, while the proposal could produce a cost-effective service solution (e.g., patents) this could however be contradictory with the *Open Access* ambition of the project. In relation to reciprocity, given the experimental nature of the process, no impact assessment on the benefits of the co-creation process were implemented. This experimental approach does not help to anticipate the outcomes of the project, as many of them are visualised during the process; however, the trust environment created among the different stakeholders could ensure that the process would continue beyond the technical resolution of the prototypes. Regarding added value, while there are measurable elements to assess (e.g., mitigation of heat island effects), there are further variables which, while crucial for ecologically relevance (e.g., shared values, collective narratives, or imaginaries), are not easily measurable.

In view of the above, the type of new knowledge related to the implementation of NBS that can be produced through these co-creation approaches depends on the agreements and incentives given to the actors involved. Both co-creation and knowledge hybridisation

can be very attractive, but its long-term sustainability for materially building the common goal is not so simple. Therefore, both the initial agreements and their follow-up are crucial elements to define from the outset of the partnership.

Similarly, the connecting functions between some stakeholders and others is critical when the actors involved share an open creative process to which they were not fully accustomed, or of which they did not have the same expectations. Therefore, the roles of the facilitators must be defined in detail in the framework of the project, with the scientific limitations that this implies, as we do not know theoretically what all the functions are and what are the limits of the facilitators. In the case of CG, the MDD and elii facilitating teams were able to complement each other's approaches by overcoming the very logics of art and urban green infrastructure design that might differ in their purposes. Combining their respective discourses and practices was not an easy goal and required incorporating listening and translation skills in interdisciplinary working teams.

The co-creation strategies and the dynamics of the workshops applied were conceived as replicable tools accessible to further communities, as these tools, documentation and records of the meetings, were available online. Obviously, the mentioned replication would necessarily require an on-site adaptation to specific contexts (e.g., to normative, cultural, heritage, environmental, and climatic terms). On the other hand, the co-creation strategy deployed fulfilled different objectives for the design of the NBS prototypes. The "*what if*" co-creation strategies solicited different expert knowledge from various stakeholders, whose contributions were incorporated into the prototypes. The scope of the *Mutant Workshop* was addressed to design students, representing diffuse knowledge, and undertaking the exploratory analysis of the habitability and comfort conditions of the area in synergy with representatives of expert knowledge and artists.

One of the objectives of the cyborg garden was to develop a series of prototypes able to reduce the average temperature of public spaces and thus be able to increase comfort and desirability. From an artistic perspective, these guidelines were reformulated as: "What if" instead of reducing the temperature of the public space, we reduce the body temperature? Or for whom should public space be desirable: for humans or for the invisible inhabitants, the non-humans? In this sense, the proposal of the artist Orkan Telhan [45] did not aim to reduce the average temperature of the public space Matadero Madrid, but to reduce the temperature of its visitors. Telhan poses the idea of a frozen "fruit" as an opportunity to generate a social encounter, generating new rituals to cool down together. Although this proposal does not fully match the NBS definition, it opens a range of possibilities and unconventional explorations and narratives closer to other knowledge areas (chemistry, biology, physics, etc.). On the other hand, *Double Happiness* [45] focuses the attention of its proposal on the coexistence between species, humans and non-humans, invisible inhabitants in public space. This proposal, which is closer to the field of NBS through urban green furniture, moves away from the human-centred approach and contributes to the integration of different forms of urban life. This proposal is complementary to that developed by UH513 [45]. These artists have developed large sculptures, in the shape of cyborg devices, which configure an optimal habitat for both plants and humans, but which also constitute a system of interspecies communication by integrating sensory devices into the plants, transforming the data captured into external stimuli for visitors to Matadero.

In light of the above, the co-creation strategies and the dynamics of the workshops can clearly be extrapolated to other contexts, since they allow their participants to go deeper in: (1) Mutualism: how to design frameworks for ecological interspecies interaction, with mutual benefit. (2) 'Interscalarity': how to design when an intervention operates at different scales: from human, plant and insect, to microorganism-scale. (3) Infrastructure: the infrastructural condition is key, both for the maintenance of the garden, as well as achieving an empowerment of the citizenry. (4) Desire: how to think the ecology from desire and not only from functionalist approaches. (5) Technology: how to integrate technology in NBS. (6) Imaginary: the importance of shared imaginaries in the climate crisis. (7) Resilience: how to design projects that are adaptable to different contexts and that

can be updated over time. (8) Intergenerational justice: how to think of space as a diverse place inhabited by different bodies with different capacities.

One type of application that could be considered more relevant is a standardised method, whether in public, private, or hybrid processes of introduction (or regeneration) of natural spaces in the city in neighbourhoods and districts. The art/SBN co-creation approach makes it possible to speak in other languages, ones less techno-scientific, and therefore accessible to a wider population. In any case, the facilitation role or figure will be essential to accompany the process of understanding and translation that is critically needed in the initial phase.

5.2. Knowledge Transfers, Tensions, and Synergies Found throughout the Art/NBS Co-Creation Process

By integrating Carayannis [4,10–12] and Manzini [13] models within the Oxman map [14], the analysis identified the strengths/weaknesses of the knowledge transfers developed along with the co-creation process. This analysis allowed us to identify the stakeholders who articulated most knowledge exchanges, acquiring the role of facilitator within the ecosystem (facilitators of both the media-based and the cultural-based, as well as the educational system). Facilitators enabled and activated the circulation of knowledge throughout continuous iterations and served as a bypass to allow external actors to incorporate new knowledge into the ecosystem. Likewise, they were able to identify what type of knowledge/agent was missing in the ecosystem and eventually could contribute to its incorporation, thus promoting the production of new knowledge. In this way, the numerous synergies and complementarities among stakeholders of the CG contributed to the maintenance and continuity of the ecosystem beyond the exposition of the CG prototypes.

