SISCODE CO-DESIGN FOR SOCIETY IN INNOVATION AND SCIENCE

D5.1

MODELS OF CO-CREATION ECOSYSTEMS

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LIST OF ABBREVIATIONS

Abbreviation	Expanded
SISCODE	Society in Innovation and Science through CO-DEsign
WP	work package
RRI	Responsible Research and Innovation
STI	Science, Technology and Innovation
NGO	Non-governmental organizations
ENoLL	European Network of Living Labs
ECSITE	The European network of Science Centers and Museums

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Executive summary

The SISCODE (Society in Innovation and Science through CO-DEsign) project investigates the application of co-creation for the operationalization of Responsible Research and Innovation (RRI). The practice-oriented approach of co-creation is meant to bridge the gap between theory and practice identified in the field of RRI (Zwart et al., 2014; Emery et al., 2014).

The research documented in this deliverable focuses on the investigation of ecosystems of co-creation and their dynamics. Acknowledging the context dependency and variations of co-creation ecosystems according to the cultural, organisational and regulatory conditions under which co-creation is applied, this document contributes to the investigation and understanding of how these ecosystems establish, evolve and function. It considers drivers and barriers in terms of static factors and analyzes co-creation ecosystems from the micro- to the macro level describing organizational, administrative, technical, human-resource and procedural changes needed for and triggered by the effective application of co-creation. Moreover, it establishes a maturity scale associating specific factors, states and characteristics to the single degrees of maturity and finally describes the dynamics that may transfer co-creation ecosystems from one level of maturity to another.

In the first chapter, the overall background of SISCODE and this deliverable is introduced detailing the concept of co-creation in the context of Responsible Research and Innovation (RRI) and its particular application in SISCODE. Furthermore, it investigates the topic of co-creation ecosystems both from a general point of view and the specific one of the project. Consecutively, the methodology adopted for the work that is documented in this deliverable is illustrated showing also its connection with previous research and findings within SISCODE.

The following two chapters focus on the analysis of co-creation ecosystems on specific levels apart from each other. While chapter 3 concentrates on the organizational- and micro level of co-creation ecosystems, chapter 4 investigates these ecosystems on a meso- and macro level looking at the overall landscape and context where co-creation takes place going far beyond the single organization.

The subsequent section triangulates the results from the two chapters to transform the separate analysis into an investigation of co-creation ecosystems in their entirety with the help of seven descriptors. The focus here lies on the dynamics of these ecosystems referring

to a maturity model with four degrees introduced already in the analysis of the macro scale. For each descriptor specific indications and recommendations are expressed that mark the transition between the maturity levels.

In the final chapter, additional reflections are made connecting the model of co-creation ecosystems and its dynamics to SISCODE's initial premises and the first model of dynamics developed for the project proposal. It provides some concrete insights, recommendations and themes to be investigated in future research.

1. Introduction and theoretical background

This chapter provides an overview on the theoretical concepts that underlie the research conducted in SISCODE. Co-creation in the field of RRI and the concept of co-creation ecosystems are described illustrating the current state of the art and findings from literature to then connect them concretely to the context and research carried out within SISCODE.

1.1 RRI in the context of co-creation

Both scholars in the field of innovation and science studies, as well as policy makers, have emphasized how engaging with stakeholders and citizens in co-creation, can produce final solutions (e.g. tangible products, services, policies and so on) that are more consistent, sustainable and appropriate to the specific situated context in which a final solution may be implemented (Voorberg, Bekkers, and Tummers 2015). Under this perspective, co-creation allows citizens to assume a pro-active role in the public sphere as collaborators and creators, and not a mere passive recipient of the concerned policy measure or service (Benington & Moore, 2010). As part of this trend in opening up innovation to wider citizen-based communities and stakeholders, RRI offered a valuable framework to solicit societal actors (citizens, researchers, NGOs, policy makers, business, etc.) to collaborate during the research and innovation process, in order to better align both the process and its outcomes with the values, needs and expectations of society and to engage citizens and end-users in the co-creation of the solutions they wish and need.

In this respect, the entanglement between co-creation and RRI seems to be a pivotal element in order to "translate" responsibility into innovation processes. Indeed, co-creation implies strong interaction among diverse societal actors relying on different cultures, beliefs and forms of knowledge within a frame of collaboration, which enacts innovation activities as a nonlinear, open-ended and iterative process. In performing such an interaction, co-creation enables a learning process in which knowledge is built and shared

in a peer-to-peer way. In this framework, citizens' lay expertise and experiential knowledge should be considered a complementary source of critical insights to be rendered actionable in (re)designing solutions and achieving innovation outcomes. Nevertheless, despite the concept of RRI being framed almost ten years ago (Jakobsen et al., 2019, Von Schomberg, 2011 & 2013), innovation communities, and policymakers as well, still consider in several cases citizens' lay expertise as an ancillary dimension of experts' technical knowledge. This is indeed limiting the role of the public to sponsored deliberative procedures for assessing ethical issues, rather than exposing innovation itself to public scrutiny (Smallman, 2019).
Therefore, further strengthening the link between RRI and co-creation appears to be necessary.
Co-creation is defined as a multilevel process for boosting the participation of end-users in the process of innovation (von Hippel, 1987). Co-creation as an innovation paradigm has been originally developed in the private sector as a consequence of two main trends. Initially, end-users were seen as possible co-creators, whose experiences with products or services could be of added value for a company by supporting the definition of product requirements and testing the quality of their interaction with them. More recently, the private sector started to ask end-users to take part in different activities of the production chain, from product ideation to their production and delivery. In this perspective, end-users started being defined as possible co-designers/co-producers of innovation. This second perspective nurtures the idea that end-users are an interesting source of product and service innovation (Vargo and Lusch, 2004; von Hippel, 2007) helping firms to achieve competitive advantage by collaborating with their customers (Grissemann and Stokburger-Sauer, 2012).
In the current practices, the notion of co-creation has become more complex by including in the process different stakeholder typologies, with different (and possibly conflicting) interests and needs to be managed, and moving from the domain of business to a variety of societal challenges that call for the inclusion of the public and the third sector. This expansion of the notion of co-creation has led to a wider exploration of the environment in which it takes places, beyond businesses and markets. Correspondingly, the SISCODE project aims at understanding co-creation dynamics and framework conditions, and has developed the idea of co-creation ecosystem as the fruitful landscape where co-creation can occur. That is, an overall system - which encompasses knowledge, institutions, regulations and policies – that circumscribes at the same time the environment where user-/citizen-driven innovation can unfold, and the results of its diffusion. In this

perspective, with reference to Nambisan and Nambisan (2013), it is possible to identify the following major roles a user/citizen can play within a co-creation ecosystems:

- Citizen as explorer: This profile implies skills in defining emerging problems of which government agencies and policymaking are partially unaware. Citizens, starting from their everyday life experiences, are best located in articulating and signaling relevant problems which affect the local or regional community;
- Citizen as ideator: This profile concerns the ability of citizens to render local knowledge and information about their specific needs actionable in order to improve existing services, or elaborate innovative solutions to civic problems;
- Citizen as designer: This profile can be boosted by a range of IT-based tools that support knowledge sharing, visualization and virtual prototyping in order to design and develop implementable outcomes and solutions to defined civic problems;
- Citizen as diffuser: This profile implies abilities in stimulating the community at different levels to adopt a suitable solution developed via a co-creation approach by the government.

1.1.1 Co-creation applied to RRI within SISCODE

SISCODE considers co-creation as responsible at its core since it builds on the principles of opening up and sharing the entire development process and the results of research and innovation. Therefore, it implicitly includes responsibility involving all key actors and investigating influencing factors collaboratively that led to its identification within SISCODE as an ideal means for the operationalisation of RRI.

According to SISCODE's findings also discussed within Deliverable 1.1 - RRI Research Landscape (Smallman & Patel, 2018), co-creation activities within the project are seen as mechanisms to achieve three distinct objectives: 1) to develop solutions to grand societal challenges; 2) to understand public values and integrate these within the R&I process; and 3) to develop user-centered approaches to policy and research and innovation processes. Hence, the co-creation activities can be framed as iterative and bi-directional dialogue by means of public engagement; stakeholder engagement; participatory processes; inclusive engagement; multi-actor dialogue; participatory involvement; societal engagement; citizen involvement; and public deliberation and consultation. In other cases, co-creation

represents a strong participatory process from below where co-production and co-design practices are at stake, thus ensuring citizen engagement in the early phases of innovation journeys.

The perspective of co-creation can allow the concept of RRI to move forward from a set of recommendations to a practice embedded into research and innovation processes and policies. Hence co-creation can support to overcome some of the current limits and weakness of RRI by:

- filling the gap on how to introduce RRI into the implementation of real solutions;
- helping to deal with wicked problems like societal challenges that require non-linear models of innovation (iterative design);
- introducing mechanisms for granting the participation of diverse stakeholders (including citizens) and the management of their complex interaction.

Given this framework, the approach embraced by the SISCODE project has been to consider co-creation as inherently bound to the notion of RRI and to concretely experiment it as a bottom-up approach to the development of solutions that are meant to tackle societal challenges. In doing so, SISCODE adopted various co-design methodologies to support the operationalization of co-creation in RRI and STI policymaking, introducing advanced modes of engagement and shifting from traditional consultation to co-design and co-production. This has been pursued by planning, conducting, monitoring and disseminating high-impact experiments in real-life contexts. By engaging citizens, local actors, stakeholders such as policy makers and the wider scientific community, SISCODE pursued the aim of increasing knowledge on co-creation through action research, as well as testing the effectiveness of co-design methodologies to better combine co-construction (ideation) and co-production (implementation) of solutions and policies for the integration of society in science and innovation. In this regards, pilot experiments took place in 10 co-creation labs across Europe, each of them a member of one of the three following networks: the Fab City Foundation (managed in part by Fab Lab Barcelona), the European Network of Living Labs (ENoLL), and the European Network of Science Centres and Museums (Ecsite). Experiments have been conducted through the implementation of co-creation journeys for around 18 months. In these experiments, each lab aimed to tackle a specific societal challenge, (meaningful for the context in which the lab is located but at the same time transversal and relevant at a wider scale) and engaged with it a set of stakeholders in a co-creation process

from the stage of co-design (e.g. analysis of the context, reframing of the problem and envisioning of alternatives) to that of co-production of prototypes in an iterative process.
This process opens up many relevant issues related to how co-creation for RRI should be integrated within a specific organizational and institutional context, promoting more inclusive innovation to achieve better societal outcomes.

1.2 Co-creation ecosystems: theoretical insights and analytical perspective

We are in a momentum of growing popularity of participatory approaches applied to the STI domain, looking at design thinking and experimentation as innovative approaches to policymaking (Nazarko and Melnikas 2019). Both the notions of RRI and co-creation have a prominent position, as shown by the debates in the European Union on the topics of research and innovation, especially from the point of view of policies (Jakobsen et al., 2019; von Schomberg, 2011, 2013), and impacts (European Commission 2014; Stilgoe and Guston 2017; Tharp and Tharp 2019). Since the early 2000s, especially the attention to include different stakeholder typologies in the process of developing innovation and value, affected the notion of co-creation (Carlborg et al. 2014; Windrum et al. 2016). Consequently, the idea of the ecosystem can be framed as a wider landscape in which co-creation takes place, moving from a top-down to a bottom-up/user-driven innovation process (or combining top-down and bottom up practices). Hence, citizen-driven innovation develops in co-creation ecosystems (European Commission, Directorate-General for Communications Networks, Content and Technology). The well-known triple helix innovation model focusing on the relationship between university, industry, and government firstly embeds a fourth helix, that of civil society and culture-based public, and then includes the fifth helix of the environment as a societal context (Carayannis and Campbell 2010), granting a more comprehensive ecologically-sensitive perspective. Co-creation is situated in a framework that values and encourages the knowledge society and knowledge democracy as pillars for production and innovation. Different stakeholders enter the co-creation process with specific interests, motivations and expectations, which need to be considered, managed, and included as promising sources of knowledge, thus hampering that differences in values, beliefs and needs become potential barriers to innovation. As a consequence, to set up novel models of interactions able to flow in new network configurations, the situated needs, specific competencies, expertise and experiences of each actor have to be carefully taken into account.

Considering the centrality of synergising knowledge and innovation with respect to environment, society, and democracy for facing societal challenges, co-creation in the domain of RRI promotes sustainable and harmonious models of inclusive participation (Jones 2018; Stilgoe et al. 2013). Recognising that the five helices serve as fundamental drivers for knowledge production and innovation, the concept of ecosystems has developed. An **innovation network** can be described as an **ecosystem of co-creation**, a complex system where ideas, institutions, regulations, and policies combine (European Commission, Directorate-General for Communications Networks, Content and Technology). All these elements concur in constituting the environment where innovation can unfold and spread, ranging from the micro scale of the niches of co-creation and innovation, up to the macro scale of the national or supranational landscape (Geels 2005). Central is therefore the awareness that well-conducted co-creation processes can go beyond the generation of new solutions, leading to reconfigure at multiple scales the socio-technical system where they take place. In other words, change is not limited to the dimension of the output or the single solution developed, but extends to the entire ecosystem, and beyond. To make the concept more explicit, Fig 01 presents Geels (Geels 2002) representation of the dynamic multi-level change that occurs in innovation ecosystems. Hence, under this perspective a co-creation ecosystem is enacted by multiple institutions and societal actors (e.g.firms, end-users, social movements, policymakers, funding organizations), who can engage in multifacet activities (e.g.exploration, learning, negotiation, power struggle, investment, coalition building, goal-setting) in the context of rules, socio-technical arrangement, norms, values and beliefs.

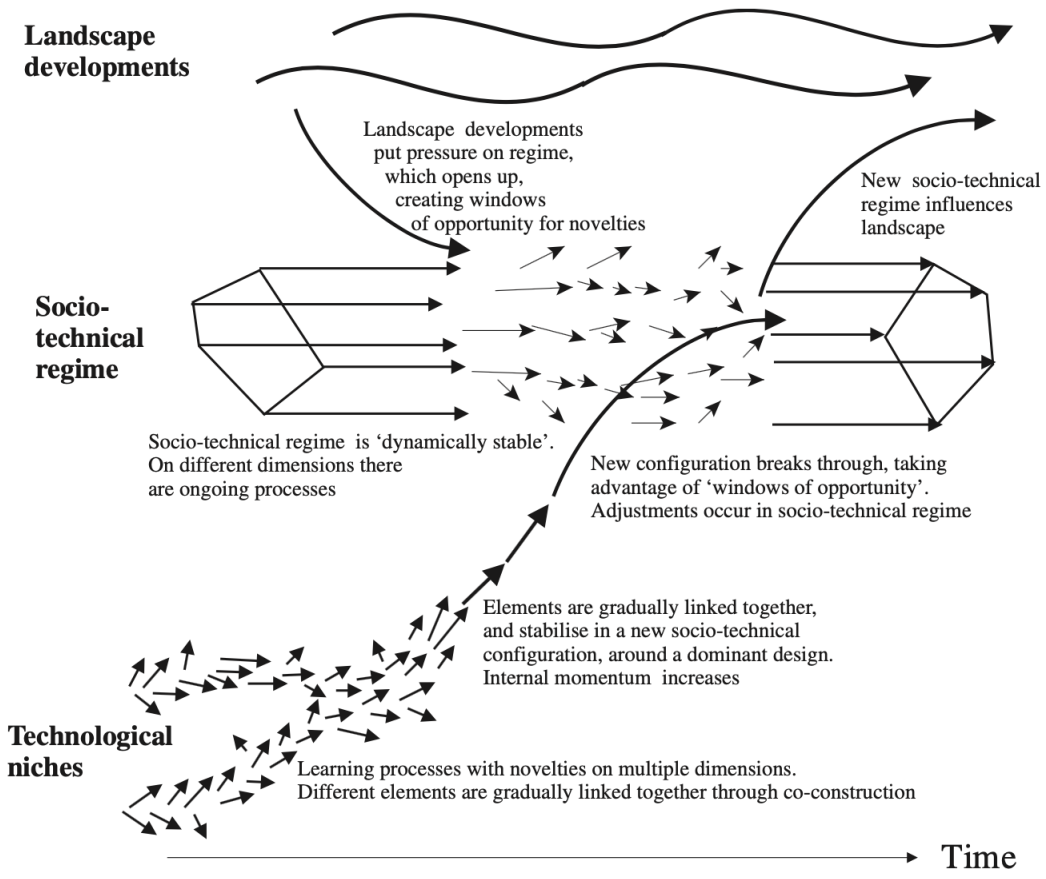

Fig 01 - Geels's dynamic multi-level perspective on system innovation (Geels 2002, 1263).

Co-creation processes occur within networks of multi-level stakeholders, being influenced by meso- and macro-level dynamics, as well as by micro-dynamics which takes place in the niches where the innovative solutions are developed.

On this account, the field experimentation conducted in SISCODE is a fundamental source of knowledge and first-hand evidence showing how niches where local-level innovations take place can extend their original spatial and institutional scale, and they can achieve broader systemic impact (Moore et al. 2015). It shows how the synergic, inclusive cooperation of multiple actors in participatory practices leads to multi-level transformations with benefits noted from the organizational level to a larger scale. At the local scale, genuine change derives indeed from the dialogue, cross-fertilization, and frequent interplay among transdisciplinary stakeholders, especially when the gap between research and practice is bridged. Learning is triggered indeed by the reflection on the participatory practices itself (Geraldi & Söderlund, 2016), as well as by the introduction in the practitioner domain of a culture of monitoring and assessing, which is typical of the research sphere. However, it is necessary to note that especially at this scale, transformation

and change can occur at different extents as they are directly related to the nature of the organization, its structure and governance, degree of freedom, interests and motives, capacities and resources, routine and habits (Tuominen Tiina et al., 2020).