The maps presented beforehand (Figures 5 and 6) show a high dependence of the project's viability on the political system in terms of legitimacy, dissemination, and funding among other factors. The fragility derived from this dependency was mitigated in the project by the commitment established between the local administration and external public bodies (EU funding, government, foundations, etc.). This outer framework provides a long-term timeline, which in some cases exceeded the political timeframes, and establishes a mandatory compliance with funding agencies. Another mitigation measure was to introduce the artists to the local context through field visits, meetings with municipal technicians, involvement in other local projects, etc. Therefore, art/NBS co-creation processes in artistic practice must be understood as an end in itself (the process and the outcomes), able to generate long-term benefits such as capacity building, new approaches to complex social problems, distributed leadership, and strengthening mutual dependence, novel distribution of power and shared learning, thus attending to the principle of reciprocity [17]. At the same time, art/NBS co-creation processes enrich urban proposals, and they also problematise them.

The maps were also useful for envisioning the connections between the environmental system and other agents, confirming that "ecology and environmental protection can be considered engines of knowledge and innovation" [12]. The environmental system is thus emerging as another (un)visible agent in the social ecosystem, as a provider of information and knowledge. This element is especially evident in the prototypes developed by UH513, cyborg elements able to transfer unexpected knowledge on the environmental quality of public space to other social systems.

The typical procedures belonging to the political and academic systems (tenders, calls for papers, research projects, etc.) imply an anticipation of the expected results from the beginning, so the co-creation experimental process might generate some tension in view of the risk and uncertainty of results. These tensions were mitigated by the fact that the GC was part of a portfolio of urban experimentation projects of the collaborative platform MDD. The MDD platform allowed, on the one hand, increasing confidence in the CG project by the academic and political systems, and on the other hand, the empowerment of artists and other stakeholders throughout the co-creation process. Therefore, it was essential to hold

dialogue spaces before, during, and after the end of the project with the aim of identifying motivations, incentives, and benefits of experimentation, thus validating the principle of innovation of the co-creation.

Another tension was identified in the entanglement of the fields of art and science. Art does not have to fulfil a utilitarian purpose or become an aesthetic wrap for scientific content. These approaches would eventually lead to the instrumentalization of the artistic pieces. At the same time, this approach assumes that there is a science agenda that the art must just communicate, suggesting a subordinate relationship between art and science [49]. This is the gap that Oxman defines as a "far-fetched" [14] jump between art and science; that is, the knowledge transfer from art to science and vice-versa. The CG experience allowed all of its participants to question preconceived solutions and open up a range of possibilities arising from artistic thought, thus validating the principle of added value in the co-creation process. This evidence reinforces the concept, raised by Carayannis, that: "The circulation of knowledge continually stimulates new knowledge. As a result, all systems in a Quintuple Helix influence each other with knowledge in order to promote sustainability through new, advanced and pioneering innovations." [33] (pp. 6–7). The design of the CG prototypes was the result of the aforementioned both synergies and tensions among the different actors and systems. Knowledge, as generated by each social system, is conditioned by inner language codes and perceptions [13]. The creation of new knowledge (the superimposition of systems on the map) leads to inevitable tensions, which oblige a rebalancing of decision-making strategies among parties, validating the principle of reciprocity [17].

6. Conclusions

> *Why a Cyborg Garden? The "garden" is considered as a space of encounter between species of different natures and a place of enjoyment, desire, and care, and the "cyborg" as a framework for imagining the relationship between nature and technology as spheres that, necessarily, have to be thought of in continuity, as a hybrid species*. [46] (p. 7)

This article exposes in a practical way two co-creation strategies (*"what if"*, *Mutant Workshops*) raised from the artistic approach undertaken for the development of NBS prototypes at the Cyborg Garden in Madrid. These co-creation strategies constituted a result intrinsically, one fostering capacity building and social empowerment, while creating stronger networks between participants. The systematisation and critical analysis of the Cyborg Garden is a scientific contribution in methodological terms on the composition of knowledge in multidisciplinary teams and actors; likewise, it entails the ability to problematize the current environmental crisis through new narratives beyond individual disciplines, enabling structural transformations and radical collaborations.

On the other hand, this article presents the collusion of the analytic frameworks of Carayannis and Manzini through the Oxman map, as applied to art/NBS co-creation processes. This conjunction, its layout and method of analysis, have been designed for the case study of the Cyborg Garden, thus expanding the state of the art. This integration enables the envisioning of connections—(un)likely—developed by the actors—(un)likely—in processes of knowledge co-creation. This new framework of analysis is replicable and can be applied to other projects and initiatives with an artistic focus, such as the projects linked to the New European Bauhaus.

Regarding Oxman's understanding of creative energy as an activator to produce knowledge, the experiment evidenced that it does not constitute an outer "reactive" to be inoculated into the social ecosystem. Rather, creative energy is constituted by the same stakeholders and systems affected, by their inner codes and perceptions—the connections, tensions, synergies, and rebalancings between them—supported by the collaborative tissue and co-creation strategies developed by facilitators which activate the circulation of knowledge throughout continuous iterations. Complex problems need to be addressed by equally complex teams that favour a diverse composition of knowledge and skills.