Generally speaking, SISCODE's research pillars paid special attention towards the examination of ecosystems of innovation, relying on academic debates rooted in innovation studies, social innovation and especially on approaches which focus on the context-dependency of social innovation. From these concepts, we selected a heuristic model and already adapted it early in SISCODE's research process (Eckhardt et al., 2019) that was originally developed and applied to explore different contextual conditions of social innovation (Kaletka et al., 2017). This model, also referred to as the "onion model" (ibid.), proved to be suitable in the course of application to the research object of co-creation in order to take a closer look at the diversity of different contextual conditions at different levels and to keep them in view. Co-creation can be understood as an operationalization of co-creation at the same time as an approach for responsible innovation processes in the sense of an operationalisation of RRI. At the same time, co-creation in the sense of newly establishing and diffusing practices (Howaldt & Schwarz, 2011) is itself an evolving social innovation. Despite these intersections between (social) innovation and co-creation, it was necessary to further develop the model and to re-tailor the contextual factors to be considered (Eckhardt et al., 2021). In the course of the application to the material from the work packages WP1 and WP2, the context factors of the Research Heuristic (Onion Model) could be inductively deepened (for further information regarding the theoretical and methodological underpinnings please see SISCODE Deliverables 1.3 (Kaletka et al., 2018) and 2.3 (Eckhardt et al., 2020)). Although the application of the model to the material from WP1 and WP2 proved to be appropriate, it became apparent that further theoretical implications could sharpen the focus on the dynamics and institutionalization of co-creation as framework conditions in which co-creation takes place. A search for literature was initiated, focussing on implications regarding the dynamics of co-creation ecosystems and the conditions for institutionalisation with the aim to identify and describe context factors influencing the success and failure of co-creation routines.

Furthermore, as SISCODE seeks to draw conclusions for the implementation of design-driven Co-creation in STI policymaking, a coherent overview of insights into the role of STI policies in such ecosystems had to be generated.

The literature review revealed some key issues to be taken into special consideration. These are:

- The role of **context factors and stakeholders' and end-users' motivations to participate**: Seeing the motivations of end-users to participate as an integral part of the overall absorptive (or "collaborative") capacity of a specific context, the issue regarding the interdependence of individual motivations and agency and a conducive context for empowering Co-creation could be a fruitful perspective.
- Closely linked to this perspective is the question to what extent existing structures of the **respective ecosystems are inclusive (enough)** to let everyone who is potentially interested and/or addressed to participate in the activities and if and how an overall culture of Co-creation is facilitated.
- **Social rejection and established top-down practices of problem-solving in the targeted context**: In the literature review it became evident that social rejection to Co-creation and the competition with traditional ways of 'doing things' need to be included into the analysis of ecosystems. Therefore, more attention should be drawn to these pre-existing contextual factors (e.g. social rejection towards digital technologies, preconceptions or negative experiences with participation activities in the past, traditionally top-down led decision-making).
- It is important to consider to what extent **infrastructures (e.g. legislative, policy related, economic and organizational substructures) for (social) innovation are also supportive to the dynamics and institutionalisation of co-creation** and which role co-creation might play in social innovation processes.
- **In enhancing the effectiveness of co-creation via civic engagement, it is essential to maintain an optimal amount of sensitivity towards stakeholders**, a factor often neglected by conventional bureaucracy and may be boosted by the presence of well-trained, professional facilitators (Hägele, 2019) in comprehensive training programmes. This can support in-house capacity building in aspects such as data analysis that would assist in providing an ecosystem conducive to policy co-creation.
- Key challenges in the mainstream application of such approaches that need to be overcome include a **clear separation of roles and responsibilities in the innovation process**, an **unambiguous determination of stakeholder interests** and **maintaining an optimal level of public involvement** to maximise innovation gains (OECD, 2018)

Therefore, the Innovation/Co-creation empowering capacity and its single elements should be one focus of the analysis: The task is to describe such a Co-creation empowering context with its relevant elements and to show how they differ in terms of context-factors described alongside the four layers of the heuristic model.

1.2.1 The role of co-creation ecosystems within SISCODE

Within SISCODE, innovation networks constitute **ecosystems** of co-creation that involve a mix of actors from the five helix framework. According to the project framework, the niche-level acts as an intermediate playground where policy makers are engaged in interacting with the multiple actors involved in the real-life experimentations of co-creation within the labs. With regard to this, the idea is that change is triggered by a learning-by-doing process, within an iterative experiential learning context. Following this logic, the experimentation of SISCODE relied on a learning framework which is in fact an experiential learning cycle. Here the innovative solutions developed act as **boundary objects** (Star and Griesemer 1989) capable of triggering processes of change, which firstly involve those diverse agents engaged in the development, and then extend more widely at the level of the organization and beyond. The solutions developed on the basis of a grassroots and small-scale approach calls for reflection on the one hand on their connection with the policy domain, and on the other on scaling models. Bottom-up solutions, designed for a local context, can impact and change the institutional framework, particularly if they are many and concentrated (thematically or geographically). At the same time, they may suggest a different way of performing policymaking by engaging multiple stakeholders in a participatory frame of action.

Going beyond the scale of the solution developed, the ecosystem itself and its multi-level dynamics can act as an effective transdisciplinary boundary object (Abson et al. 2014). They engage different stakeholders, with a variety of background and expertise, aiming at achieving innovative solutions that tackle societal challenges. Moreover, they link policy makers with the different actors involved, encouraging collaboration, integration of multi-level knowledge, as well as triggering potential change.

1.3 Co-creation ecosystems: Micro, meso and macro level

The link of small-scale experimentations to a broader impact on the policy landscape has been addressed in SISCODE referring to different scales and levels that are connected to each other. Moving from the micro- to the meso- and finally the macroscale and vice versa, the layer model developed during the project visualizes how the different layers are

connected by dynamic processes (Fig 02). SISCODE's initial hypothesis is the connection of the micro- to the macro scale by establishing an intermediate level, the interactive playground.

The first level defines the macro scale, also referred to as strategic playground, which refers to the overall environment on a larger level as policies and regulations often at a national or even international scale. SISCODE's pilot experimentation is situated mainly at the third and bottom level referring to the operative playground as the micro scale. The solutions and processes developed as results of the micro experiments are meant to function as boundary objects on this intermediate level to establish a dialogue between bottom-up initiatives and policymakers (Rizzo et al, 2018).

Constituting this dialogue, it is aimed to make policies more user-centred, inclusive and implementable while co-creation grassroots initiatives are meant to become more strategic and structured. Both external layers are interconnected with the interactive playground through specific dynamics and interrelations.

These dynamics are analysed in the final chapter of this document on the ground of the research carried out in SISCODE to investigate how this interactive playground was created within the project analysing how the transitions from one level to another may occur in practice.

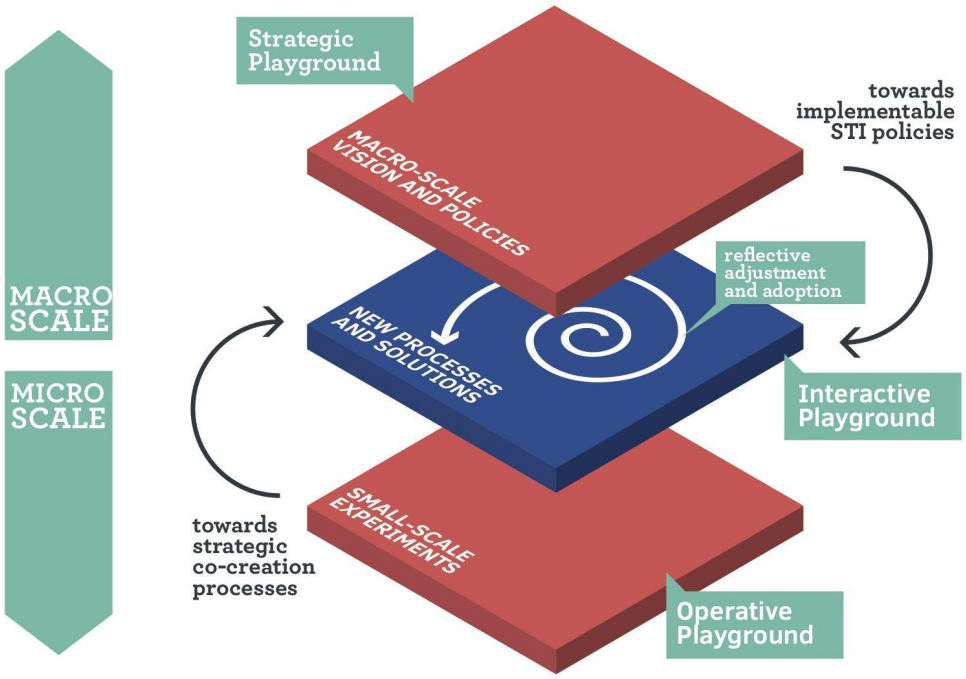

Fig 02 - Interaction between small-scale experimentation and STI policymaking (Rizzo et al., 2018)

2. Methodology: a matter of triangulation

WP5 *Co-creation for implementable RRI* aims at providing an understanding of the configuration and the transformative processes occurring within co-creation ecosystems, as well as to open the reflection toward the ecosystems' dynamics that allow agents of co-creation to overcome internal and external barriers in configuring solutions to societal challenges. By focusing on ecosystems, this document at first captures the different dimensions and factors at the micro, meso and macro scale that configure co-creation ecosystems. It then triangulates these results aiming to find the right balance between transversally applicable co-creation practices, approaches and tools, and the capacity to take into account contextual factors and constraints in specific contexts towards the development of effective solutions and policies in an RRI context. The research design, by relying on the theoretical remarks previously discussed, is based on a process of triangulation of the different kinds of qualitative data collected within WP1, WP 2, and WP3.

More in detail, this methodological framework is based on a mixed methodology (case studies research conducted in WP2 and the SISCODE lab experimentation as action research within WP3) and an iterative cycle of conceptualising, analysing, evaluating and transferring the gained knowledge. Thanks to this mix, this deliverable develops strong synergies between: the analysis of the already produced theory and knowledge about RRI and STI policymaking in the context of co-creation (WP1); the results from the comparison of 40 co-creation case studies and 15 co-creation biographies across Europe (WP2); and 10 real life experimentations developed in the SISCODE co-creation labs (WP3). Triangulation boosted a systemic interpretation of SISCODE research results, thus allowing the development of knowledge related to co-creation able to cross-fertilized the field of RRI, both recognisable to academic and practitioner actors, such as policy makers. Hence, triangulation in SISCODE referred to the application and combination of diverse research methods in the study of co-creation to give robustness and larger reliability to the project's main findings and recommendations. Under this perspective, the analysis of co-creation ecosystems has been developed through a robust mechanism of continuous data triangulation, as a way to operationalise the complementarity between the analytical and the action research approaches. Indeed, the combination of different research perspectives allowed the consistent enlargement of the quantity of data available, as well as the enrichment of their significance. Finally, the robustness of the above-mentioned methodological design definitely enhanced SISCODE's reflexivity on co-creation and allowed

the achievement of the specific objectives in locating co-creation in the field of RRI and STI policymaking.

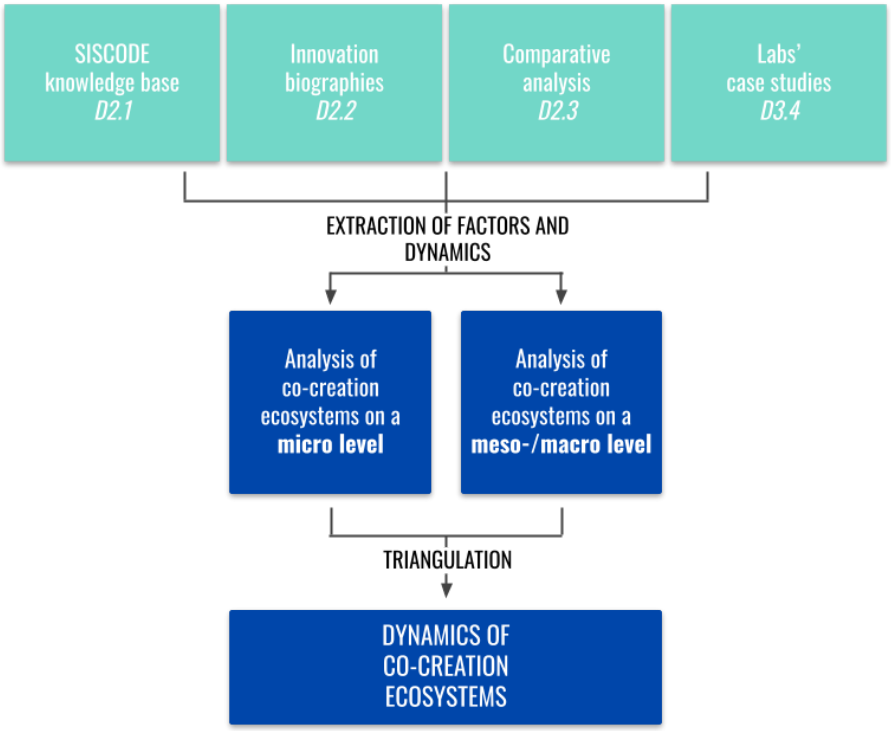

Fig 03 - Assets and workflow for the analysis

Operationalisation of concepts

In its analysis of co-creation experiments and co-creation cases from the SISCODE field research, this report uses several key terms that are not necessarily uniformly understood in literature and practice. Therefore, an overview of key terms and their operationalization for the analyses in this report follows below:

- **Ecosystems of co-creation:** linked to the multi-level perspective developed so far, we conceptualize co-creation ecosystems as the totality of factors in which a process of co-creation alongside the SISCODE definition of co-creation is embedded. This encloses actors just as much as framework conditions, like norms and structures. Furthermore, the approach does also allow considering the function of concrete practices – be them on the operational level of co-creation or the managerial level of the co-creation initiatives.

- **Dynamics**: As the process of co-creation in SISCODE is envisioned as an iterative cycle of design with the phases of **understanding, ideating, prototyping, and verifying** it is possible to describe the process dynamics, especially the relevant drivers and barriers. This represents the dynamics of the co-creation process itself. At the same time, co-creation is linked to context-specific dynamics. While framework conditions may often seem stable in the first place, they can also be subject to change. This reflects social dynamics that influence co-creation. Transformations, transitions, political and cultural change or crises can determine the dynamic environment of co-creation. In this respect, dynamics is a cross-cutting theme for co-creation.
- **Institutionalisation**: As the final stage of a co-creation process. Thereby, in this report the notion of institutionalisation does not mean the implementation of the output of co-creation – be it a service, a prototype, a tangible artefact or else. Much more, institutionalisation in this respect is the sustainable and accepted implementation of co-creation as a new mode of collaborative practice in a certain context like an organization, an ecosystem, a societal sector or a geographical area etc.

2.1 Analysing dynamics and framework conditions of co-creation ecosystems at the micro level

The analysis and systematisation of the factors and dynamics of co-creation at the micro level is at the center of the task T5.2 *Dynamics of co-creation ecosystems.* This task aims at the analysis of the micro level investigated within 15 innovation biographies of existing cases (WP2; D2.2 (Maylandt et al., 2020)) and the 10 real-life experimentation (WP3, Real et al., 2020)) conducted by the SISCODE co-creation labs within and along the project.

The aim is describing the factors and dynamics influencing co-creation, paying attention to the multi-level changes occurring in the networks of the stakeholders involved, in terms of culture, internal processes, and organization. The analysis conducted looks at each of the co-creation processes, scrutinizing its multi-level impacts, identifying patterns and recurrences characterising innovation ecosystems, while considering unicities. This knowledge relies on the outcomes of WP2 and WP3, specifically *D2.2 Case studies and biographies report D3.4 Labs' journeys as case studies.* To analyse processes and factors that affect co-creation at the micro level of the ecosystems, while uncovering transversal and situated approaches and solutions to better integrate innovation and science with society an

analytical grid has been developed. It focuses on the core themes of stakeholder engagement, co-creation and dissemination (see Annex 1). The analytical grid allowed the description and analysis of the factors and dynamics of co-creation and the triggered transformation that occured at the micro level of co-creation ecosystems.

More in detail, three analytical domains were identified that concern transformation that may occur at the micro level of co-creation processes:

ANALYTICAL DOMAIN	DESCRIPTION
I - Engaging	Stakeholder engagement
II - Organizing	Internal processes, culture, and organization: the co-creation mind-set
III - Scaling	Outcomes and value of co-creation processes beyond the project (scalability and replicability)

The major hypothesis under the identification of these three analytical domains mentioned above concerns the idea that adopting co-design approaches should support the operationalization of co-creation in RRI and STI policymaking. An adoption meant to elicit both the implementation of novel engagement strategies and boosting a shift from an organizational culture based on top-down consultation to more participatory, bottom-up practices, where co-design and co-production are at stake.

For what concerns the first analytical domain (i.e. “engaging”), the aim was to capture stakeholders engagement process (i.e. of policy makers and regulatory bodies; research community; education community; business and industry; citizens and civil society organizations), and to identify transformations (and the drivers of these transformations) in the organizational culture of engagement, that can be described as a shift towards the adoption of more intensive participatory engagement practices, as well as the embedding of those practices making them routines.

Concerning the second analytical domain (i.e. “Internal processes, culture, and organization: the co-creation mind-set”), the aim was to capture the actual processes of organizing and carrying-out co-creation and which factors hinder or boost co-creation processes in itself. In doing so, it has been possible to detail and address internal organizational dynamics occurring at the micro level, which can act as drivers/barriers for the adoption of co-creation methodologies to operationalize RRI within the concerned organization.

Finally, the third analytical domain pertained to the specific outcomes (both in terms of tangible and intangible outcomes) emerging from co-creation processes, hence allowing us to provide insights about the effectiveness of the prototype/lessons learned from situated experimentation and specific practices of co-creation. In doing so, a special attention has been drawn to any considerations or effective implementation in terms of scaling or replication of the prototype / final solution toward other contexts, as well as on the assessment and self-assessment practices adopted within the co-creation initiative.

The key insights have been extracted from the filled grids to be clustered for each domain identifying a number of overarching topics and recurring patterns (Fig 04) described in the corresponding chapter 3.