Finally, as future lines of research, we pose the following questions: (1) how to overcome the fragility of co-creation experiences when they are excessively dependent on the involvement of some stakeholders/systems; (2) what are the required conditions (intrinsic and extrinsic) for a successful co-creation process in the field of art/science; (3) how to measure the long-term impact of projects that implement art/science co-creation actions; and (4) what are the limits of the functions of the facilitators in the implementation of co-creation strategies that combine art and NBS? These questions will surely deepen and fill the gaps and limitations of this research.

Supplementary Materials: The following supporting information can be downloaded at: https://drive.google.com/file/d/1d6FoagLj2kAWXSK03Vq8eqxSvCO35VUE/view, https://drive.google.com/file/d/1d7KqrDCOxDZGaJmq3ZjTXnSwGEAnLN0O/view, https://drive.google.com/file/d/1dAgb9_1PRiOZdAHyUQcgRvUr_izwVEKf/view, https://drive.google.com/file/d/1XMr7biqyV6wRj6abvBVeLoQ1ITXfW7QW/view, https://drive.google.com/file/d/1SiGoSe2JAGnssMqeEEEppCCOWveR3WuF/view, https://drive.google.com/drive/folders/1eZWUk8zuXbIGwWP_NDX0aty7QzNomwVv (accessed on 15 December 2022).

Author Contributions: Conceptualization, M.A. and S.R.-M.; methodology, M.A.; formal analysis, M.A.; investigation, M.A., S.R.-M., N.M., U.F., E.G. and A.M.; resources, M.A., S.R.-M., N.M., U.F., E.G. and A.M.; data curation, M.A. and N.M.; writing—original draft preparation, M.A.; writing—review and editing, M.A., S.R.-M., N.M., U.F. and E.G.; visualisation, M.A.; supervision, N.M.; project administration, M.A.; funding acquisition, M.A. This research is part of the doctoral research of M.A. developed in the Escuela Técnica Superior de Arquitectura de Madrid, Universidad Politécnica de Madrid. All authors have read and agreed to the published version of the manuscript.

Funding: This research received funding from the European project Madrid Deep Demonstration of Healthy and Clean Cities of the EIT Climate-KIC under grant 210328.

Data Availability Statement: Data will be made available on request.

Acknowledgments: The authors would like to acknowledge the hard work of the people constituting the Madrid Deep Demonstration facilitating team and the institutional commitment of Universidad Politécnica de Madrid through the Innovation and Technology for Development Centre (itdUPM), Ayuntamiento de Madrid, Matadero Madrid, EIT Climate-KIC, and MDD's members: Rosa Ferré, Juan Azcárate, Luis Tejero, Rafael Ruiz, Carlos Mataix, Julio Lumbreras, María Ángeles Huerta, Luisa Fernanda Guerra, Carlos Palacios, and Lucía Fernández, and the leadership of the artists of the Cyborg Garden: uh513 [María Castellanos y Alberto Valverde], TAKK [Mireia Luzárraga y Alejandro Muiño], Orkan Telhan, y Double Happiness [Joyce Hwang y Nerea Feliz].

Conflicts of Interest: The authors declare no conflict of interest. The funders had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript, or in the decision to publish the results.

Appendix A

Table A1. List of European projects regarding green Infrastructures and/or according to the Community Research and Development Information Service (CORDIS) [3].

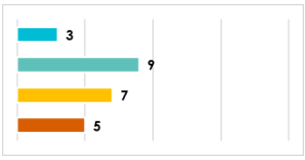
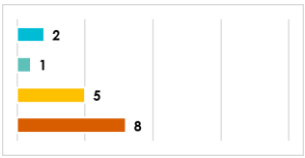
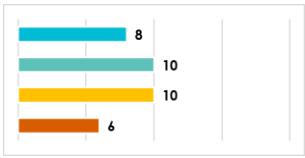
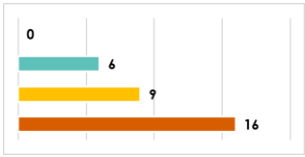
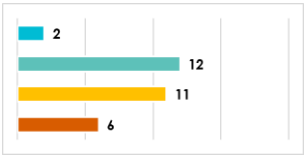
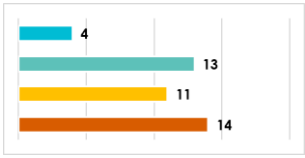
	ID Project | Acronym Project | Total Cost		ID Project | Acronym Project | Total Cost
1	182242 | CLEARING HOUSE | 7,687,863.75€	69	730285 | RUN4LIFE | 7,720,900.61€
2	776681 | Phusicos | 9,645,857.14€	70	891538 | Green CURIOCITY | 172,932.48€
3	730426 | URBAN GreenUP | 14,802,476.25€	71	101082224 | DEFINITE-CCRI | 1,978,837.5€
4	730338 | ThinkNature | 3,569,788.75€	72	101079952 | NEB-STAR | 4,999,721.25€
5	730052 | UNALAB | 14,278,699.25€	73	101080052 | NEBourhoods | 5,483,644.75€
6	730497 | NAIAD | 5,081,176.25€	74	818173 | AquaVitae | 8,748,035€
7	730243 | NATURVATION | 7,797,877.5€	75	101025184 | NOBILIS | 224,933.76€
8	776866 | RECONECT | 15,399,379.47€	76	869324 | INTERLACE | 5,476,165€
9	776848 | OPERANDUM | 14,696,501.68€	77	101093865 | CLIMAREST | 8,701,780.25€
10	776783 | URBiNAT | 13,742,228.64€	78	101086379 | SBEP | 113,398,798.75€