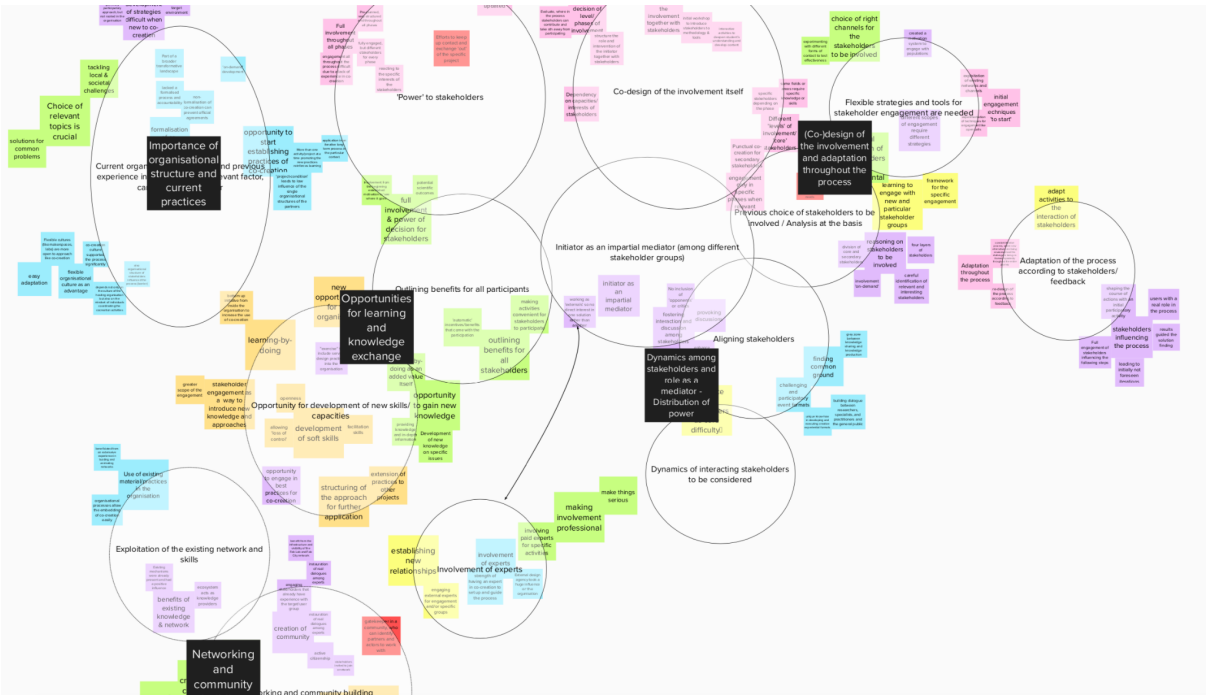

Fig 04 - Clusterization of results from the analytical grid

These clusters and patterns led to the development of 13 descriptors (Fig 05) used in the corresponding chapter (chap 3) to investigate and describe the results of this analysis.

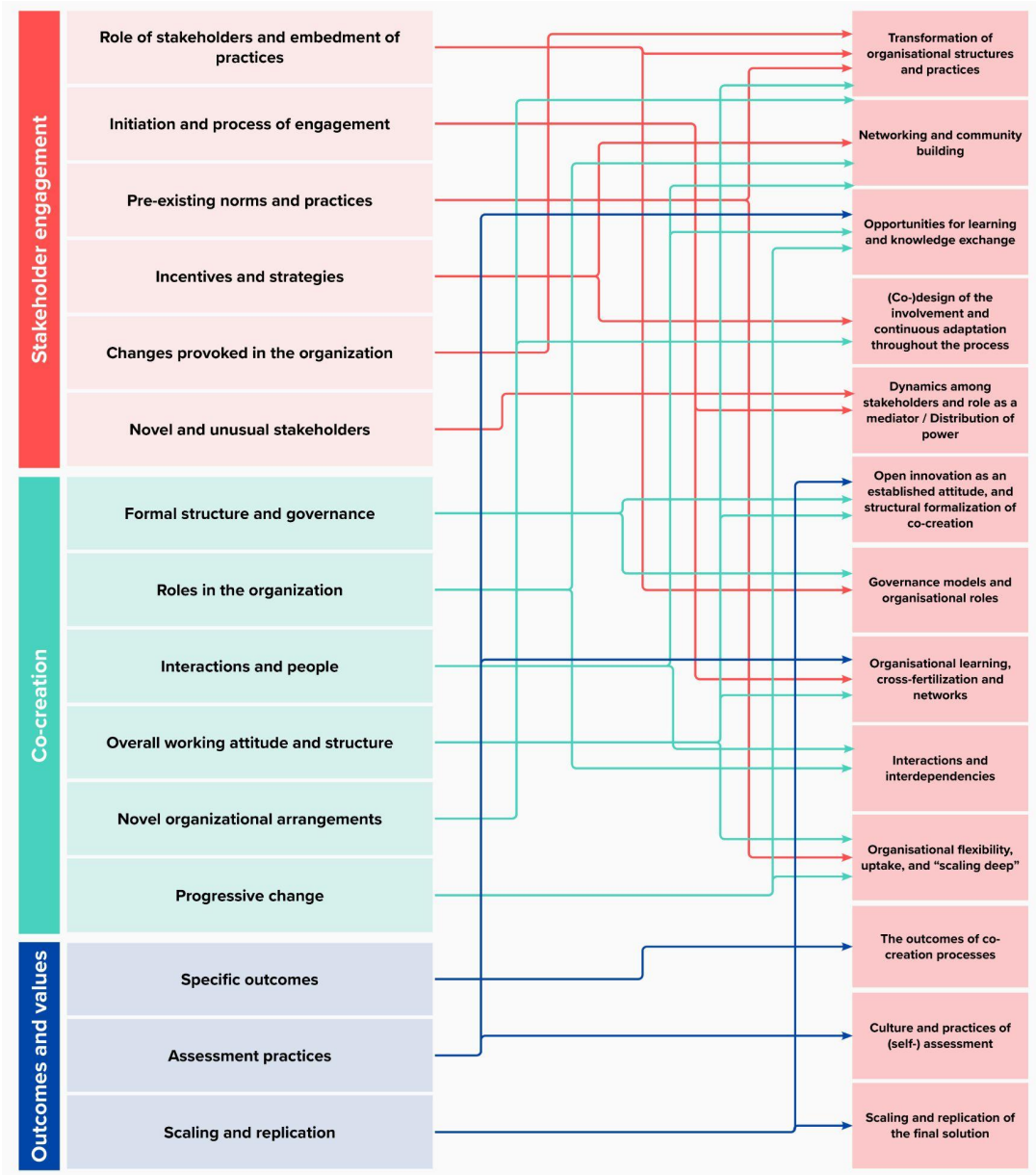

Fig 05 - Development of descriptors for the analysis on a micro level

2.2 Analysing dynamics and framework conditions of co-creation ecosystems at the meso- and macro level

The analysis of factors that affect co-creation at the meso and macro levels of ecosystems starts from analysis discussed in SISCODE's WP1, WP2 and WP3. More specifically, results from the comparative analysis of co-creation case studies, 15 co-creation biographies and results from the knowledge base from SISCODE's tasks T2.1, T2.2 and T2.3 (SISCODE 2.1 - Eckhardt et al., 2019 & SISCODE D2.2, Maylandt et al., 2020) in task 2.4 (SISCODE D2.3 - Eckhardt et al., 2020) form the empirical data basis together with results from the analysis of 10 real life experimentations from the SISCODE lab experiments conducted within task T3.4 (SISCODE D3.4 - Real et al., 2020). With this collection of results, the analysis in T5.1

builds on findings from the case studies of co-creation in practice analysed during WP2 and WP3.

The goal was to identify drivers and barriers and framework conditions that determine the characterization of co-creation ecosystems. The aim was also to distill the most concrete and tangible recommendations. The research process was designed accordingly, and the results of the SISCODE case studies of the co-creation journeys have been deeply scrutinized. This new data material was provided with SISCODE Deliverable D3.4 (Real et al., 2020) and was first pre-structured for analysis based on the co-creation ecosystem model. This model, going back to a model originally developed for structuring analyses of social innovation cases (Kaletka et al., 2017), was adapted for the observation context of SISCODE as part of the work on WP2 (Deliverable D2.3 - Eckhardt et al., 2020). The adaptation for the research object co-creation also served as a research heuristic for T5.1 and was the basis for the qualitative content analysis to identify framework conditions of co-creation across the entire data basis. Starting from the ecosystem model, categories for the observation levels 'Actors and Roles' (acting within the socio-technical regimens), 'Functions', and 'Structures' (the regimens) and 'Norms' (landscape development) were initially taken up from the research process of WP2 (SISCODE D2.1 - Eckhardt et al., 2019 & Deliverable D2.3 - Eckhardt et al., 2020).

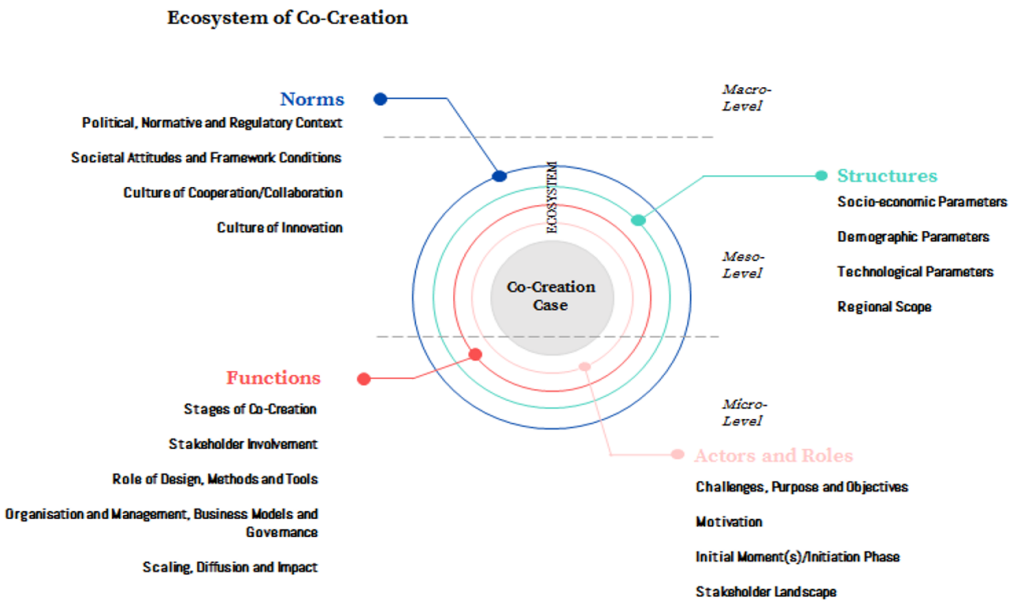

Fig 06 - Co-creation ecosystems (based on Kaletka et al., 2017)

For T5.1, these categories served as an analytical grid again. With the help of this grid, text passages from the case-study document (Real et al., 2020) were first identified that offered information on the observation levels with respect to driving and hindering framework conditions. In a next step, these passages were assigned to the parent categories elaborated in WP2, using MaxQDA analysis software. In a further step, these categories had to be deepened and appropriated to fit the inductive findings. This deepening and adaptation of categories to the findings was particularly necessary because, on the one hand, the data material provided additional results and, on the other hand, the focus was more specifically on drivers and barriers. This approach allowed a holistic view of all context levels of the co-creation journeys while preserving distinctiveness and retrievability of identified information by creating a database of relevant text passages. In a next step, the new results thus obtained were comparatively analyzed with results from the comparative analysis (Eckhardt et al., 2020) of Co-Creation Case Studies, Co-Creation Innovation Biographies (Maylandt et al., 2020) and the results from the quantitative analysis of data from the SISCODE Knowledge Base (Eckhardt et al., 2019). In the course of this analysis, the influence of all levels of analysis from the initial analytical grid (Actors and Roles, Functions, Structures, and Norms) on drivers and barriers became apparent. Therefore, it was necessary to overcome the individual levels of analysis in order to do justice to the results. The presentation of the results (cf. ch. 4.2, 4.3, 4.4) thus adopts a holistic perspective that does not separate according to individual contextual factors anymore, but rather presents the inductively identified relationships. This results in a new abstraction and observation level for the overall view of the results.

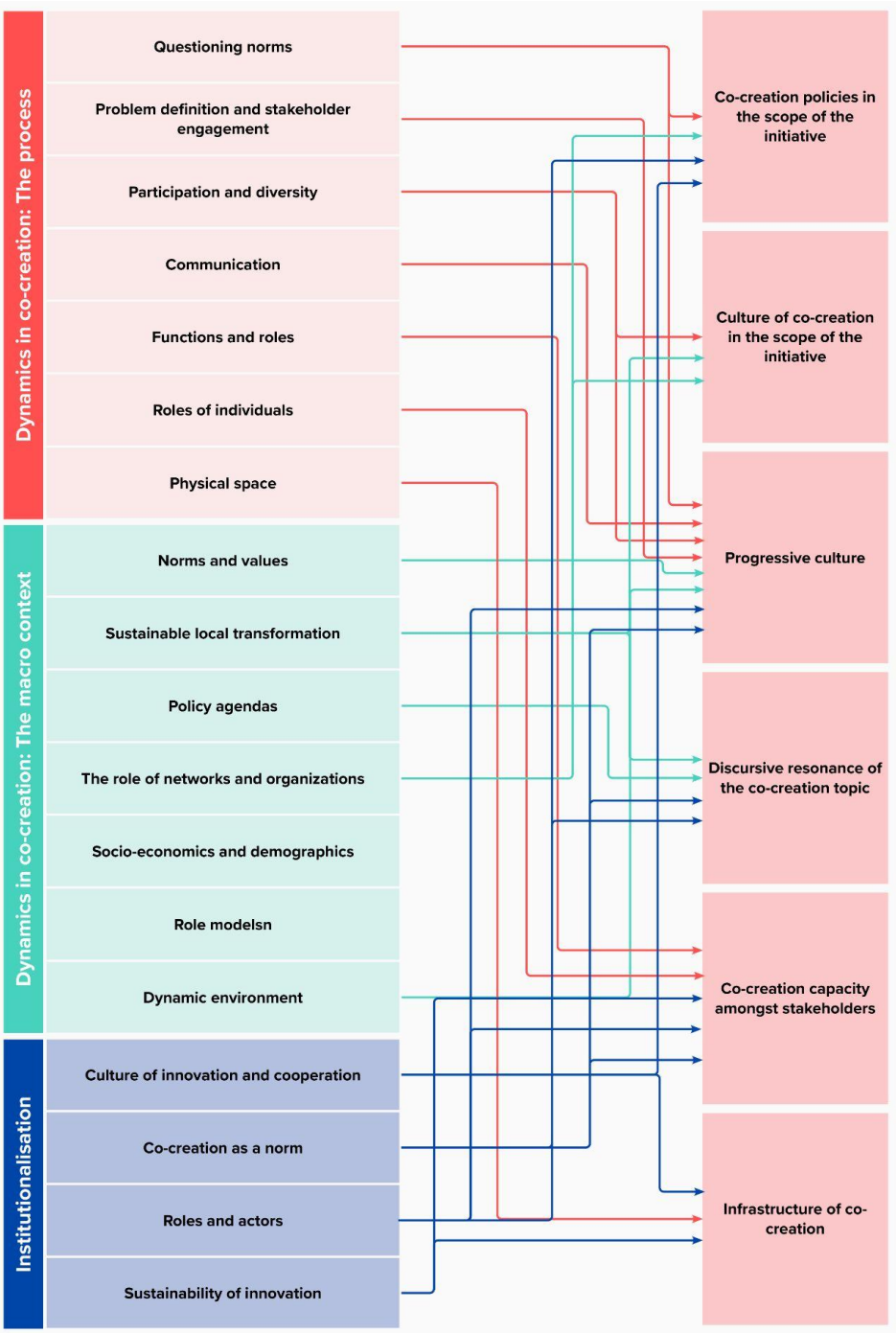

Fig 07 - Development of descriptors for the analysis on a macro level

Based on the results of this comparative analysis, characteristics were identified and derived in a further step, which allowed a classification of ideal-typical ecosystems (cf. ch. 4.5 '*Ecosystems of Co-Creation*'). On the basis of these results, policy implications (cf. ch. 4.6) could then be derived, which relate to the ideal-typically constructed ecosystem constellations.

All identified dimensions were analysed and described in relation to the ideal-typical ecosystem. For this scope, a maturity scale was developed ranging from a non-existent to a far mature ecosystem. The specific characteristics of an ecosystem are detailed for each level of maturity in relation to the dimension analysed.

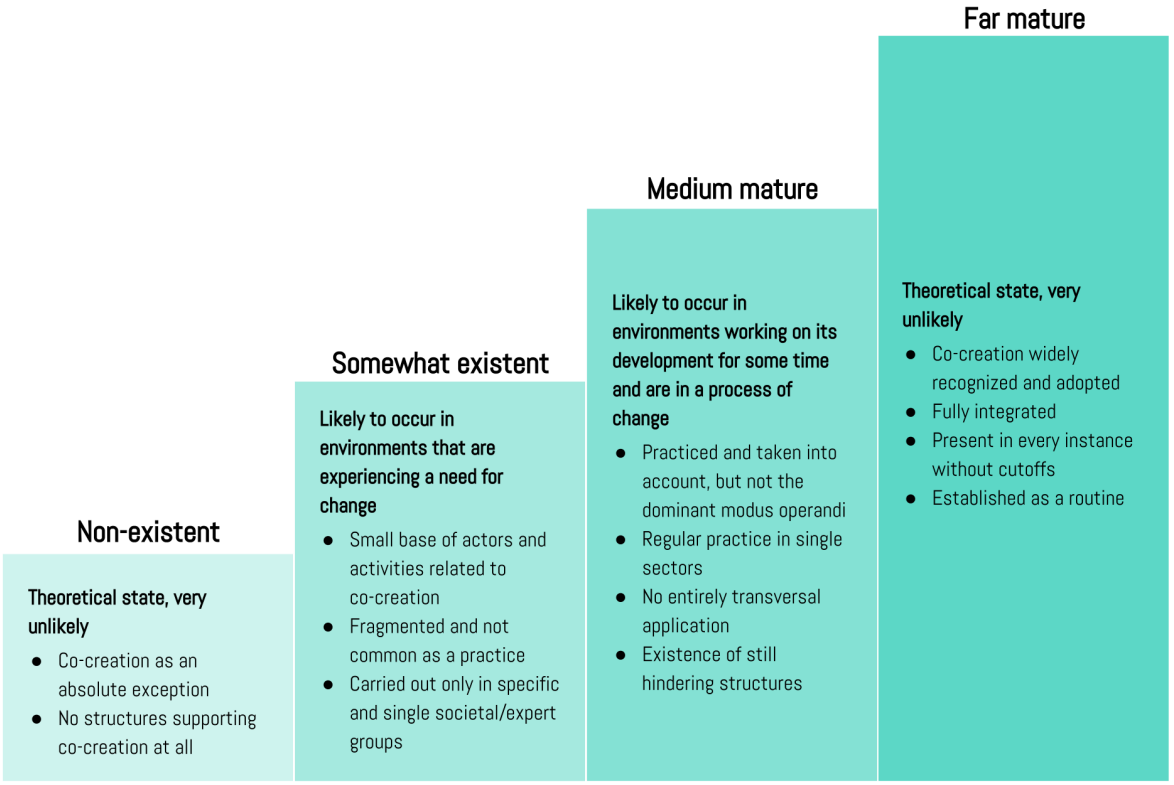

Fig 08 - Maturity scale of collaborative ecosystems

2.3 Triangulation of the results of the micro, meso and macro level

On the ground of the maturity model applied to the analysis of the macro- and meso scale, the knowledge developed in tasks T5.1 and T5.2 is then elaborated to build and analyse a model of co-creation ecosystems, which is based on different framework conditions and potential pathways and dynamics of co-creation. Including micro, meso, and macro level dynamics, the model presents the variety and multiplicity of connections between solutions, factors from the scale of the niche to that of the national and supranational landscape (Geels 2005), as framework condition of and for co-creation. In doing so, conclusions on directions for the field of policymaking for its replication, diffusion and scaling are drawn.

From a methodological perspective, the data, evidence, cases and tools drawn from the three main lines of research of the project as (i) conceptual development and validation, (ii)

case analysis and comparison; and (iii) experimentation and prototyping, are further triangulated. The design of the model of ecosystems of co-creation relies on the analysis of the theory and knowledge (WP1), the results from the comparison of 40 co-creation case studies and 15 co-creation biographies across Europe (WP2); and 10 real-life experimentations of co-creation in as many labs across Europe (WP3).

All information and descriptors applied in the micro scale (chap 3) as well as on the macro- and meso scale (chap 4) have been triangulated to define seven final descriptors applicable to co-creation ecosystems on a micro-, meso- and macro scale (Fig 09).

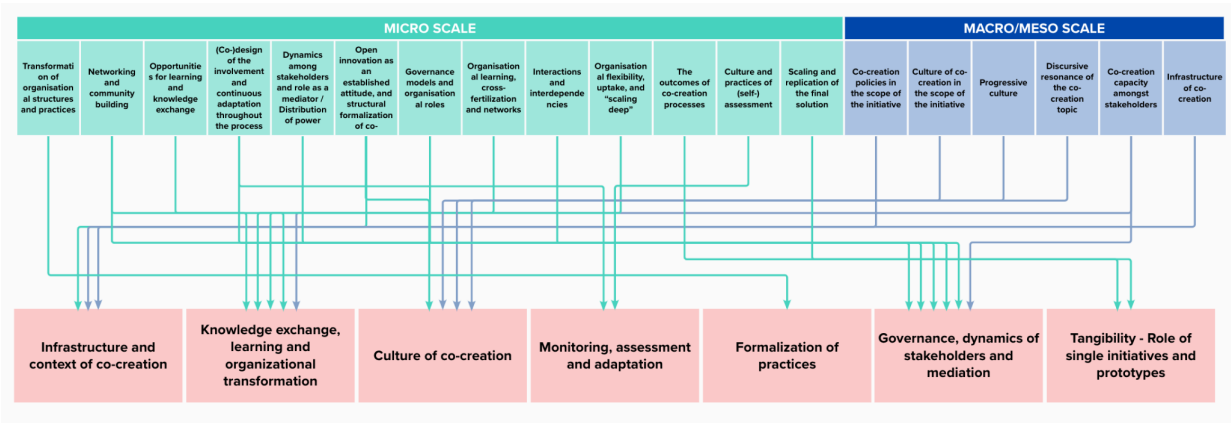

Fig 09 - Triangulation and development of descriptors

Each descriptor was analysed extracting and illustrating the key points transversal to all three scales. Following the analysis, the results have been connected to the previously introduced maturity model focussing on the dynamics between the levels of maturity. For each transition from one level to another the main drivers and barriers have been extracted concrete recommendations.

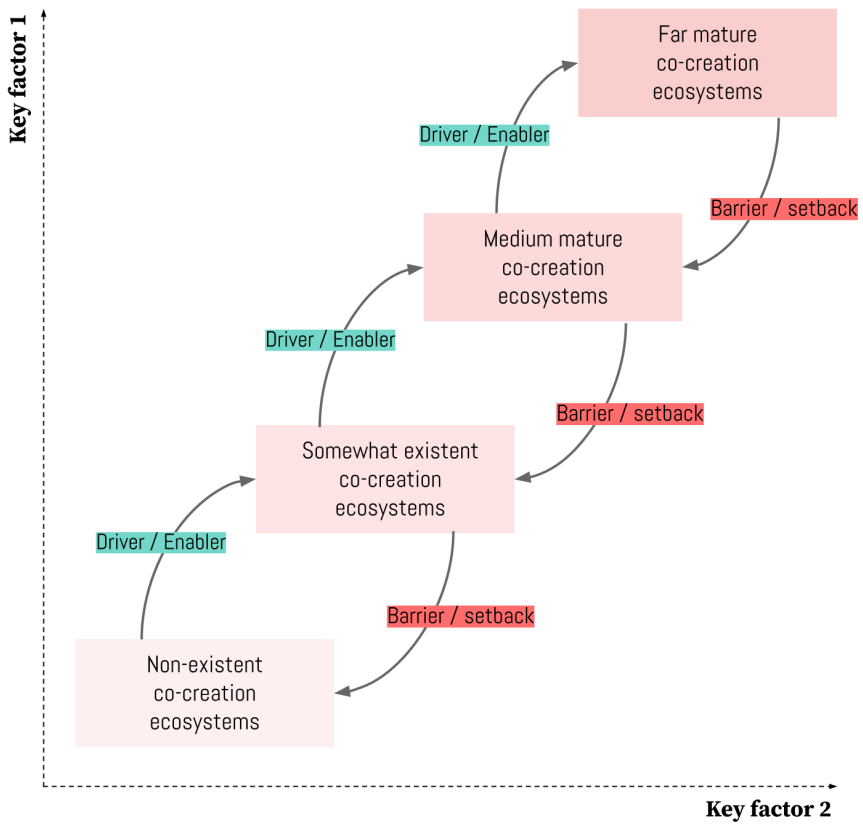

Fig 10 - Dynamics of co-creation ecosystems in relation to its maturity

In the final chapter, the overall results are summarized and combined with a series of concrete recommendations on how to plan, establish and further develop co-creation ecosystems in the context of RRI and STI policymaking.

Moreover, the final chapter connects the findings and results to the SISCODE layer model (Fig 02, see chap 1.3) as presented in the initial stages of the project as a theoretical model to combine bottom-up and top-down approaches and bridge the gap between the ideation and implementation of policies (Rizzo et al., 2018). The concrete results of the analysis documented in this deliverable are therefore connected to the initial theoretical model to reflect on the overall aim of the project as the connection of theory and practice to develop concrete points of attention for co-creation in RRI for STI policymaking.

Moreover, final reflections on the achieved results and further research to be done are included in this last chapter.

3. Dynamics and framework conditions of co-creation ecosystems at the micro level

3.1 Institutionalising RRI in organizational settings

One very problematic issue with the concept of RRI is that it has been primarily conceived in a closed community of researchers operating in the field of STS studies. Despite the many attempts to open up to a broader audience to spread the concept and sustain its diffusion and uptake in organizational settings, it is perceived as quite abstract by many practitioners and organizations that work on the ground to pursue innovation in diverse fields. The focus on the ethical impacts of research and innovation, coupled with the tendency to produce broad recommendations and frameworks to measure the performances of organizations or national research systems, seems to have made it even less attractive and difficult to operationalize. Another reason for this difficulty is that the focus on research has prevailed over the investigation of RI (Responsible Innovation) and its societal impacts (Jakobsen et al., 2019), which has led to a concentration on specific forms of innovation, primarily research- and technology-driven, excluding many other typologies of innovation that have weaker connections with science and technology, such as user-centred innovation, social innovation, business model innovation, public sector innovation, experience innovation, etc. Among the few exceptions, we find studies focussed on responsible innovation in the financial sector (Armstrong et al., 2012; Asante et al., 2014). The focus on research- and technology-driven innovation has paradoxically limited the engagement of society and the societal commitment which should be at the core of RRI, consolidating the idea of an abstract concept discussed in a small community of experts and researchers and hampering the development of a more context-sensitive perspective (Jakobsen et al., 2019).

Consequently, implementing RRI and embedding it into real practices and organizational processes are proving to be major challenges. Despite the large amount of literature produced in a relatively short time, RRI is struggling to be embedded in the daily practices of organizations showing its impact and potentialities.

In this framework, operationalizing, contextualizing and institutionalizing RRI emerge as key issues and objectives. For this reason, SISCODE's approach has been to experiment with co-creation as a means to operationalize RRI, with a view to include the neglected forms of innovation and with special sensitivity to the diversity of the contexts in which innovation may take shape and be diffused. The project has done this in practice, through real-life experiments carried out in the ten co-creation labs, also with the aim of reconnecting the

knowledge and insights gathered through action research to the already established knowledge that we can find in literature from the field of RRI and the field of co-creation. While both these two fields of study have dealt with the question of institutionalization and with the need to investigate how the concepts could be turned into practices and embedded in organizational contexts, it is interesting to notice that they have been developed separately by different communities of researchers that had very limited and sporadic contacts. For both, open science and innovation have been key references (European Commission, 2016). Openness is actually seen as a pre-condition and driver for co-creation, but is also key for RRI, even if being open does not automatically mean being more responsible.

3.2 Micro dynamics of RRI in co-creation landscapes: evidences from the SISCODE project

3.2.1 The practice of stakeholder engagement

The engagement of stakeholders as a fundamental element in making innovation more responsible through the involvement and inclusion of a variety of stakeholders has been investigated from different aspects and points of view. Stakeholder engagement here refers to the engagement and involvement of not only direct stakeholders, but all kinds of actors, users and citizens in the development of a solution.

At first, the **role of the stakeholders** in the specific process of the case and in general for the organization have been analysed to trace this role back to the embedding of engagement practices within the single organization taking a particular focus on the **pre-existing norms and practices** present both in the organization and the specific project (Lehtinen & Aaltonen, 2020)**. These can influence the engagement** to reconnect drivers and barriers to existing organizational structures, setting them in a context and analysing them as part of such. In particular, the **initiation of the engagement,** both of familiar and **novel stakeholders** in terms of strategies, practices and channels to reach out to users and stakeholders as well as the **engagement throughout the different project phases** in relation to the choice when and where to involve certain stakeholders and the links to the choices on the basis and the **incentives** set up to keep motivation high and the involvement constant (Ferguson et al., 2017).

Lastly, the **changes provoked within the organization** are examined especially considering what the general full involvement of stakeholders triggered in terms of reactions,

knowledge exchange, acquisition of new capacities and implementation of new practices and processes.

The results can be grouped in 5 overarching and interconnected themes:

- Transformation of previous organizational structures and practices
- Networking and community building
- Opportunities for learning and knowledge exchange
- (Co-)design of the involvement and continuous adaptation throughout the process
- Dynamics among stakeholders and role as a mediator / Distribution of power

Transformation of organizational structures and practices

Generally speaking, the relevance of how organizations applying co-creation are structured has been raised referring to both the general facility with which co-creation may be adopted and the profundity of change necessary to embed it considering the current organizational structures (Bruce & Shelley, 2010; Sloan, 2009). Stakeholder engagement is easily adopted specially by institutions with a very flexible organizational culture at the basis (Näsholm & Blomkvist, 2015). In SISCODE, Fab Labs or makerspaces were identified as particularly flexible organizations with an openness towards the adoption of new ways of working, methodologies and techniques. The routine of these organizations emerged as easily adaptable to different circumstances as they already have a quite horizontal structure and a mindset open to co-creation. All these factors have been found to be a facilitator to the full involvement of stakeholders supporting the development of an initiative.

It is also worth to be mentioned that not only the structure of an initiative or an organization practicing co-creation is relevant, but also the one of the participating stakeholders that especially in the case of public administrations or big enterprises can hinder the process through rigid procedures and legislations.

The 'project-condition' in which stakeholder engagement is often performed has been identified both as a potential driver and barrier to the embedding of practices into the system of an institution.

On the one hand, the extraordinary condition of a project that is totally focussed on experimenting co-creation practices allows the leading organization for a full immersion into a new practice that to date has been applied more sporadically. Practices that have been proven successful in this process can then eventually be spread beyond the single project by formalizing practices within the organization. In some of SISCODE's co-creation labs these

dynamics are already in place before the conclusion of the project. In the case of Science Gallery Dublin the engagement of stakeholders was already a common practice before the participation in SISCODE, but throughout the project a new approach of using a gatekeeper to engage new groups and entire communities was experimented. Having proven successful within SISCODE, this new technique has been established permanently in the organization as an effective and promising way to engage and involve new stakeholders and actors.

On the other hand, when many organizations are involved in the project, the quantity of actors that take part in the co-creation process can lead to a lower impact on the single one. Single organizations may be involved only in parts of the whole process and the dynamics among the various participants makes it difficult for one single organization to evaluate the impact and functionality that the embedding of practices of stakeholder engagement would have.

One potential way to overcome this barrier has been identified in the participation of the organization in more than one project promoting the same practices of stakeholder engagement. This gives at the same time the opportunity to deepen knowledge, involve more members of the organization and see the same practice applied in diverse settings and conditions.

The practice of stakeholder engagement and involvement resulted in an opportunity to start establishing novel processes and practices of co-creation within an organization. It triggered bottom-up initiatives from within the organization itself applying and spreading the practices and requesting their formalisation.

Networking and community building

The aspect of networking and community building was identified as an advantage point for both the initiator and the stakeholders that are simultaneously involved in the initiative (Maak, 2007).

As pointed out by Ferguson et al., the social aspect of stakeholder engagement can be a key motivation to participate in events and entire initiatives to get to know other participants, practice networking and take the opportunity to have a dialogue (Ferguson et al., 2017).

The project is an opportunity for both setting up a new network of scope and/or a community (which can possibly live on beyond the duration of the initiative) and for building on already-established networks and communities.

The belonging to a network or community proved to be a strong factor in making involved stakeholders get into real dialogues among each other, to share and represent common interests leading to a feeling of belonging and responsibility and a more constant participation and involvement. For example in the case of ThessAHALL, the group of elderly involved in the life-long learning programme led to the creation of a community of interest. The feeling of belonging and being part of a community was pointed out as one of the key aspects of motivation by the participants to continuously engage in events and opportunities for exchange. Tackling the social exclusion of elderly with their programme, already the involvement in the development of this programme turned out a means for inclusion and community-building.

In relation to the set-up of these networks or communities, the opportunity of drawing on existing communities and networks within and beyond the ecosystem of the organization was identified: The ecosystem can function as a knowledge provider. Although they might not be directly related to stakeholder engagement, a variety of practices and materials already present in the organization (like workshops, mapping tools or databases) can be utilized to support the new practices and connect them to the current organizational culture. This results also in a facilitation for the comprehension of these tools and practices seeing them applied in real contexts.

Furthermore, the importance of contributions and benefits for all stakeholders deriving from their involvement needs to be defined and pointed out in the beginning. Both organizations and stakeholders were identified as beneficiaries in terms of gaining new perspectives and establishing real and productive dialogues with external actors (Maak, 2007). These dialogues have shown to support the development of collaborative structures transforming competitors into partners, fostering the idea of teaming up with similar stakeholders to obtain the best possible result for everyone. At the same time, the clash of very different opinions and points of view can lead to conflicts and hinder the overall process, even causing drop-outs of single groups when the confrontations are not managed. The conflict of interest needs to be addressed in every initiative. During the experimentation in SISCODE PA4ALL developed a new teaching module for highschools specialized in agriculture in Serbia. While students reacted enthusiastically to the idea of installing meteo stations in the schools to introduce precision agriculture in their teaching schedule, teachers were worried about the additional workload to prepare the module and institutions reacted with hesitation to the costs and effort that such an implementation would bring. KTP had to deal with the contrasting opinions of citizens, industry and politics

during the development of the new Air Protection Programme for the region. Charging the different parties with their responsibilities in polluting the air and the view on prospective measures to address the problem led to conflicts among the stakeholders that needed to be managed and mediated.

In close relation to the creation of networks and communities that may occur inside an initiative, opportunities for further collaboration were found. These opportunities for future partnerships represent a potential benefit for both initiator and engaged stakeholders. This aspect is closely related to the previously mentioned set up of networks and communities going beyond the single project and its duration.

Opportunities for learning and knowledge exchange

The importance of analysing, outlining and communicating potential benefits bound to learning and knowledge exchange is fundamental (Payne & Calton, 2017). It can function as a driver to involve stakeholders and motivate members from the organization to further practice stakeholder engagement (Ferguson et al., 2017) both assisting in engaging stakeholders and starting to practice it themselves. Some of the benefits are automatic, like a potential learning-by-doing effect, but often not visible to stakeholders in the first place and therefore need to be expressed. For example in the case of Cube Design Museum the policy makers engaged in the co-design process started to be highly engaged after an initial phase of hesitation. Their regular and active participation was traced back to the fact that the participation in these co-design activities was perceived as an opportunity to acquire new capacities in relation to co-creation and design seen as valid and important competences.

Furthermore, the peer-to-peer learning that may occur during the exchange with and among stakeholders is another aspect often not considered previously to an initiative.

The exchange and confrontation with and among stakeholders can lead to the acquisition of new expertise, especially in relation to soft skills that are developed throughout the process like the facilitation of heterogeneous groups and balancing power and dominance. This balance in power to be achieved implicates also the partial loss of control for the initiating organization itself that has been pointed out as a difficulty and a precious learning opportunity at the same time.