Table A1. *Cont.*

	ID Project | Acronym Project | Total Cost		ID Project | Acronym Project | Total Cost
11	809988 | RENATURE | 995,905€	79	101079912 | DESIRE | 4,754,000€
12	730222 | CONNECTING Nature | 11,768,009.61€	80	101093845 | BlueMissionBANOS | 2,999,993.75€
13	730468 | Nature4Cities | 7,499,981.25€	81	101059407 | MarinePlan | 3,587,828.75€
14	101060464 | NATURANCE | 3,206,687.5€	82	869226 | DRYvER | 6,702,008.75€
15	730283 | GROW GREEN | 11,514,817.76€	83	823952 | TREND | 1,573,200€
16	821016 | REGREEN | 5,325,013.84€	84	101060568 | BEPREP | 5,469,918.75€
17	776643 | HYDROUSA | 12,015,448.75€	85	778120 | GeoRes | 954,000€
18	689518 | MERCES | 6,651,117.8€	86	101096464 | CLIMABOROUGH | 11,408,458.75€
19	776604 | CLEVER Cities | 14,864,688.84€	87	870337 | CURE | 2,805,012€
20	887396 | NetworkNature | 2,189,833.75€	88	101059957 | EmpowerUs | 5,197,512.75€
21	101084220 | COEVOLVERS | 5,254,627.5€	89	101096943 | Re-Value | 12,418,093.75€
22	776665 | EdiCitNet | 11,807,287.71€	90	101081858 | ECONUTRI | 5,979,716.25€
23	769003 | NBS2017 | 274,516.58€	91	101079929 | CULTUURCAMPUS | 4,999,216.25€
24	101061083 | Invest4Nature | 4,995,172.5€	92	692331 | NitroPortugal | 999,937.5€
25	101003765 | NICE | 4,996,342€	93	101082131 | InvestCEC | 1,961,575€
26	101022685 | SHIEELD | 183,473.28€	94	101079948 | EHHUR | 4,994,902.5€
27	101003527 | MULTISOURCE | 5,169,165€	95	869237 | BiodivClim | 15,151,516€
28	896651 | Nature-In | 310,968€	96	858375 | WATERAGRI | 6,999,986.25€
29	776708 | HOUSEFUL | 8,464,060.61€	97	101079963 | SUPERSHINE | 2,320,492.5€
30	101060525 | NBS EduWORLD | 4,997,583.09€	98	101059988 | MPA Europe | 2,682,228.25€
31	869448 | EuPOLIS | 11,358,637.39€	99	739732 | INNOV | 119,225€
32	786566 | Mind4Stormwater | 270,918€	100	101017857 | RESET | 2,116,200€
33	101003757 | JUSTNature | 10,308,676.79€	101	101081774 | OptFORESTS | 8,191,328.75€
34	867564 | CONEXUS | 5,635,956.25€	102	101081845 | CircularInvest | 1,999,800€
35	821303 | We Value Nature | 2,192,426.25€	103	101003799 | DivAirCity | 10,794,875€
36	190135769 | SEQANA | 3,443,106.25€	104	101058956 | Marine SABRES | 8,755,388.75€
37	945095 | RECETAS | 5,403,657.5€	105	101081251 | wildE | 8,555,016.25€
38	852633 | Niche4NbS | 1,500,000€	106	101054755 | ERA Conference | 100,000€
39	101060638 | D4RUNOFF | 3,332,948.75€	107	845419 | RESISTREE | 203852.16€
40	824711 | MICS | 1,944,428€	108	817903 | EFFECT | 4,999,365€
41	869300 | FutureMARES | 8,555,905€	109	101094070 | DALIA | 8,627,861.25€
42	101081847 | trans4num | 5,034,396.25€	110	871128 | eLTER PLUS | 10,065,009.44€
43	869296 | PONDERFUL | 6,993,407.5€	111	101060020 | NORDBALT-ECOSAFE | 1,999,008.75€
44	690474 | EKLIPSE | 3,117,272.49€	112	101096405 | UP2030 | 12,233,133.75€
45	642420 | BiodivERsA3 | 38,974,332.66€	113	764908 | WEGO | 3,870,806.62€
46	101093908 | EcoDaLLi | 2,684,875€	114	734409 | Water4Cities | 1,242,000€
47	101091246 | NBSoil | 4,688,807€	115	101093962 | BlueMissionAA | 2,997,778.75€
48	776528 | proGIreg | 11,663,925.84€	116	818002 | URBAG | 1,893,754€
49	869710 | MaCoBioS | 6,980,657.5€	117	735012 | MobileRecycle | 71,429€
50	730280 | ROCK | 10,629,453.26€	118	787419 | SECurITY | 262,269€
51	678034 | GREENLULUS | 1,453,868€	119	202639 | iSCAPE | 5,850,830€
52	101079995 | BoSS | 4,999,975€	120	110888 | GREEN SURGE | 7,189,725.6€
53	101093956 | A-AAgora | 9,778,174.76€	121	242969 | Urban ReLeaf | 4,463,982.5€
54	873964 | METABUILDING | 5,126,625€	122	226290 | YADES | 1,909,000€
55	101036683 | TransformAr | 12,730,322.5€	123	230673 | CLIMRES | 219,312€
56	101027076 | MOVE-NBS | 247,606.08€	124	210518 | CLARITY | 5,906,273.71€
57	101003890 | FirEUrisk | 10,539,794€	125	218697 | IMPACT HAU | 1,999,999€
58	101026318 | BIO-POLIS | 232,393.92€	126	221012 | MossTree | 1,815,500€
59	798867 | ADAFARM | 170,121.6€	127	243354 | BUILDSPACE | 2,968,525€
60	642007 | ESMERALDA | 3,133,306€	128	202678 | RESCCUE | 8,057,266.65€
61	101059498 | eco2adapt | 10,037,066.25€	129	211910 | NEUROSOME | 3,427,305.06€
62	101036337 | MERLIN | 22,034,617.5€	130	218546 | RE-CITY | 3,306,310.8€
63	101003632 | REXUS | 4,984,331.25€	131	111482 | POLLINS | 2,685,355.74€
64	101082232 | DECISO | 1,999,725€	132	205716 | ShaleSafe | 2,990,102.5€
65	101003818 | Upsurge | 9,703,462.5€	133	193234 | DIABOLO | 4,998,970€
66	745766 | BIOMOTIVE | 15,175,589.23€	134	110918 | HEALS | 14,982,032.56€
67	101093985 | DANUBE4all | 8,422,267.5€	135	229011 | StormTre | 252,802.4€
68	101060707 | MSP4BIO | 3,490,501.25€		

Appendix B

Table A2. List of European projects integrating the co-creation approach and NBS based on the Community Research and Development Information Service (CORDIS).

EU Project's Name, Objective, and Cities Involved	Consortium (Based on QHIM)
Name: URBAN GreenUP//(June 2017–May 2023) [50] Aim: It aims to co-create, implement, and replicate renaturing urban plans in several partner cities in Europe and outside of Europe with the intention of reducing the effects of climate change, enhancing air quality and water management, and enhancing the sustainability of our cities through creative NBS. Cities: Valladolid, Liverpool, Izmir, Mantova, Ludwigsburg, Medellin, Chengdu, and Binh Dinh-Quy Nhon	
Name: NATURVATION//(November 2016–May 2021) [51] Aim: It aims to deepen our comprehension of what nature-based solutions can accomplish in cities, investigate how innovation can be encouraged in this area, and contribute to realizing the potential of nature-based solutions for addressing issues of urban sustainability in a co-creation process with stakeholders and communities. Cities: Barcelona, Utrecht, Leipzig, Malmö, Győr and Newcastle	
Name: CLEVER—CITIES—Co-Designing Locally Tailored Ecological Solutions for Value-Added, Socially Inclusive Regeneration in Cities//(June 2018–May 2023) [52] Aim: It seeks to advance local understanding of nature-based solutions, show how greener cities benefit residents and communities, provide data and information for EU policymaking, and ultimately encourage and facilitate the adoption of nature-based solutions in global urban planning. Cities: Hamburg, London, Milan, Belgrad, Larissa, Madrid, Malmo, Quito, and Sfântu Gheorghe	
Name: URBiNAT—Healthy Corridors as Drivers of Social Housing Neighbourhoods for the Co-Creation of Social, Environmental, and Marketable NBS//(June 2018–November 2023) [53] Aim: It aims to plan a healthy corridor through community-driven co-creation processes that incorporate various NBS. The goal is to regenerate and integrate underprivileged social housing urban developments with an inventive and inclusive catalogue of NBS that assures sustainability and mobilizes forces for social harmony. Cities: Porto, Nantes and Sofia; Siena, Nova Gorica, Brussels and Høje-Taastrup	
Name: UNaLab—Urban Nature Labs (June 2017–November 2022) [54] Aim: It aims to develop, via co-creation with stakeholders and implementation of "living lab" demonstration areas, a robust evidence base and European framework of innovative, replicable, and locally attuned nature-based solutions to enhance the climate and water resilience of cities. UNaLab focuses on urban ecological water management, accompanied by greening measures and innovative and inclusive urban design. Cities: Stavanger, Prague, Castellon, Cannes, Basaksehir, Hong Kong and Buenos Aires	
Name: CONNECTING—Co-production with Nature for City Transitioning, Innovation and Governance (June 2017–May 2022) [55] Aim: Its goal is to jointly co-create the policies and procedures needed to increase urban resilience, innovation, and governance through NBS. To jointly develop useful and applicable knowledge, an open innovation ecosystem model will be adopted. Through a plan aimed at multiplying cities, Linking Nature will serve as the reference framework for a new generation of urban NBS processes and empower transitioning ambassadors. Cities: Stad Genk, Glasgow; Poznan; e A Coruna; Bologna; Burgas; Ioannina; Malaga; Dimos; Sarajevo	
Legend:	

Appendix C

In order to frame co-creation within the collaborative process, it is important to identify its differential nuances regarding similar terms such as co-design, co-production, co-innovation, or co-construction, which are fundamentally different approaches compared to conventional methods:

Table A3. Exploring the distinctive dimensions of co-creation: differentiating it from co-design, co-production, co-innovation, and co-construction in the collaborative process.