If successful, these practices have shown to be drivers for consistent motivation and real involvement as well as spaces to acquire new skills and knowledge from others and together with them. In the case of TRACES the experimenting with AI as a spectator of cultural events gathered stakeholders like artistic groups, organizers of cultural activities and

citizens interested in culture and AI. The engagement turned into an opportunity of intellectual exchange that was created during the co-design of the prototype leading to increased motivation and mutual exchange and learning on the respective topics.
Stakeholder engagement has been identified also as a means of organizational learning in terms of the development of specific skills related to stakeholder engagement and the experimentation of novel methodologies and tools. The methodologies and tools have the potential to be then integrated within the organizational culture and its daily practices. In particular, the step-by-step integration of a new approach, for example experimenting them in single projects, has shown to be an opportunity for acquiring familiarity, for customizing practices and tools and for embedding them into the organization. The step-by-step approach allows organizations to experiment and develop tailored versions of methodologies and tools in specific projects while acquiring the capabilities needed for their use to then extend the application to other projects until it is fully embedded into the system.

(Co-)design of the involvement and continuous adaptation throughout the process
When engaging and involving stakeholders it is necessary to previously analyze and define benefits of contributions of each stakeholder or stakeholder group to align expectations and carefully plan the involvement (Phillipson et al., 2012; Bourne, 2016).
A fundamental point raised throughout all cases in this respect was the co-design not only of the solution together with the stakeholders but of the stakeholder involvement itself. The methodology adopted in SISCODE foresaw an initial analysis and a reasoning done by the single lab, which were asked at the beginning of the project to define a first framework of stakeholders to be potentially involved. This framework analyzed why the single stakeholders could be relevant and what kind of skills they could bring into the initiative not only in terms of roles but also in relation to competences and specific knowledge. Also, the framework asked to identify possible benefits for the stakeholders to be involved in the initiative, so that they could be engaged by leveraging on these benefits.
Following this first initial hypothesis, it was suggested to further define the active involvement and commitments directly together with the identified stakeholders co-designing not only the solution, but the entire process leading to its development.
This resulted in a more active commitment as well as in making the entire involvement in the process more a collaborative development of solutions instead of a top-down initiative.

In this way, all actors were able to contribute and benefit at the same time instead of having the initiator requesting contributions from single actors or groups of stakeholders without considering their benefits.

Even though the full and integrated involvement of stakeholders has proven successful, it is also worth mentioning that not all stakeholders need to be and should be necessarily involved in the entire process and throughout all phases. In fact, in some cases involving specific stakeholders only in a single phase might prove more effective. During the development of their Air Protection Programme, KTP initially involved a wide variety of lay people and citizens to grasp their needs and points of view. While their contributions were fundamental in the phase of exploration and ideation during the final stages of developing the legal document lay people were not able to contribute or benefit from participating actively in the process. The complexity and expertise needed led to KTP functioning as a mediator making sure the initially identified interests and needs of citizens were considered and respected in the final solution without actively involving them.

Stakeholders may play different roles and have different degrees of commitment with the project/initiative. For this, stakeholder maps and involvement strategies were created to reason on the entirety of engagement as well as on the phases and activities where specific stakeholders could both contribute and benefit at the same time.

These strategies are flexible and require a certain adaptability also in terms of the tools utilized for the set up of the strategies that need to be done individually for each initiative even if their development can be facilitated with a general framework for planning, engagement and involvement.

The need for flexibility and adaptability was stressed as crucial not only during the setup of an initiative but through the course of it as well. Depending on the observations made throughout the process, an adjustment of strategies may be necessary and beneficial that can result in the involvement or drop out of stakeholders. Some may have not been considered yet while others may become less relevant and the reorganization of working groups or other strategies can make the interaction among stakeholders more efficient.

A particularly interesting practice applied in this context was the development of a framework for the involvement 'on demand' of single stakeholders and entire groups of them in the process whenever necessary.

Dynamics among stakeholders and role as a mediator / Distribution of power

The dynamics and interactions with and among stakeholders are a central aspect of stakeholder engagement (Windsor, 2010). These dynamics occur especially when involving a variety of different stakeholders with diverse opinions and points of view (O'Brien et al., 2013).

The analysis of SISCODE's experimentation and real-life cases showed the need to see and consider the involved stakeholders as an entire system of real and possible interactions instead of single entities. Their interaction can lead to strong dynamics within and among the groups fostering and provoking discussion and confrontation. As mentioned in the previous paragraph, the development of the legal document defining new legislations to reduce the air pollution in the region around Krakow KTP had to manage the interaction of the different entities and parties responsible for the issue of air pollution. This process was characterized not only by collaboration to find a feasible solution but also entities blaming each other as the main cause of the problem fearing restrictions or costs caused by the new regulations.

In this context, the initiator was identified as a particularly important element when functioning as a mediator among stakeholders. As mediators, the organizations were able to find or create common ground among the diverse stakeholders and put a horizontal approach into practice by regulating the distribution of power and creating a balance of power between lay people and experts, who can leave their roles and positions behind.

The concrete solutions and prototypes developed within the SISCODE project resulted as boundary objects for concrete discussions to discuss contrasting points of view and interests to move towards a concrete solution.

Prototypes allow for the effective engagement of supposedly "lay" people: they might not be experts in the solutions but are often owners of the problems and can contribute in multiple ways when the discussion moves from the domain of abstraction to the assessment of a concrete prototype, or the involvement opens up to the possibility to co-design and co-produce solutions. In the case of Science Gallery Dublin, the prototype aimed at addressing the issue of mental health of young people through the creation of hobby clubs in highschools gave the opportunity to students to express their opinion being themselves highly involved and therefore experts in the topic. They could contribute with first-hand experience that even experts in the topic of mental health may not be aware of.

In fact, problems themselves should be questioned before trying to develop solutions. The way in which a problem is set may anticipate solutions or lead to some kinds of solutions instead of others. Moreover, the design process is not only a problem-solving one. It can

help reframe problems and can (frequently) lead to unsuccessful innovations, but the process can be equally important as the outcomes, and many unsuccessful attempts can lead to a successful innovation that can possibly be diffused.

3.2.2 Internal processes, culture, and organizations: the co-creation mindset for RRI

The effective inclusion of stakeholders and users with multiple backgrounds and expertise is recognised as a constant source of innovation. Designerly including societal actors, valuing their diversity and multiplicity of perspectives, favours a better alignment of the innovation process and its outcomes with society, meeting its values, needs and expectations. Open innovation within the context of RRI challenges the silo mentality with a cultural break that flows across the singular organizational boundaries, favouring openness shaped as cooperation within a quintuple innovation helix framework (Carayannis & Campbell, 2010; Galvao et al., 2019). Knowledge derives indeed from the circulation and exchange between societal subsystems, where valuable assets and capitals move across the five helices. Given this premise, this paragraph focuses on how co-creation within the RRI domain impacts on the **organization culture and mindset, in terms of processes and practices, posing particular attention to point out and discuss drivers and barriers to its introduction.**

The results can be analysed through 5 comprehensive and correlated dimensions:

- Open innovation as an established attitude, and structural formalization of co-creation
- Governance models and organizational roles
- organizational learning, cross-fertilization and networks
- Interactions and interdependencies
- organizational flexibility, uptake, and “scaling deep”

The rationale behind these dimensions is to provide a clear understanding of the extent to which the introduction or presence of established practices of co-creation affected the internal processes and culture of the hosting organization. Rather than being analysed through the stakeholder engagement lens (see chap 3.2.1), in this paragraph, the case studies under scrutiny are here observed from an organizational point of view to outline the dynamics of transformation that occur at the micro level of co-creation ecosystems. Hence, the reasoning is based on the fact that the application of co-creation, especially within a RRI

perspective, varies according to the organization itself, its nature, structure, mindset, regulations, and so on.

Co-design as an established attitude, and structural formalization of co-creation

The first dimension explores the level of embedment of co-creation as an attitude within the organization, where an element to consider is the acquaintanceship with the participatory practice. The involvement of multiple actors in the design process is confirmed to benefit from the **familiarity with stakeholder engagement practices** (see 4.5.5).

Even in cases of well-established and well-integrated practices of co-creation, the implementation is influenced by the structure and governance of the organization. A fundamental premise is that when co-design is an **established and already integrated attitude**, the presence of pre-existent competences and mindframe in the organization facilitates the application of co-creation. However, the discourse goes beyond the fact that previous experiences of co-design and co-creation are acknowledged as valuable for successfully framing the involvement of stakeholders and focus on participatory practices. When an organization already presents a mindset or rooted culture for collaboration and co-design there is proneness and openness towards the implementation of co-creation. In this case, co-creation becomes an aspect that characterizes and engages the community as a whole. Then, a horizontal structure often facilitates the embedment of co-creation at various levels, mutualising design practices, tools and spaces.

This is the case of TRACES, a think-and-do-tank working in the field of science and its interrelation with society applying a horizontal way of working, where co-creation is embedded at all levels. Collaboration and co-creation are part of the organization culture to the extent that everyone's input is welcomed and considered precious, whether it comes from an intern, a student or the director. Moreover, it has a flexible approach that favours and privileges volunteering, believing it brings better results. Given this premise, during SISCODE experimentation, TRACES did not encounter any urgency to adapt the internal organization to the mindset and practices of co-creation. The experience brought to improve their resilience and optimized the sustainability of co-creations as practiced inside the organization. Knowledge in terms of methods, approaches, and tools gained during the SISCODE project was constantly discussed and shared among those who are involved at various levels in the organization, bringing benefits for the entire team of TRACES and even its broader community of reference.

A flexible approach, often accompanied by a volunteering participation, is also associated with an open and exploratory process with frequent informal practices which opens up to

different directions and frequently leads to unexpected results. Such an exploratory application is often related to possible lack or difficulties of concrete implementation.

However, the application of a horizontal way of working also relates to the structure of the organization and its governance. Bringing co-creation in contexts that are not used to participatory practices can lead to introducing elements of discontinuity and change with previous dynamics. Forms of co-creative experimentations shaped as real-life projects can be a trigger for relevant territorial innovation processes aimed at effectively unleashing economic, social, or cultural development and igniting new competitive capacity within the local fabric (see chap 4.3.4 & 4.4.1).

From the point of view of governance practices for managing the co-creation initiative, the range goes from agile processes as informal organization, to the definition of precise structures and specific roles determined to fulfill the scheduled activities. Highly exploratory practices can produce a foggy process with fewer constraints in terms of commitments. This is the case of Cube design museum, where a process theoretically based on a clear plan that step-by-step uses different methods and triangulation for a rigorous analysis, is then applied in an exploratory manner. The result is an open-ended and flexible approach, characterized by the occurrence of many (unexpected) episodes, which may drive the process in entirely different directions.

Otherwise, a formalized application of co-creation in the ecosystem is often associated with an **overarching, established attitude towards the participatory practice**. Whereas introduced in larger and more structured organizations not used to participatory processes, the cases under scrutiny showed that it led to setting up a dedicated team meant to develop more in-depth knowledge and expertise on the topics of co-creation and design thinking. The team involved experts who shared their knowledge and expertise to other projects and internal processes. However, this does not necessarily imply that beyond the project in which co-creation took place, further steps are taken to fine-tune the internal organization to implement the practices in the organization culture and mindset, aiming at its replicability, sustainability, and even scaling. Especially in larger organizations featured by a rooted siloed mentality, triggering a cultural break requires time and effort.

Independently from the dimension and nature of the organization, a further consideration regards the **scale of application of co-creation**, which **ranges from a diffused and general to a more selective and punctual application**, for instance within specific projects, or only for single stages of a development process. Co-creation is applied in quite a structured and strategic way, with more or less formal strategies and tools for engaging stakeholders. Its occurrence, even following a defined path and strategy, entails freedom to adapt to the

context. Moreover, its formal or informal implementation depends on the engaged group and the desired output.

The analysis shows that independently from the above described variables, co-creation is recognized as a key driver for reaching innovative solutions.

Governance models and organizational roles

The dimension of governance articulates the operational definition provided by Stilgoe and Lindner (Stilgoe & Lindner, 2015). Observed at the scale of the single institution, governance relates to management and control, and as such it entails the definition of objectives, as well as of the strategies and tools for their achievement. Also in this case, the formal structure of the organization hosting the co-creation initiative plays a pivotal role. In the RRI domain, established forms of engagement and prononess for multi- or trans-disciplinary and cross-sector collaboration result in multi-level impacts (Meijer & van de Klippe, 2020). The reasoning extends by consequence to co-creation practices occurring under the RRI sphere. Given this premise, governance constitutes a delicate matter to consider and address when dealing with projects which use co-creation. Indeed, **the way in which power is distributed or catalysed requires attentive consideration, aiming at responsible decision making, ensuring a balanced, fair and inclusive distribution among the multiple actors is paramount**. This implies that competencies and motives have to be kept into constant account, as well as attention has to be posed to how the power is distributed. To incentivise and reach a fruitful and effective participatory process, a clear differentiation between organizational roles and a net separation between the facilitation and the decision process emerge as a common need and recommendation, considering skills other than positions as drivers for assigning roles. The cases confirm that roles are generally defined and distributed since the beginning, with no overlapping for purely technical roles like funding or punctually engaged stakeholders. Nevertheless, it occurs that an initial well defined division has been **later challenged, blurred and partly overcome** to answer needs. Strict roles are responsible for preventing flexibility and responsive adaptation to the capacities of the stakeholders, as well as to the way in which the process evolves. However, a perspective complementary to this reasoning is given by Fab Lab Barcelona that underlines the need of a net division and precise governance between facilitation and decision making processes. This need derives from the encounter of mechanisms of collective decisions and relevant budget structures, and the aim is to better incentivize and retribute the involved stakeholders.

Speaking of roles in co-creation initiatives, the **initiator** is given the function of "enabler" in charge of initiating and orchestrating the process, mapping out and investigating the ecosystem, soliciting broader and punctual involvement of the stakeholders, granting their inclusive participation along the co-creation process. Moreover, the initiator as organisator is seen as responsible for scaling, as impacting cultural roots, or opening up replication and dissemination for a broader impact, as to say increasing the persons or communities impacted (Moore et al., 2015).

The **initiator** is responsible for identifying and involving the relevant stakeholders/actors, and ensuring that multi-stakeholders' needs and expectancies are kept into consideration and uptaken as creative inputs for innovative solutions. The task is particularly challenging considering the RRI domain and its being situated within a quintuple helix innovation framework, which implies the complexity of being interdisciplinary and transdisciplinary at the same time. The five-helix structure requires a thoughtful and deep understanding of all helices, being transversal to the disciplinary social, cultural, economical and political spectrum (Carayannis & Campbell, 2010, p. 62).

External stakeholders can be engaged as advisors, contributors and investors, with primary and secondary end-users involved as **experts**. Experts in co-designing activities can play the role of the **facilitator**, as a third party in charge of orchestrating the dialogue and smoothing the participatory activities. As for the case of Ciência Viva, the collaboration with a teacher in charge of holding workshops for the construction of kayaks turned into strongly influencing the overall process, from the ideation to the development. The concept collaboratively transformed from the initial idea of conducting workshops in schools into a platform for distributing knowledge and know-how, providing more people with the access to tools and knowledge to build their own boat.

The role of persons with experience is recognised in laying foundations of co-creation initiatives, as planning and executing the co-creation and its activities, choosing and designing the tools to be used under the different stages of the co-creation process. Besides, the contribution of experts and specific stakeholders as **facilitators** is to be considered as linked to their skills and competences as well as to their interests, availability and possibilities. Therefore, their level of involvement may vary over time. Therefore, it becomes necessary to consider an alternation or overlapping of roles. While acknowledging that a clear definition of roles can ensure the effectiveness of the process – and thus of the project – by providing a clear institutional and governance setting, it is recognised that roles such as mediator and facilitator can vary, and be performed by different actors depending on the stage of the co-creation and of the emergence of specific needs.

Moreover, from the cases, the facilitator also emerged as gatekeeper mediating the process: the position of the **facilitating organization**, whether it is a cultural institution, a university, or a business may indeed impact on the overall process. As it can ease the process, it can also hinder it, because of internal structures and policies, bureaucracy and regulamentations impacting the ability to be agile.

Finally, the role of **participants** includes stakeholders of different kinds, as people with various social and cultural backgrounds, different ages (from young adults to older people), and with different levels and interest of participation. Analogously, it has to be acknowledged and managed the fact that the contribution of specific stakeholders may vary through time, as well as along the process, depending on their availability, but also skills and expertise.

KTP has addressed this problem by initially involving all actors in the early phases of analysis and ideation, including citizens, so to ensure the consideration and uptake of their needs and creative inputs for the final solution. Differently, citizens were not involved in giving the final shape of the Air Protection Programme as a legal document, since it had to be developed and decided by experts from the field. In adjunct to be the initiator, in this process KTP also played the fundamental role of the mediator, ensuring the consideration of lay people's voices even in the stages where they could not be actively involved. Analogously, Maker underwent a nimbl switch to answer the specific need of reducing the distances between makers, facilitators, and users. Hence, an initial clear division has been challenged, resulting in opening the process to participants, and giving them responsibility in decision.

Consequently, the inherent variety of stakeholder groups that may characterise certain processes may lead to ambiguities and complexities that need to be carefully managed to avoid dissatisfaction. The case of elderly people that Thess-AHALL involved in co-creating a life-long learning programme is exemplar. While they are declared as truly engaged and genuinely committed to the process, their influence on the development of the solution often appears limited, mostly relegating their role to that of testers. Then, the fact that the participatory practice can lead to not-immediate solutions is a common source of some drop-outs in the follow-up of the journey. The length of the process requires to be controlled through effective communication and a fateful management of expectations, making stakeholders aware that developing innovative solutions within an RRI domain takes time.

In general, when the facilitation and moderation of the co-creation activities presents blind spots or lacks in fully engaging the multiplicity of stakeholders, there is the risk that participants become mere providers of knowledge, opinion and information. An

advantageous and constructive practice is to retain stakeholders, maintain them engaged over time. Making them witness the results of their efforts contributes in establishing trust and sense of belonging to a community. For this purpose, an attitude towards constant and clear communication towards the variety of actors engaged is pivotal, also benefitting of a multichannel strategy able to reach out to all the persons interested. Especially dialogue serves to establish mutual trust, empowering the stakeholders to **access** the conversation and join the discussion, expressing themselves, and sharing their point of view. Going beyond building mutual trust and understanding, it contributes to the perception of transparency. In this sense, it is crucial the role of having a clear and shared scope and rules. An initial outlining of the scope and objectives of the co-creation, a definition of the overall and specific benefits, and lastly a clear statement of the commitments play a function in increasing the motivation among stakeholders, generating awareness and alignment on expectations and possible uptakes.