Concept	Authors	Description
Co-production	Elinor Ostrom [56]	She focused her work on the relationship between services and communities. She had a particular interest in the cooperative economy and how communities manage common resources.
	Boyle y Harris [57]	It is the provision of public services in an equal and reciprocal relationship between professionals, the people who use the services, their families, and their neighbours. When activities are co-produced in this way, both services and neighbourhoods become much more effective agents of change.
	Edgar S. Cahn [58]	He develops the concept of "time banks" through which people can exchange skills and time instead of monetary transactions. Through his research, he frames co-production in the context of civil rights and the role of the most vulnerable populations in these processes.
Co-design	Szebeko and Tan [59]	Also referred to as participatory design or cooperative design, it is the promotion of citizen collectives in the involvement in creative processes of architecture and design, and their valuation as partners in the processes of production and decision-making.
Co-construction	Hargreaves [60]	"The willingness to treat learners as active partners in the design, implementation and evaluation of their education".
	Osborne et al. [61]	It confers knowledge and learning as a consequence of the construction process.
Co-innovation	Lee et al. [62]	"It is a business management model where "external, collaborative and co-creative ideas converge to create organisational and shared value" as a result of a new "ecosystem" of interdependence between individual and organisational actors from different sectors".
Co-creation	Voorberg et al. [18]	A process of collaboration and active participation between different actors coming from different backgrounds with the objective of generating value. It implies a relationship of equality between participants based on transparency, dialogue and trust.
	Prahalad y Ramaswamy [20]	" . . . process for better engagement between companies and their customers in response to changes brought about by globalisation, including: increased public scrutiny through access to information, increased networking across social networks and geographic boundaries, improved customer choice and experimentation with different services and products."
	Trischler, et al. [19]	A new paradigm of customer contact originates through co-creation: the role of the customer/citizen is no longer limited to being the end user of a product or service. Instead, the customer/citizen also becomes a co-creator and co-designer. In other words: people are no longer subjects; they are evolving to become true partners.
	Stott, L. [17]	It is a new and more inclusive way of developing and delivering public goods and services. In response to concerns about the extent to which the state on the one hand and the market on the other can realistically provide public services that adequately meet the needs of different citizens, the concept of co-creation has positioned itself as an integral part of a new form of governance that involves the contribution of multiple actors to public services.

References

1. European Commission. Green Infrastructure Strategy: Promoting the Use of Green Infrastructure in All EU Policies, to Help Restore Nature and Boost Biodiversity. Available online: https://environment.ec.europa.eu/topics/nature-and-biodiversity/green-infrastructure_en (accessed on 21 March 2023).
2. Faivre, N.; Fritz, M.; Freitas, T.; de Boissezon, B.; Vandewoestijne, S. Nature-Based Solutions in the EU: Innovating with nature to address social, economic and environmental challenges. *Environ. Res.* **2017**, *159*, 509–518. [CrossRef] [PubMed]
3. CORDIS European Commission. Available online: https://cordis.europa.eu/en (accessed on 21 March 2023).
4. Alméstar, M.; Sastre-Merino, S.; Velón, P.; Martínez-Núñez, M.; Marchamalo, M.; Calderón-Guerrero, C. Schools as levers of change in urban transformation: Practical strategies to promote the sustainability of climate action educational programs. *Sustain. Cities Soc.* **2022**, *87*, 104239. [CrossRef]
5. Briz, J.; de Felipe Boente, M.I.; Köhler, M. *Multifunctional Urban Green Infrastructure*; Editorial Agrícola Española SA: Madrid, Spain, 2019.
6. Vargas-Carpintero, R.; Hilger, T.; Tiede, K.; Callenius, C.; Mössinger, J.; Souza, R.F.; Barroso Armas, J.C.; Rasche, F.; Lewandowski, I. A Collaborative, Systems Approach for the Development of Biomass-Based ValueWebs: The Case of the Acrocomia Palm. *Land* **2022**, *11*, 1748. [CrossRef]
7. European Commission. New European Bauhaus: Beautiful, Sustainable, Together. Available online: https://new-european-bauhaus.europa.eu/index_en (accessed on 21 March 2023).
8. European Commission. Funding & Tenders Opportunities—Demonstrating the Potential of Nature-Based Solutions and the New European Bauhaus to Contribute to Sustainable, Inclusive and Resilient Living Spaces and Communities. Available online: https://ec.europa.eu/info/funding-tenders/opportunities/portal/screen/opportunities/topic-details/horizon-cl6-2024-biodiv-02-2-two-stage;callCode=null;freeTextSearchKeyword=;matchWholeText=true;typeCodes=0 (accessed on 21 March 2023).
9. Simon, D. Co-Productive Tools for Transcending the Divide: Building Urban–Rural Partnerships in the Spirit of the New Leipzig Charter. *Land* **2021**, *10*, 894. [CrossRef]
10. Etzkowitz, H.; Leydesforff, L. The dynamics of innovation: From National Systems and "Mode 2" to a Triple Helix of university-industry-government relations. *Res. Policy* **2000**, *29*, 109–123. [CrossRef]
11. Carayannis, E.G.; Draper, J.; Crumpton, C.D. Accelerating the Arrival of Fusion Energy within a Quintuple Helix Innovation Ecosystem to Address Climate Change. *SocArXiv* **2019**, *4*. [CrossRef]
12. König, J.; Suwala, L.; Delargy, C. Helix Models of Innovation and Sustainable Development Goals. In *Industry, Innovation and Infrastructure. Encyclopedia of the UN Sustainable Development Goals*; Leal Filho, W., Azul, A.M., Brandli, L., Lange Salvia, A., Wall, T., Eds.; Springer: Berlin/Heidelberg, Germany, 2020. [CrossRef]
13. Manzini, E. *Design, When Everybody Designs: An Introduction to Design for Social Innovation*; MIT Press: Cambridge, MA, USA, 2015.
14. Oxman, N. Age of Entanglement. *J. Des. Sci.* **2016**. [CrossRef]
15. Serna, J.M.; Chaparro, T.S. Systemic Collaborative Platforms: Accelerating Sustainable Development Goals Transitions through Multi-Stakeholder Convening Arrangements. Ph.D. Thesis, Universidad Politécnica de Madrid, Madrid, Spain, 2021.
16. Eisenhardt, K.M. Building Theories from Case Study Research. *Acad. Manag. Rev.* **1989**, *14*, 532–550. [CrossRef]
17. Stott, L. *Co-Production—Enhancing the Role of Citizens in Governance and Service Delivery*; Publications Office of the European Union: Luxembourg, 2018. [CrossRef]
18. Voorberg, W.H.; Bekkers, V.J.; Tummers, L.G. A systematic review of co-creation and co-production: Embarking on the social innovation journey. *Public Manag. Rev.* **2015**, *17*, 1333–1357. [CrossRef]
19. Trischler, J.; Pervan, S.J.; Kelly, S.J.; Scott, D.R. The value of codesign: The effect of customer involvement in service design teams. *J. Serv. Res.* **2018**, *21*, 75–100. [CrossRef]
20. Prahalad, C.; Ramaswamy, V. Co-opting Customer Competence. *Harv. Bus. Rev.* **2000**, *78*, 79–89.
21. Amabile, T.M. *Creativity in Context: Update to the Social Psychology of Creativity*; Westview Press: Boulder, CO, USA, 1996.
22. Spina, L.D.; Carbonara, S.; Stefano, D.; Viglianisi, A. Sustainable Collaborative Strategies of Territorial Regeneration for the Cultural Enhancement of Unresolved Landscapes. *Land* **2023**, *12*, 497. [CrossRef]
23. Griffiths, M. *Co-Production, Presentation at ESF Transnational Platform Thematic Network on Partnership Meeting, Dublin, 27 November 2016*; European Commission: Brussels, Belgium, 2016.
24. Lind, M. The Collaborative Turn. In *Taking the Matter into Common Hands: On Contemporary Art and Collaborative Practices*; Billing, J., Lind, M., Nilsson, L., Eds.; Black Dog Publishing: London, UK, 2007; pp. 15–31.
25. Bishop, C. *Artificial Hells: Participatory Art and the Politics of Spectatorship*; Verso: London, UK, 2012.
26. VVAA. *Participation*; Bishop, C., Ed.; Whitechapel Gallery: London, UK, 2006.
27. VVAA. *Curating and the Educational Turn*; O'Neill, P., Wilson, M., Eds.; Open Editions-de Appel: London, UK; Amsterdam, The Netherlands, 2010.
28. Soberón, M.; Sánchez-Chaparro, T.; Smith, A.; Moreno-Serna, J.; Oquendo-Di Cosola, V.; Mataix, C. Exploring the possibilities for deliberately cultivating more effective ecologies of intermediation. *Environ. Innov. Soc. Transit.* **2022**, *44*, 125–144. [CrossRef]
29. Hodson, M.; Marvin, S. Can cities shape socio-technical transitions and how would we know if they were? *Res. Policy* **2010**, *39*, 477–485. [CrossRef]