Finally, the aspect of communication and recognition is closely related to the vulnerability of certain communities and stakeholder groups, whose integrity can be jeopardised in case it is missed to recognise, acknowledge and attribute ownership or contribution to those who did it or even played a part in it. This issue raises the need to recognize and attribute value to the contributions of the various stakeholders, acknowledging the role of the community. Common is the debate of ownership that is frequently arisen when solutions are co-created; a debate that can become intense and create tensions in the partnership.

Organizational learning, cross-fertilization and networks

Organizational learning is related to how co-creation triggers the creation, retention, and transfer of knowledge within an organization (Payne et al., 2008). organizational learning can result both in knowledge gained through time, as it gains experience, and also into novel arrangements enabled by means of implementing co-creation approaches. This paragraph explores the topic from a capacity building perspective, balancing exploration and exploitation as a strategy to gradually reach innovation and sustainable development (Argyris & Schön, 1996; Schein, 2010). The focus is on how co-creation activates dynamics of organizational change at the level of routines, procedures and organizational practices. From the acquisition or exchange of knowledge, expertise and know-how, capacities and skills, to the retention and integration of methods, approaches and tools, as well as further resources, which are scaled (up) and implemented within the organization.

The practices and tools used for co-creation are constructed to be highly adaptable to both their users and the contexts in which they are applied. They are therefore

characterised by a strong predisposition towards the **appropriation of processes, activities and tools** (Real et al., 2019). It is precisely the ability to appropriate, modify, and adapt tools according to the specific needs that requires an understanding of the practice in progress, its objectives and overall scope, as well as a clear idea of its potential. It follows that the emergence of appropriation practices within the organization is in itself a sign of change and growth. An explanatory case of appropriation is that of Science Gallery Dublin. The toolbox developed by SISCODE to support the adoption of co-creation (Real et al., 2019) has been appropriated at the point of being adapted and utilised in multiple aspects of programming as a powerful tool for multi-stakeholder engagement, both offline and online. Its tools have also been employed in various EU projects in which the lab is engaged. A further dissemination occurred across the Science Gallery Network, with partner organizations in London, Melbourne, Bengaluru, Venice, Detroit, and Rotterdam. The lab has also developed a training module documenting and demonstrating co-creation tools and best practices, available across the network.

During SISCODE's real-life experimentations, especially the organizations with limited experience in applying co-creation underwent a learning-by-doing process together with their stakeholders and users.

Considering the target group of older adults, Thess-AHALL found difficulties in applying co-creation tools and methodologies. Such tools are indeed often developed for younger people. To overcome the barrier, an adaptation and appropriation of the tools was required: all activities were conducted in-person, developing a set of soft skills for facilitation and empathic engagement. As a result,the activities were successfully applied with older adults and chronic patients. When the Covid-19 pandemic made in-person meetings impossible, the lab had to face a further challenge. User-friendly channels of communication were chosen. Simple telephone calls and Skype meetings allowed a continuation of the prototyping, while contributing in building new capacities and empowering older adults, by making them familiar with the video-call software chosen. Additionally, to deal with the particularities of the single stakeholders and enable an individual and sensitive contact with each stakeholder, Thess-AHALL developed its own panel management tool for stakeholder engagement. Finally, the pandemic entirely transformed and complemented the solution developed by Polifactory. The constraint to remotely test the system for motor stimulation of children affected by cerebral palsy led to the development of a secondary solution. It allowed not only therapists to apply the solution in their environment, but it enabled everyone with a computer to use a less technical version through a web platform accessible remotely from home.

Looking at the overall process, a first benefit is due to the inclusion of multiple and multi-level perspectives in productive conversations, where stakeholders with different backgrounds and expertise share views and contribute in generating ideas. Forms of constructive dialogue and open discussion have proven to be paramount resources to support innovation, concurring in setting a fertile field in which confrontation and exchange catalyze (open) innovation. The acquisition of new knowledge and expertise can be traced back to cross-fertilization and pollination that are prompted by such favourable circumstances. From an organizational perspective, among the expertises gained, the mere participation to co-creation initiatives is a source of understanding related to the management and facilitation of complex, heterogeneous groups, where power and dominant relationships need to be controlled and balanced. Within such complex ecosystems, interactions are in constant need of facilitation. For the purpose of better informing decisions and conducting decision-making about and within the ecosystem impacted by the innovation, specific tools are frequently employed. Moreover, within the iterative cycle of co-creation, the urge to synergize and cooperate among stakeholders implies to provide all the parts with a clear understanding of the overall structure and its phases. Moving from the organizational standpoint, embracing the perspective of local stakeholders, the inclusion and effective integration of communities and other societal actors brings valuable dynamics of learning-by-doing and co-learning. The exchange of knowledge and transformation are favoured by the participation in co-creation processes which encourage the interplay between multiple stakeholders with different scholarships. In terms of capacity building, the process also nurtures the development or strengthening of soft skills as the capacity to successfully act within domains with strong dominant forces and power imbalances.

The advantage of collaboration instead of competition also applies to a broader, **systemic perspective**, making evident the benefits deriving from reaching out to **new stakeholders and even networks**. Noteworthy is that organizations reinforcing their position and function as intermediary and knowledge broker, become references and role models within broader communities and networks. For example, co-creation is nowadays almost a formalized practice in the ecosystem of Fab Labs, where the practice to include the multiple stakeholders who inhabit the ecosystems is a common habit. In this sense, Maker points out that the effort of engaging novel stakeholders and activating new collaborations with the local ecosystem went beyond previously established networks and stakeholders. Reaching out to novel stakeholders was necessary to build bridges among all the actors. On the one

hand it encouraged multiple stakeholders to gain a systemic understanding of the benefits deriving from their cooperation, on the other it triggered reflections on how to create and sustain novel partnerships beyond the initial ecosystem.

Advancing the reasoning on organizational learning, the analysis conducted on the 10 pilots demonstrated that applying co-creation under the guidance of the SISCODE learning framework **shed light on flaws in how it was previously employed**. In particular, such a procedural and reasoned application demonstrated to have encouraged an overall reflection on how co-creation was embedded in the organizational culture of the hosting pilots. Often resulting in a relevant modification of previous habits and mindset, most of the pilots recognised the occurrence of a change, ranging from a shift in their daily practices as the integration of tools and practices as an integral part of the organizational routines, up to more informed and long-term arrangements and improvements (see 4.3.4 & 4.4.1). In relation to this, Science Gallery Dublin underlines that the co-creation process proposed under the SISCODE learning framework allowed the team to identify weaknesses in the existing structures and processes of co-creation. The reflection finally triggered a change in their daily practices and likewise informed long-term arrangements and approaches to engage audiences. In particular, an important change regarded the role and value attributed to youth voices, together with the gained skills for better amplifying the youth insights. In addition, it also led to a review and systematisation of some co-design methodologies employed by the collaborative structure, which before lacked a formalised process and accountability. Finally, the expertise gained strongly positioned Science Gallery Dublin at national level as a facilitator of multi-stakeholder engagement.

Interactions and interdependencies

The governance of co-creation within the RRI domain is strongly related to the multiple actors who play a role in shaping innovation. The RRI processes are indeed associated with actors from the public and private sectors, as well as the civil society organizations, the policy and decision-making spheres (Paredes-Frigolett, 2016). Hence, the perspective is that of the **quintuple innovation helix framework** which adds to the (1) academia/universities, (2) government, and (3) industry of the triple helix perspective (Ranga & Etzkowitz, 2013), the fourth dimension of (4) users and civil society (Leydesdorff, 2012), and the fifth dimension of (5) the environment as a political system (Carayannis & Campbell, 2010; Galvao et al., 2019; Peris-Ortiz et al., 2016).

This dimension investigates co-creation as a process that occurs among the **quintuple helix actors**, addressing real needs of territories while boosting the connection with relevant

actors in the context towards the development of innovative solutions. In doing so, it reflects on the fact that co-creation processes can be shaped and impacted by a **variety of interactions among the different stakeholders involved**, since each is entering the process with a potential distinct and specific set of motivations and interests.

The discourse explores the relationships between motivations for initiating and partaking in the process, their role in terms of problem identification and their purposes against the overall mission of the organization in which the process develops. Further on the inherent connection characterising the social context where the co-creation occurs, interdependence looks at the relationship, correlation, and interplay among the multiple stakeholders involved in the process of co-creating innovative solutions and value. The notion of 'interdependence' is borrowed from Pfeffer and Salancik (1978), and it is extended from the resource dependence theory domain in which it originated to observe the impact at a contextual and organizational level, embracing a systemic perspective. The reasoning acknowledges that the magnitude of interdependence varies depending on the issue addressed, the scale and scope of the intervention, the nature of the process at stake as well as of the subjects involved or affected.

The reasoning on **interdependencies** relies on two intertwined forces. Firstly the value creation derived from using each other's resources in the most effective way, and secondly the value exchange between the organizations or stakeholder groups. Building on this premise, the interdependence and dynamics that characterise the relationship between the individual stakeholders and organizations involved can produce both opportunities and act as barriers. Being in a context where numerous stakeholders interact can make an effective assessment of the real contribution and impact that various stakeholders brought to the process. The occurrence of this dynamic can harness the organizational change and capacity building, constituting an important potential barrier to consider. In terms of organizational change, applying co-creation to multiple projects while involving various members from the organization can contribute in building knowledge on the process, exposing more individuals to its logics, benefits and impacts. Greater benefits result when such a strategy of differentiation results in an application to multiple contexts with various conditions, since it turns in broader expertise and know-how to be returned to the organization as gained knowledge.

However, the presence of multiple organizations can also nurture **dynamics of partial involvement and limited influence** on the process. For example, the involvement of the stakeholder groups of end-users can imply their exclusion from phases as that of technical development. To co-create a smart system for children with cerebral palsy, Polifactory

involved both patients and caregivers in the testing. Such involvement, however, did not extend to the technical development phase, due to a lack of competencies and expertise that prevented these stakeholders from contributing in this part. The second example is KTP that involved citizens in the initial stages in order to gather needs, ideas, and points of view. Even though the presence of citizens was fundamental in this initial stage, it diminished when defining the legal document of the Air Protection Programme. The limited knowledge on the specific topic and the absence of a specific background prevented them from being an active part in developing and evaluating a legal document. This selection of specific and relevant phases of involvement has been identified rather as a positive aspect that being perceived as exclusion providing the possibility of real contributions to all stakeholders when involved having positive effects on motivation and interest.

The reason lies in a lack of specific knowledge, competencies and expertise which lessen or even prevent the ability of such stakeholders to contribute. Such an exclusion is evidently motivated by the rationale and nature of the phase of development, since the inclusion of third parties without specific competencies would bring delays on the one hand, and even frustration on the other. Therefore, it is quite common to witness an alternating presence of certain stakeholder groups that are engaged in different stages. Again, in such cases it is crucial a clear communication meant to share the overall scope, the objective of the current activities and their advance. Moreover, policy makers are recognised as one of the commonly most difficult groups to engage. Nevertheless, a shared scope and motivation can ease the situation, favouring the participation in the activities.

An initial overview of the interdependencies can be obtained from mapping the stakeholders involved in the process. However, their presence as well as the strength of their mutual relation may vary over time, in consequence of the process and its evolution. The interaction itself is the domain where existing interdepencies are revealed, but it is also a fertile ground where to build new relationships, creating novel interdependency. Opportunities and benefits from the collaboration, sharing common interests and scopes, are evident leading drivers when building collaborative structures. Common benefits together with the possibility to obtain better results can even turn competitors into partners (Eckhardt et al., 2020).

Organizational flexibility, uptake, and change - “scaling deep”

The last dimension explores the way in which co-creation ensures a progressive change in how the organization addresses challenges at the crossroad of science, technology and society. It relates to the degree of penetration of co-creation within the overall organization,

as the ability to affect relationships, cultural values and beliefs (Moore et al., 2015). This aspect refers to the ability of co-creation to scaling deep, looking at the magnitude of embeddedness of the practices within the organization. From its application to its institutionalisation, this dimension enquires if and to what extent the co-creation developed within the initiative impacted on the organizational culture, leading to a change due to the introduction of participatory practices and approaches which go beyond the project. This can be referred to daily organizational practices, practices applied in other projects, routines, strategies and planning or simply the way how specific tasks are carried out.

The analysis of the cases demonstrates that when co-creation takes place in living labs, fab labs, hacker spaces and makerspaces which are typically featured by an horizontal structure, the **practice benefits from an inherent agile structure**. Moreover this typology of organizations presents a tendency towards dynamicity and responsiveness towards the context in which they are situated. Analogously their anatomy makes them prone and receptive towards changes in the context, such as evolution in terms of needs, interests, shape and systems of interactions, among the others. In particular, their small scale and a tendentially flexible organizational culture endow these organizations with an established disposition to change. Such a mindset is innately aligned to co-creation, denoting these spaces as fertile settings for participatory experimentations and processes. Alongside a natural propensity to adapt to the ever-changing circumstances, there is a genuine inclination to fully involve and integrate the contextual stakeholders, making them effective participants in value creation.

Moving outside the network of Fab Labs and makerspaces, another interesting example is provided by Science Gallery Dublin where co-creation was already applied in quite a structured way. However, the project and its real-life experimentation ignited further understanding. Especially sharing approaches, methods, and tools led to a more strategic use of co-creation and a revision of the role and impact of stakeholders previously involved.

Following this reasoning, it is necessary to consider the size and structure of the organization, as it can affect and hinder the process, due to institutional procedures and legislation.

Performing a rabbit hole-like function, the **project dimension emerges as a promising dimension of experimentation, capable of encouraging familiarisation with co-creation**. It is precisely its timely and precise experimentation with a limited and "extraordinary" context that favours an immersion free of prejudice. So the encounter with a new practice takes place in a favourable space, where the limited and protected dimension provides a

first-hand understanding of the dynamics and possible benefits. Such circumstances and conditions provide the ideal context for controlled and safer experimentation with particular practices. Once gained familiarity with the practice and having understood the benefits of including multiple stakeholders, the application can undergo a process of replication and scaling, leading to adoption beyond the single project. One or more controlled experimentations that have proved successful and effective have proven indeed to be the first step towards a more structured formalisation within the organization.

This has manifested in the case of KTP, a specialized institution offering a range of services for business development with a system including more than 350 enterprises in Poland, did recognise the benefits of co-creation practices leading to the establishment of a specialised co-creation unit in one of its entities to further explore and spread the approach step-by-step. A punctual application becomes the reason for stepping out from a settled comfort zone. Especially the presence of a well structured methodology with clear phases and objectives favour the understanding of the logic and enables application and embedment also in larger and structured organizations. As in the case of Polifactory (FabLab in Politecnico di Milano) and KTP, the size and spread of the organization makes co-creation not an overall working attitude. While Polifactory was already very familiar with a practice that is used to adopt across its projects and researches, KTP underwent an important transformation with the establishment of a new unit and the potential to spread further. The division involved in the real-life experimentation started a significant change of mindset, paving the way for turning a selectively applied approach into a constant and systemic application. Especially in this case, the benefits and advantages deriving from engaging multiple-stakeholders in co-creating innovative solutions need to overcome the cultural and economical price of renovating/exnovating existing practices.

Exploring the dimension of change in terms of scaling-deep, the implementation of the pilots within SISCODE has led to a series of positive dynamics and effects like the further promotion of the approach within the organization and the ecosystem after having demonstrated its success with a concrete case. The relation of a successful example as a driver for the in-depth embedding and scaling of the approach was identified by a number of pilots. Ciência Viva for instance has noticed a bottom-up movement advocating for the distributed use of co-creation activities in other projects, started after having experienced its benefits and outcomes in SISCODE. The initial introduction as a top-down approach coming from the project and its attitude was transformed into a bottom-up initiative aimed at scaling the application within the organization.

3.2.3 Outcomes and value of co-creation processes

The aim of this paragraph is to describe the specific outcomes and final solutions, as well as its potential to scaling, emerging from multifaceted co-creation processes. The outcomes here considered are both tangible or intangible solutions directed to address social challenges and relevant issues in various fields and domains, such as environmental sustainability or healthcare. In particular, this section tries to identify and explore different kind of outcomes related to co-creation initiatives, such as those aiming at: i) defining broader societal issues; ii) guiding research orientation; iii) creating dialogue around policymaking; iv) supporting policymaking; v) defining and build a service, or material and technological solution (even just in terms of prototype). Generally speaking, the paragraph provides insights about the effectiveness of the outcomes developed by the case studies under scrutiny, thus to identify conditions and processes at stake in facilitating or hampering the effective implementation in terms of scaling or replication of the outcomes and final solutions toward other contexts of application. More in detail, the following topics will be addressed:

- The outcomes of co-creation processes
- Culture and practices of assessment, self- assessment and self-reflexive approaches for monitoring and evaluating processes and outcomes of co-creation
- Scaling and replication of the final solution

The rationale behind these questions is that co-creation processes – based on iterative cycles of understanding context, ideating a solution, prototyping it, and assessing its value – can support outcomes and final solutions inspired by an RRI sensitivity to move from the ideation of new solutions to their real implementation. This is possible because co-creation methodologies can enable the results of such initiatives to feed processes of real implementation that face, match and conflict with opportunities and barriers that may occur in the internal and external environment in which innovation is developed (e.g. organizational cultures and values; cultural, institutional and regulatory frameworks; economic resources; societal needs and interests). Accordingly, co-creation can offer valuable strategies to engage people and stakeholders in the ideation, implementation and assessment of innovative solutions to societal challenges, by embracing a sensitiveness towards their (ethical) acceptability, sustainability, social and societal desirability. So, in this regard it will be analyzed if, and to which extent, the case studies under scrutiny adopted assessment or self-assessment tools (e.g. surveys, questionnaires, or more open methods like interviews or focus groups) for monitoring and evaluating co-creation processes and

outcomes in the context of RRI. This represents a crucial point for advancing further the debate over the relevance of co-creation, since if in principle co-creation based initiatives seem to act in accordance with RRI frameworks, gaps and inconsistencies in current assessment practices of this kind of projects and initiatives are increasingly recognized, in terms of evaluation of both short term valuable outcomes (acquisition of knowledge and skills, transformation of value-building processes, empowerment of people, etc.) and medium/long term desirable impacts (development of ethical sensitive cultures, change of decision-making processes, embedment of sustainability principles, etc.). This also applies for what concerns the assessment of the potential of the final outcomes and solution to be replicated or to scale toward other settings.