30. Kivimaa, P.; Boon, W.; Hyysalo, S.; Klerkx, L. Towards a typology of intermediaries in sustainability transitions: A systematic review and a research agenda. *Res. Policy* **2019**, *48*, 1062–1075. [CrossRef]
31. Kanda, W.; Kuisma, M.; Kivimaa, P.; Hjelm, O. Conceptualising the systemic activities of intermediaries in sustainability transitions. *Environ. Innov. Soc. Transit.* **2020**, *36*, 449–465. [CrossRef]
32. Carayannis, E.G.; Campbell, D.F.J. «Mode 3» and «Quadruple Helix»: Toward a 21st century fractal innovation ecosystem. *Int. J. Technol. Manag.* **2009**, *46*, 201–234. [CrossRef]
33. Carayannis, E.G.; Barth, T.D.; Campbell, D.F. The Quintuple Helix innovation model: Global warming as a challenge and driver for innovation. *J. Innov. Entrep.* **2012**, *1*, 2. [CrossRef]
34. Roman, M.; Fellnhofer, K. Facilitating the participation of civil society in regional planning: Implementing quadruple helix model in Finnish regions. *Land Use Policy* **2022**, *112*, 105864. [CrossRef]
35. Carayannis, E.; Campbell, D. Triple Helix, Quadruple Helix and Quintuple Helix and How Do Knowledge, Innovation and the Environment Relate To Each Other? *Int. J. Soc. Ecol. Sustain. Dev.* **2010**, *1*, 41–69. [CrossRef]
36. Carayannis, E.G.; Campbell, D.F. Democracy of climate and climate for democracy: The evolution of Quadruple and Quintuple Helix innovation systems. *J. Knowl. Econ.* **2021**, *12*, 2050–2082. [CrossRef]
37. Carayannis, E.G.; Campbell, D. *Smart Quintuple Helix Innovation Systems: How Social Ecology and Environmental Protection Are Driving Innovation, Sustainable Development and Economic Growth*; Springer: Berlin/Heidelberg, Germany, 2019.
38. Laplaine, J. The Rich Gold Matrix | Connecting Data to Information to Knowledge. Available online: https://ioannouolga.blog/2018/04/19/the-rich-gold-matrix/ (accessed on 23 April 2023).
39. Buchanan, B.B.; Arnon, D.I. A reverse KREBS cycle in photosynthesis: Consensus at last. *Photosynth. Res.* **1990**, *24*, 47–53. [CrossRef] [PubMed]
40. Yin, R.K. *Case Study Research and Applications: Design and Methods*; Sage Publications: Thousand Oaks, CA, USA, 2018.
41. Stott, L. *Partnership Case Studies in Context. The Partnering Initiative*; IBLF: London, UK, 2005.
42. Hughes, T.; Bence, D.; Grisoni, L.; O'Regan, N.; Wornham, D. Scholarship That Matters: Academic–Practitioner Engagement in Business and Management. *Acad. Manag. Learn. Educ.* **2011**, *10*, 40–57.
43. Dresch, A.; Lacerda, D.P.; Miguel, P.A.C. A distinctive analysis of case study, action research and design science research. *Rev. Bras. Gestão Negócios* **2015**, *17*, 1116. [CrossRef]
44. Verhoef, L.; Bossert, M. *The University Campus as a Living Lab for Sustainability: A Practitioner's Guide and Handbook*; Delft University of Technology: Delft, The Netherlands, 2019.
45. Universidad Politécnica de Madrid (Madrid, Spain). Madrid Deep Demonstration Report, Annex 8: Cyborg Garden as Prototype of Nature-Based Solutions. 2019; *Report Unpublished*.
46. Matadero Madrid. Un Jardín Cyborg Para Matadero Madrid Matadero Acción Mutante. 2019. Available online: https://www.mataderomadrid.org/sites/default/files/v2/prensa/d/1/obras-jardin-cyborg.pdf (accessed on 21 March 2023).
47. Tapia, C.; Abajo, B.; Feliu, E.; Fernández, J.G.; Padró, A.; Castaño, J. *Análisis de Vulnerabilidad ante el Cambio Climático en el Municipio de Madrid*; Ayuntamiento de Madrid: Madrid, Spain, 2015.
48. Mutant Institute for Environmental Narratives. Ecovisionarios: Arte para un Planeta en Emergencia Handbill. 2019. Available online: https://www.mataderomadrid.org/sites/default/files/v2/prensa/d/1/ecovisionarios-programa-mano-web.pdf (accessed on 23 April 2023).
49. Art in Science Exhibitions—An Opportunity or an Afterthought?—Ian Brunswick—On Science and Culture. Available online: https://ianbrunswick.wordpress.com/2017/08/29/art-in-science-exhibitions-an-opportunity-or-an-afterthought/ (accessed on 26 April 2023).
50. New Strategy for Re-Naturing Cities through Nature-Based Solutions | URBAN GreenUP Project | Fact Sheet | H2020 | CORDIS | European Commission. Available online: https://cordis.europa.eu/project/id/730426 (accessed on 20 March 2023).
51. Nature Based Urban Innovation | NATURVATION Project | Fact Sheet | H2020 | CORDIS | European Commission. Available online: https://cordis.europa.eu/project/id/730243 (accessed on 20 March 2023).
52. CLEVER Cities—Co-Designing Locally Tailored Ecological Solutions for Value Added, Socially Inclusive Regeneration in Cities | CLEVER Cities Project | Fact Sheet | H2020 | CORDIS | European Commission. Available online: https://cordis.europa.eu/project/id/776604 (accessed on 20 March 2023).
53. URBiNAT—Healthy Corridors as Drivers of Social Housing Neighbourhoods for the Co-Creation of Social, Environmental and Marketable NBS | URBiNAT Project | Fact Sheet | H2020 | CORDIS | European Commission. Available online: https://cordis.europa.eu/project/id/776783 (accessed on 20 March 2023).
54. Urban Nature Labs | UNALAB Project | Fact Sheet | H2020 | CORDIS | European Commission. Available online: https://cordis.europa.eu/project/id/730052 (accessed on 20 March 2023).
55. COproductioN with NaturE for City Transitioning, INnovation and Governance | CONNECTING Nature Project | Fact Sheet | H2020 | CORDIS | European Commission. Available online: https://cordis.europa.eu/project/id/730222 (accessed on 20 March 2023).
56. Ostrom, E. Crossing the Great Divide: Coproduction, Synergy, and Development. *Rev. World Dev.* **1996**, *24*, 1073–1087. [CrossRef]
57. Boyle, D.; Harris, M. The Challenge of Co-Production, How Equal Partnerships between Professionals and the Public Are Crucial to Improving Public Services, London: NESTA. 2009. Available online: http://www.nesta.org.uk/sites/default/files/the_challenge_of_co-production.pdf (accessed on 21 March 2023).

58. Cahn, E.S.; Gray, C. Co-production from a normative perspective. In *New Public Governance, the Third Sector, and Co-Production*; Routledge: Abingdon-on-Thames, UK, 2013; pp. 147–162.
59. Szebeko, D.; Tan, L. Co-designing for society. *Australas. Med. J.* **2010**, *3*, 580–590. [CrossRef]
60. Hargreaves, D. A New Shape for Schooling? SSAT, the Schools, Students and Teachers Network. 2006. Available online: www.ssatuk.co.uk (accessed on 21 March 2023).
61. Osborne, S.; Radnor, Z.; Strokosch, K. Co-Production and the Co-Creation of Value in Public Services: A suitable case for treatment? *Public Manag. Rev.* **2016**, *18*, 639–653. [CrossRef]
62. Lee, S.; Olson, D.; Trimi, S. Co-innovation: Convergenomics, collaboration, and co-creation for organizational values. *Manag. Decis.* **2012**, *50*, 817–831. [CrossRef]