The outcomes of co-creation processes

For what concern the specific kind of outcomes at stake in the co-creation initiatives under analysis, we firstly identify a heterogeneity of outcomes related to different domains such as the promotion of environmental sustainability, circular economy, policymaking, healthcare, and digital transformation.

Environmental sustainability issues have been addressed with a particular attention to the scientific and technological dimensions, thus promoting public awareness programs about crucial emerging themes such as the living marine leisure and its sustainability (as in the case of Ciencia Viva), or concerning air quality in urban and metropolitan areas (as in the case of KTP). This was done by adopting public engagement strategies such as festivals, public debates with experts or multi-stakeholders workshops, or by engaging lay people in co-creating a monitoring platform for industrial pollution (as in the case of KTP). The relevant aspect relating to the development of these kinds of outcomes concerns the ability of the initiatives to open a dialogue with policymakers. Although the direct engagement of policymakers has been a complex activity – also due to the pandemic crisis – it is possible to observe a relative transformation of the political agenda occurred, thus eliciting a sensitivity among local and national policy makers on environmental issues. This intervention in the domain of policymaking has been especially possible when the engagement of policymakers took place on a local scale, and in urban contexts where policymakers were already sensitive to the relevance of public participation for addressing issues over environmental sustainability (as in the case of Fab Lab Barcelona). In terms of outcomes concerning environmental sustainability, we find also the development of educational initiatives and teaching programs to be implemented in high schools for helping students to

address issues neglected by the prevailing educational programs, such as the relevance of agricultural production in our contemporary economy (as in the case of BioSense).

Closely related to the environmental sustainability domain, we detect relevant outcomes in the **field of circular economy**. That is, outcomes can boost circular economy by developing actionable final solutions, such as the co-creation of new circular product-service systems and innovative materials from local food waste (as in the case of Fab Lab Barcelona). Furthermore, other relevant outcomes, in terms of cultural intervention, concern initiatives to enhance the awareness of local communities on how to re-circulate materials and engage in the circular economy through a distributed ecosystemic approach as well as the community that formed around the topic of circular economy. This community showed the potential to engage, participate and share future initiatives and commit to long-term engagement.

By looking at the **domain of policymaking**, we detect a relevant final outcome devoted to support lay people and multi-stakeholder engagement for policymaking, by offering flexible and ready-to-use tools that adopt a universally comprehensible and understandable language.

The **healthcare domain** gathers different novel final solution able to face relevant health needs and problems neglected by the prevailing healthcare system, such as a prototype which proposes a new way of performing physical reactivation (Polifactory); the co-creation of an innovative mental health program (Science Gallery Dublin); and the implementation of a life-long, experiential research initiative to address everyday living challenges of older adult (ThessAHALL).

Regarding **ICT and digital transformation** issues, we identify a final solution, structured in terms of an innovative public engagement strategy, aimed at boosting awareness about artificial intelligence, thus to support the public to recognize potentiality and emerging social and ethical implication arising by AI-based devices.

Culture and practices of (self-)assessment

Specific learning is then associated with the practice of monitoring and assessing the co-creation of value deriving from innovative solutions and their impact. Within this challenging and still debated domain, awareness emerged from the practices of self-assessment and self-reflexive approaches triggered by the SISCODE learning framework. Recognizing that the RRI field reports a general, structural weakness on the topic, which becomes especially relevant in the case of small-scale experimentations (Meijer & van de Klippe, 2020; MoRRI Consortium, 2018), SISCODE included moments of

reflection, triggered by the specific tasks and activities. On the one side, going beyond the concept of reflection-in-action (Schon, 1983), pilots were asked to elaborate their co-creation journeys, reasoning on its multi-level impacts through time, from the small scale of daily practices to changes in the organizational culture. It occurred that such a reflection on current organizational practices eventually led to their being questioned. In parallel, punctual attention was drawn on the topic of assessing and monitoring the solution developed, considering its short, medium, and long term impact. On the topic, the RRI field reports on the lack of integrated practices, together with the presence of sporadic, simplistic, and often weak tools and standardised models. Monitoring and assessment remain major obstacles, because of the compresence of circumstances. Among the others it emerges a comprehensive lack of research habits within the practitioner domain, which causes a difficulty to collect and interpret data. This spots light on a well-known issue that is the distance between practitioners and researchers. To meet the need, attempting to bridge this gap, through its learning framework, SISCODE shared, introduced and provided guidance for empowering practitioners to conduct in-field research. As a consequence, both qualitative and quantitative evaluations of the innovative solutions prototyped were identified as a source of stable relations with stakeholders. Exemplar is the case of how an observation diary as a tool for collecting feedback was integrated in the designed solution itself. The observation diary grew to be a trigger able to spur discussion and open dialogue among the various stakeholders, with evident benefits brought to the team of facilitators. Differently, other pilots formerly lacking a culture of assessment, introduced surveys and sources of data collection to be later analysed by the team members. In certain cases it even led to the development of frameworks aimed at evaluating the solutions developed with their end-users. These cases make evident the high degree of organizational penetration achieved (Schmittinger et al., 2021), leading to the acquisition of new knowledge, expertise and skills, the transformation of value-creation processes, and the empowerment of multiple actors.

Culture and practice of (self)-assessment identify a broad range of practices concerning any kind of evaluation processes of the co-creation phases, as well as tools for performing assessment (e.g. surveys, questionnaires, or more open methods like interviews or focus groups), implemented by both by the team members (e.g. the lead partner), or by external experts.

First, it is worth noting that all the SISCODE co-creation labs benefited from the monitoring tools developed within the project (see Deliverable 3.5 for a comprehensive overview).

In this regard, most of the co-creation experiences under scrutiny show a structural weakness in self-assessment cultures and practices. This gap in self-assessment cultures concerns both the assessment of co-creation processes themselves; and the evaluation of the short, medium and long term impact of final solutions and developed outcomes. Indeed, it seems quite common that evaluation practices are carried out sporadically, with quite simplistic and weakly standardized tools (e.g. collection of narrative feedback, Miro boards, or online surveys designed by people without strong expertise in the field of assessment and evaluation studies). Furthermore, it is not clear whether and to which extent the analysis of the data emerging from these "weak forms" of assessment triggers effective changes in the forms and practices of co-creation.

Further, we identify few initiatives (in particular within the SISCODE co-creation lab) with a high degree of organizational penetration of self (assessment) practices and tools within the everyday practices of co-creation. In these cases, it has been mainly adopted a multi-method self-assessment approach that integrates qualitative tools (including interviews and workshops) with quantitative surveys for the *in itinere* monitoring and evaluation of co-creation activities. Such monitoring approaches, which may also include follow-up meetings among the co-creation teams, are managed in house, without resorting to external structures or organizations that have expertise in the evaluation processes. However, it is important to mention that such evaluation practices mainly concern co-creation activities. Less frequent is the assessment of the social impact in the short, medium and long term deriving from the outcomes of co-creation activities.

Scaling and replication of the final solution

Processes of scaling out of final solutions and outcomes represent one of most relevant challenges for actors and stakeholders engaged in co-creation initiatives aimed at infusing RRI in diverse fields of work. The effective scaling out and replication of final solutions and outcomes can depend on many structural and contingent interrelated factors (e.g. economic resources, legal framework, market dynamics) and network configurations (e.g. partnerships with public and private actors, capacity to influence policymakers). In this regard, the co-creation initiatives here considered are mainly located on a local, urban or metropolitan scale. Although these initiatives faced crucial challenges that are transversal to many contemporary social contexts, their outcomes and proposed solutions clearly present strong idiosyncrasies deriving from the need to address local specificities and contingencies. On the one hand, this aspect is undoubtedly positive, since it allows the development of final solutions that are particularly suitable for responding to the

peculiarities of social contexts in which co-creation initiatives are located. On the other hand, the characteristics that make the final solution particularly suitable for responding to the challenges of the local contexts in which they operate can limit the potential for scalability and replicability of the concerned solution.

Generally speaking, most final outcomes here considered seem to have a great potential for reproducibility, although this does not actually occur often. In this regard, the potential for scalability seems to be more marked within initiatives that – from the earliest stages of the co-creation process – adopted clear and standardized tools and methods, with the contextual production of documentation able to describe the different stages of the co-creation activities in a clear way. Hence, it seems that excessively "destructured" co-creation processes, based on serendipity and spontaneous forms of engagement, can strongly limit the potential for replication of developed outcomes.

Furthermore, most of the co-creation initiatives under analysis are mainly interested in an effective implementation of their solutions within the local context, rather than supporting the possibility that other co-creation communities can re-appropriate them. This last aspect is particularly evident in the case of initiatives aimed at designing services or public awareness initiatives over health, environment and digital transformation societal challenges. On the contrary, the greatest potential for scalability, or the effective reproducibility, is observable in such initiatives where the final solution is a tangible product, designed through the use of easily available ICT. Indeed, in such cases the prototype or the outcome, thanks to the adequate documentation produced, can easily migrate in other suitable contexts (as in the case of Polifactory, or Ninux.org bottom-up infrastructure). In this regard, it should not be underestimated the difficulties of scaling up of "maker-solutions" on an industry level, due to the regulatory frameworks and technological standards required for the marketing of tangible products based on ICT technologies, especially for what concern healthcare-based final solutions. Finally, from the analysis of the co-creation activities, it emerges a substantial weakness in the lobbying strategies aimed at promoting and disseminating the outcomes among potential stakeholders interested in their adoption within different contexts. In fact, as reported by KTP, to support scaling up it would be necessary to establish contacts with new stakeholders in other regions and influencing public institutions, or private organizations in order to implement the outcomes being considered and evaluated as a relevant opportunity for facing concerned challenges and societal needs. Analytically speaking, starting from the analysis of co-creation initiatives, it can be said that the problem of replication and

scaling-out should be considered from the earliest stages of co-creation, so as to design "open" and "flexible" outcomes – in form of a boundary object (BO) – which can be re-appropriated by other communities and translated into other contexts, taking into careful consideration their characteristics and contingent factors. For the purposes of this deliverable, the notion of BO – as an inspiring conceptual device for situated co-creation processes – is particularly relevant for addressing replication and scaling up processes. Developed by Star and Griesemer (1989)[1], the concept of BO identifies material and immaterial artefacts that are versatile in the different domains, but at the same time, they maintain a strong identity and are easily identifiable. So a final solution, in the shape of BO, can be intended as a sort of open-ended arrangement that allows different groups to work together without necessarily a strong consensus. At the same time, the shapes this may take are not arbitrary, since they embed information and work requirements that can be perceived locally and by groups who wish to cooperate.

4. Dynamics and framework conditions of co-creation ecosystems at the meso- and macro level

4.1 Introduction

This chapter is dedicated to the integration of knowledge that was produced in order to better understand the framework conditions (especially in terms of drivers and barriers) in which Co-creation takes place at the macro and meso level. Given the different cultural, institutional and regulatory frameworks of Co-creation across Europe, this chapter points towards a set of overarching ecosystemic factors which shape the collaborative capacity of an ecosystem. These were developed out of an integrated view on the data material that was generated during the SISCODE-project: the descriptive knowledge base with 138 international cases of Co-creation, the 40 case studies, 15 biographies and the journeys of the 10 SISCODE lab-experiments.

Here, some core aspects regarding the underlying base concepts and the research design are described. In 1.1.2, the theoretical background to the study is briefly contoured. For further information on the methodological underpinnings of the single research steps in WP2 and WP3, please see the respective Deliverables D2.1 (D2.1, 2019), D2.2 (D2.2, 2020), D2.3 (D2.2, 2020), D3.4 (D3.4, 2020), and D3.5 (D3.5, 2021). One focus here lies on the

[1] Star SL., Griesemer JL (1989) Institutional ecology, translations and boundary objects. Amateurs and professionals in Berkeley's Museum of Vertebrate Zoology 1907–1939, Social Studies of Science, 19: 387–420

outcomes of the literature review that was conducted in preparation for this task (cf. ch. 2.1.2). The chapter on empirical application informs about the sample of cases that was taken into account, as well as the operationalisation of concepts (ch. 2.1.3).

4.1.1 European policy context

Starting from the 3Os strategy (2016) co-creation has become increasingly omni-comprehensive and deeply "embedded" in EU R&I policies whereby open innovation and open science has been evolving into a cross cutting issue within the EU Framework Programmes. At the same time, other policy agendas and approaches pave the way for co-creation in the EU. Among these, it is possible to fnd the so-called "Mission approach", which was introduced with the Lamy Report (2017) in conjunction with the policy principle of "Mobilise and involve citizens through stimulating co-design and co-creation" and which has been extensively framed within the report by Mariana Mazzucato "Governing Missions in the European Union" (2019). Mission oriented policies identify ways and tools to harness social movements and citizen participation in a creative, open and empowering process of challenge-led innovation.

On the verge of the new Framework Programme - Horizon Europe, the opportunity arose for the European Union to use mission-oriented research and innovation (R&I) to drive investment-led growth across the region, bring European citizens closer to policymaking and invest in those areas that matter to people's lives.

In particular, through the establishment of Mission Boards the European Commission has tried to put the principle of co-design into practice. Mission Boards in fact include end-user representatives and have been tasked to directly consult citizens on the formulation of concrete mission proposals. The Mission Boards discussed with stakeholders as well as citizens, listening to their expectations and needs through a series of events across EU countries. At the European Research & Innovation Days (September 2020), each Mission Board presented their proposals to the European Commission for possible EU Missions. The process resulted into the five EU Missions, currently provided for within the Horizon Europe programme namely: Conquering Cancer: Mission Possible (EC, DG RI, 2020c); A Climate Resilient Europe - Prepare Europe for climate disruptions and accelerate the transformation to a climate resilient and just Europe by 2030 (EC, DG RI, 2020a); Mission Starfish 2030: Restore our Ocean and Waters (EC, DG RI, 2020d); 100 Climate-Neutral Cities by 2030 - by and for the citizens (EC, DG RI, 2020); Caring for Soil is Caring for Life (EC, DG RI, 2020b).

According to the approach, in order to achieve the ambitious and measurable objectives set by each Mission, the entire work has to be conducted following a given set of recommendations: Formal consultations and direct interaction; Citizen scientists and innovators participation to be actively encouraged; Enabling the use of citizens' experiences and observations to monitor progress towards mission objectives; Citizen-oriented communication & dissemination activities to be ensured throughout the entire life cycle of missions.

In order to respond to the grand challenges of our current societies, co-creation can help to combine perspectives and experiences from multiple societal actors with the knowledge of experts. In this regard, public engagement is considered an effective way to consider the citizens opinions and to better understand public values and needs. Although public engagement is valuable, it also has its shortcomings in terms of not always providing real/expected impact on policymaking due to the taken approaches. It is therefore necessary to further improve the approaches to engagement of citizens and other relevant stakeholders to create more tangible policy advice for governance (Gudowsky and Peissi, 2016). As shown in the following chapters, creating a safe and inclusive space that motivates lay people and stakeholders to actively participate in discussions can foster a productive environment for co-creation with citizens. The language, topics and methods identify relevant aspects to be considered and should be adjusted to accommodate the participants and their knowledge, expertise and backgrounds. Enabling public administrations to successfully carry out co-creation processes suggests a transformation of internal services and governance structures. A cultural and organizational change which strengthens the bond between the government and actors outside the government are required in order to ensure favourable conditions for co-creation and design of sustainable services (Halmos et al., 2019).

Amid the trend of digitisation, governments have taken advantage of opportunities to engage stakeholders at different stages of the innovation process through open, co-creative and socially responsive policies and initiatives such as hackathons and living labs (OECD, 2018). The 2018 OECD Open Government Data Report: Enhancing Policy Maturity for Sustainable Impact details that in the United States, Code for America encourages open government data (OGD) release and reuse to promote public dialogue, foster productive participation on key issues, and enable communities to work with local governments better. Events such as National Day of Civic Hacking can promote awareness on OGD reuse and its benefits. Under OECD principles for digital and open governments, policy actions aimed to

sustain publication and reuse of open government data are encouraged. They may be used to bridge use of technology and data to achieve policy goals, thereby enhancing business and civic innovation.

Other fields with steady development of contemporary technological solutions to current issues have also shown that interdisciplinary collaboration may help improve relations between the public and policymakers by building mutual trust and eliminating misunderstandings via communication of key knowledge regarding the subject matter. In this line, the OECD-report Science, Technology and Innovation Outlook 2018 has stated that co-creation processes in the interaction of disease groups, academic researchers, and pharmaceutical companies to develop the next generation of health therapies has been shown to enhance the relationship between science and society by building a more scientifically literate, supportive, and engaged citizenry (OECD, 2018a). In the field of nanotechnologies, several large-scale research and development (R&D) efforts were put in place to further strategic developments and public perceptions through an upstream and proactive approach.

In addition, expectations regarding the effectiveness of co-creation solutions need to be explicitly laid out in a realistic manner. Its potentials, limitations and risks are to be clearly specified. Moreover, the success of these co-creation activities is dependent on the collaborative capacity of scientists, experts and companies, together with the minimisation of inter-party conflict via clear contracts and binding agreements. Citizens would also need to be sufficiently empowered to utilise data and other supporting information to enable the development of their own value-based judgement (CIMULACT, 2017).

In the contemporary age of digitalisation where mechanisms to enhance civic engagement in co-creation such as feedback channels become ever more important, technical aspects such as data quality, privacy and intellectual property require sufficient consideration and safeguards for quality assurance and maintenance of reliability. To maximise the benefits gained from innovation of policymaking via technologies and digital infrastructures, a systemic approach is to be established, with both time and financial outlays properly managed. Concerns over regulatory, ethical and cybersecurity matters need to be addressed.

The perceived dissonance between conventional science-based policymaking and perceptions for increased need for expressions of knowledge based on values and other cultural ideas has resulted in the development of alternative models to co-define science policymaking, thus to engage the public in the co-production of knowledge. Therefore,

many approaches have been considered in fostering greater civic engagement in future public policy design. One recent approach which EU bodies have been considering strongly for co-creation mechanisms is design thinking. In this regard, Sgueo, within a paper for the European Parliamentary Research Service, explains that EU institutions have shown immense interest in design thinking motivated by a collaborative vision for policymaking. In so doing, the author details platforms where design thinking has been exercised, such as Futurium and Design (Sgueo, 2020).

Open science, the notion of making the scientific process more open and accessible to relevant stakeholders through digital technologies and new collaborative tools, is another approach increasingly sought today to enhance innovation in fields of data science and artificial intelligence while these digital platforms can facilitate co-creation in numerous ways (OECD, 2020).

All of these developments provide the broader framework in which co-creation evolves and spreads as a practice of innovating in the context of EU policymaking. In particular, the SISCODE experiments represent examples of how co-creation can also benefit in a very practical way from supportive policies that inform and shape the development of research framework programmes. As an H2020 funded project, SISCODE not only enabled the implementation of co-creation experiments and thus the practice of co-creation, but at the same time the research and thus the further development of co-creation practices.

4.2. Dynamics in co-creation: The process

4.2.1 Dynamics through questioning norms

Basically, innovation processes and thus co-creation processes are characterised by the departure from existing solutions or their further development. In any case, they are characterised by the need to innovate and change the state of the art about certain societal challenges. This means that they can be in conflict with established norms. Hence it is precisely the questioning of established norms that can support dynamics of co-creation. A good example is SISCODE co-creation journey AI as Co-Spectator. Here, a path was already taken in the basic approach that overcame the mainstream norm of using AI in order to make AI more transparent. The concrete approach of placing AI in other contexts and scrutinizing the public reception of AI in turn was significant for the creative engagement with the addressed challenge of making the influence of AI on public life more visible. This example shows that co-creation does not only have to take into account valid, context-specific values and norms in order to be successful. At the same time, it can also be

helpful to question dominant norms and values in order to generate dynamics in the first place and to (co-)create something new.

4.2.2 Delicate phases: Problem definition and stakeholder engagement

All research pillars in SISCODE brought the high importance of the very initial phase of co-creation to light. On the one hand, when it comes to the co-creation process itself,, this concerns the definition of the problem to which the co-creation routine should provide a solution. On the other hand, when it comes to the framework conditions of co-creation,this first phase of co-creation is where the motivation or capacity of stakeholders to engage is paramount. Basically, as the cases analysed show, it is crucial for the success of a co-creation process whether stakeholders who are directly or indirectly affected by the innovation already co-define the problem. Also, early stakeholder engagement facilitates a common understanding between the participating parties and sheds light on potential differences and mismatches regarding the understanding of crucial concepts and general aims of the initiative.

There seems to be a decisive difference between externally initiated co-creation routines which follow a specific agenda and co-creation processes which are embedded in specific contexts (cf. D2.3, 2020; e.g. ch. 4.3.1; ch. 5.3.3). If the process is planned, initiators might also think about whether it is required to have the same people participating throughout the initiative or not from the start on. Indeed, the process might need flexibility towards individual and collective availability among different stakeholders or depends upon the knowledge of certain key actors. Therefore, it should be analysed beforehand which kind of information, and expertise are needed and who might be able to enact them

Especially when dealing with vulnerable groups, there might be bureaucratic barriers, which are time-consuming and require reflection on ethical and privacy aspects. As marginalized people are often outside of the co-creation process that aims to solve their problems, special attention should be drawn to building up structures which allow the participation of everyone, regardless of personal dispositions. In this sense, it might be beneficial to think about individual resources and personal capital composition (in a Bourdieuian meaning) of the persons that should be part of the process. In terms of the stakeholders' motivation to invest their time and their engagement in the co-creation activity, it is also worthwhile taking the subjective perspective with its specific values, positioning and functions (depending on their roles) into account. Contextual factors influence the stakeholders will and agency to engage in co-creation on multiple levels.

Furthermore, in some contexts, the engagement of stakeholders might be highly dependent upon personal ties and reputation and goal-keepers might need to be identified.

In summary, the following influential factors concerning personal dispositions to engage in co-creation processes were identified:

- Individual resources and composition of individual capital (social, economic, cultural, symbolic capital)
- Type of experiences with past participation/co-creation processes
- Overarching subjective goals
- Ideological/political background

4.2.3. Ensuring participation – ensuring diversity

Another point in stakeholder engagement, which should be considered carefully, is the involvement of a heterogeneous group of participants (see Siscode Deliverable 2.3, 2020, pp. 130). As laid out above, the involvement of actors pushes co-creation processes and increases the understanding and acceptance of the proposed changes by co-creation. Here, a radiance is visible which exceeds the micro practices of the Co-creation routine, especially in terms of policy agendas.

Moreover, benevolent actors donate their time and effort in co-creation, where they feel socially included (cf. SISCODE co-creation journey Partners of Experience).

Co-creation by definition needs the involvement of participants with diverse backgrounds. Hence, it firstly depends on the will and capacity of actors to participate in a co-creation process. In this respect, co-creation benefits from an environment with actors who are sympathetic or at least open to participation processes and collaboration. However, this is of course not always the case in the practice of co-creation. Fundamental rejection of participation in co-creation can be a major hurdle. Means are then needed to make participation more attractive. An example of this is the SISCODE co-creation journey of ICT for Agricultural Schools. Here, the challenge of the need for modernisation in agriculture could not in itself motivate all groups to participate. However, the inclusion of digital technology aroused interest. In this way, groups took part in the co-creation process that might otherwise not have participated and would not have contributed their perspectives. This individual example shows that co-creation cannot always rely on its own practical attractiveness or the attractiveness of the challenge. Not every challenge necessarily appears relevant or interesting to all groups whose perspectives may be helpful for a successful solution.

Across the cases, the importance of common ground for successful co-creation was repeatedly emphasised. The building of trust and a trusting, open, collaborative relationship can depend on it significantly. While co-creation can often be successfully realised from a common ground of all stakeholders, the SISCODE co-creation journey of AI as Co-Spectator offers an alternative approach that was successful, at least in this case. Instead of agreeing on a common goal, the diversity of goals was maintained here. Thus, the specific objectives of policy makers were also taken into account and accepted. The result was a greater willingness to participate in the co-creation process. It follows that while common ground is promising in principle, the diversity of co-creators must be taken into account. If it is not possible to define a common goal, diversity of actors can possibly be maintained by accepting and considering different consistent purposes.

Considering different logics of different stakeholders can help to increase the willingness to participate in co-creation and thus give co-creation a higher weighting for the identified stakeholders. Despite a general openness of policymakers to participate in co-creation, both in the SISCODE co-creation journeys and in the cases from the field research, sometimes clear deficits with regard to the willingness or opportunities of representatives of public institutions or policy makers to participate in co-creation became apparent, especially due to time constraints. While in principle an orientation towards the time resources of such actors can help here, another level also becomes apparent: If policy makers or public administration representatives are not willing to put aside other commitments to participate in co-creation, an institutional gap becomes apparent. If co-creation was a formalised mode of decision-making in politics and more generally in public administration, actors from the political/public sector would be more likely to participate. In principle, this observation does not only apply to the political/public sector. However, it seems particularly important to formalise co-creation in political and public decision-making processes due to their highly formalised (and bureaucratised) character. This is all the more important because a lack of participation by policymakers and public administration can not only hinder the dynamics of co-creation, which is essentially based on the diversity of the actors involved. The legitimacy of co-created outputs (i.e. innovations) also depends on the participation of all actors. Here, it is then also policymakers or representatives of public administration who can help shape legitimacy for innovations due to their power to change framework conditions in which these innovations are intended to institutionalize.

4.2.4. Communication breakdown

Already data collected with the quantitative survey for the SISCODE Knowledge Base (SISCODE Deliverable 2.1, 2019) indicated the importance of communication practices for the success of co-creation. For a share of 32.1% of the described initiatives, a mismatch between participants related to incompatible "wording and language" (SISCODE Deliverable 2.3, p. 31) was stressed. Furthermore, barriers within the co-creation process were assigned to mismatches concerning stakeholders' "divergent conceptions towards crucial concepts" (ibid.) even for a share of 37.7% of the initiatives in the sample. The in-depth analysis of cases added to these standardised information. As pointed out in Deliverable 2.3, "communication needs to be comprehensible, direct, and clear for all participants" (D2.3, 2020, 52 f.). Furthermore, a posture of openness and transparency was identified within the Co-creation journeys. The characteristics of this posture are an open, non-judgmental and accessible wording, a constant exchange of information and a dedication towards feedback-loops and self-reflection.

But, the importance of communication also reaches beyond the co-creation initiative as it also refers to reaching out to external stakeholders or experts and their briefing for participating. As Co-creation is often linked to the communication of knowledge, which is necessary to understand a problem and develop the object of co-creation, respective expert-knowledge needs to be adequately prepared for laypersons.

In general, open and creativity-enabling communication between groups of co-creators from different backgrounds is sometimes also hampered by biased opinions about each other. According to the description of SISCODE's co-creation journey The Co-Design Canvas, attitudes of innovators from civil society towards political actors were an obstacle for achieving cross-sectoral dynamics in the co-creation process. Based on previous experiences with policy makers, they were perceived as opponents rather than partners. However, by changing the perspective on each other, this hurdle could be addressed. Accordingly, it proved helpful to gain an understanding of the complexity of political levels and thus a more differentiated perspective. Transferred to a more general level, it follows that trust between groups of co-creators, who have so far tended to compete or oppose each other, can be built, among other things, on understanding the other individual position of individual representatives of other societal sectors or social groups.

Certain unpleasant issues are hard to address, especially when the stakeholders are not well acquainted with each other. It proved to be of benefit for the co-creation routine, if these topics are addressed in an early stage of the process.

4.2.1. Clarification of functions and roles

It has been shown that a decisive aspect in the initial phase of a co-creation practice should be dedicated to a dialogue process about the individual functions and underlying motives to take part in the process. This serves the process in at least two ways: On the one hand, everyone should be aware about what she /he might expect from the other. On the other hand, people gain awareness about their own roles and about what they are expected to bring during the co-creation process it-self. Closely connected is a definition of areas of responsibilities and, if already possible, a distribution of these responsibilities to certain actors.

An important differentiation between co-creative routines is rooted in their upcoming as **top-down co-creation, where** "the frames for co-creation (funding, duration, purpose, methods, etc.) are already set by the group of external and internal stakeholders that fund, initiate and promote the initiative" (cf. D2.3) and **bottom-up co-creation,** "where the group of stakeholders that initiates a process is also congruent with the group of participating stakeholders. It is evident that the distribution of responsibilities, as well as role-making and role-taking, is highly influenced by the character of the overall initiative as top-down or bottom-up. Within the comparative analysis, four main roles of actors were distinguished, namely they are: initiators, funders/investors, facilitators and participants. It was stated that these roles especially overlap in bottom-up initiatives, where individuals at times fulfil all of the abovementioned roles. Contrary. Top-down initiatives are characterized by a division of labour, which was planned and intended before even starting the process (cf. D2.3, 2020, p. 158).

4.2.2. On crowd pullers, local matadors and regulars

Obviously, a wide majority of co-creation processes rely upon the individual engagement of single individuals or groups and per definition crucially depend upon the participation of all stakeholders affected by a future solution (cf. D2.3, 2020, p. 155). One hurdle here is the targeted involvement of end-users, which can fail, for example, due to a lack of accessibility via the chosen communication channels of an organizational team. End-users in this respect are those stakeholders who are particularly affected by the co-created innovation. Thus, they are not only the ones who have a particularly high stake in the solution of the addressed challenge, but they are also the target group. These target groups can be citizens or residents of a target context or social groups who benefit from co-created devices, products or services in their everyday lives. The literature review clearly pointed towards a

scientific desideratum in the field of end-users' motivations and their agency to participate in relation to the context of action. In SISCODE, quite a set of participant-types became visible. Whereby the analytical depth is not mature enough to constitute and establish a typology at this point, a first abstraction of end-users types is laid out as follows:

“The crowd puller”

Often, a “crowd puller” works in the educational, social or health system (e.g. psychologists, social workers) (cf. Lab of Collaborative Youth (LoCY)|Portugal). The crowd puller is willing to try out new things and motivates others, who might have more reservations, to participate. Especially top-down initiatives which target a specific context and a specific (maybe hard to reach) group of people seem to benefit from crowd pullers in terms of stakeholder engagement.

To reach a crowd puller in the first place, a special expertise in the field might be necessary. This can be delivered by the next end-user-type.

“The local matador”

The “local matador” is a nearly indispensable actor for co-creation routines which are targeted towards change in a more narrow scope (e.g. neighbourhood, district, region). He or she is someone who knows the people and the regional conditions by heart, has a huge network in the target context and knows how things work there. The matador might also be helpful in an initial stage of “mapping and analysing the local systems, existing and possible solutions, best practices in infrastructure management, production models, legislations and regulations in hardware production” (cf. D.3.4, 2020, p. 70) which proved to be a good entrance in the overall process during the SISCODE co-creation journeys.

“The regular”

They tend to look at the facilitators with an initial mistrust and want to know exactly what is going on (cf. SISCODE case-study Será que o mar vai engolir o Bairro?). Often, they were drawn to the process by a “crowd puller” or a “local matador” and are sceptical about what will happen and if there is any use of it at all. There is a high chance that “the regular” won’t show up a second time after participating in the kick-off meeting.

The approach to identify more subject-figures of Co-creation participants seems to be a promising approach to generate more knowledge towards end-users' motivations and their resources to take part in the process.

4.2.3. The importance of physical space

Already in the SISCODE-database respondents pointed towards the necessity to have a physical room, a steady contact point, where the stakeholders are able to meet, exchange experiences or continue to work on the solution. This aspect was further developed within the Case studies and biographies and its relevance was once more confirmed in the SISCODE co-creation journeys. Especially during the Covid-pandemic, where activities moved to online structures, physical space was missed.

Policy makers or public administration can support by providing such a space, providing an infrastructure to create such spaces or through support during the search process for a suitable location (cf. SISCODE Biography Umea). Across the sample, a recurring scheme were neighbourhoods in which new spaces for creative places were created in the course of a top-down initiated restructuring.

4.3. Dynamics in Co-creation: The macro context

4.3.1. Norms and values creating momentum for co-creation

Co-creation in practice is addressing a variety of challenges and specific needs. Especially the perception of very specific needs and the necessity to act upon solutions to these needs is not always objective but subjective, hence related to specific social values and norms. When norms are institutionalised in the form of laws or regulations, an objective perception of necessities seems to be possible. In reality, however, such norms can differ since they are related to the specific context. As a consequence, not only is co-creation itself context-dependent, but so is the perception of challenges and needs. But what does this mean for the practice of co-creation?

Both the cases from SISCODE's field research and the co-creation journeys show that a strong connection of addressed challenges and needs to context-specific values and norms can act as a strong driver, and can be crucial for initial momentum. At the same time, norms and values can also bring dynamics into the co-creation process itself – for instance, right at the beginning when the challenge is identified or reframed. In the case of the SISCODE co-creation journey Partners of Experience, for example, the question arose about the perception of elderly who should be active in the co-creation process, being the target group at the same time. The experiment aimed to address "cultural stigma[s]" (SISCODE Deliverable 3.4, p. 114) related to ageism. By this, it also aimed to address prevailing norms and values associated with such perceptions of elderly people. In the initial phases of the co-creation process, a new role of elderly participants in the process was envisioned,

framing them as "early-stage-researchers" (ibid., p. 119). This new role also meant an approach to overcoming prevailing norms of their perception as a marginalised and culturally stigmatised group. At the same time, this approach also shows the importance of values of equality and justice: after all, the need for a changed role in the co-creation process would hardly have been stimulated without a recognition of the importance of these values. . This shows not only the importance of norms and values in the specific context, but also their importance in the co-creation activity. Because of its relation to RRI, participation, self-determination and democratisation of innovation processes, co-creation itself is highly charged with normative meanings. Especially for policymaking, expectations are high. It is seen as an approach to citizen engagement going significant steps beyond "consultation" and "asking the citizens" (Figueiredo Nascimento et al., 2016, p. 32), shifting towards collaborative policymaking of citizens and traditional policymakers. (ibid.) Hence, it is linked to expectations for new trust in politics and as a means to strengthening democracy (Vesnic-Alujevic and Scapola, 2019). In the realisation of co-creation, it is therefore important to take into account the motivation of actors to participate in the first place and their expectations that arise as a result. Otherwise, dynamic changes may take place in the co-creation process due to the tension between normative expectations and practical realisation. Moreover, there could be a risk of disappointing expectations, and this may result in frustration. As a consequence, building trust and creating a safe space, which is important for co-creation as SISCODES co-creation journeys and innovation biographies show, could thus be jeopardised.

If the challenges and the perception of social needs correspond to the norms and values of the context, the chances for successful co-creation with the participation of different stakeholders seem to be good. As indicated above, the participation of diverse actors particularly benefits from a link to existing laws and other explicitly institutionalised norms. Especially the participation and support of public administration and policymakers is more likely in such cases. The SISCODE case studies, biographies and co-creation journeys show that such norms do not necessarily have to be long established. The participatory policy agenda in the Netherlands or the transformative policy agenda in Sweden demonstrate that progressive policymaking can also set a normative framework in which co-creation can dock and benefit from political support (SISCODE co-creation journey of CUBE; co-creation biography Sharing City Umea). However, more traditional and long-established values and norms can also promote co-creation and be related to policy agendas. Cases from the SISCODE field research, for example, show that strengthening local or regional

communities and collaboratively addressing of social challenges through co-creation can also receive political support (e.g. Borgernes Hus). Furthermore, legal norms can also create momentum for co-creation through their deficits. If these deficits are recognised by policy makers, their support becomes more likely. For example, in the case of the SISCODE co-creation journey AI as Co-Spectator, lapses in the enforcement of the GDPR are, in the longer term, expected to lead to political support for changing the perception of the impact of AI in public life, which is the main goal of this experiment. However, if the perception of the addressed deficits as such is not shared by political actors, there may be a risk of creating opposition from the public administration and policy makers. This might be especially relevant, if the co-creation to be carried out is in contradiction to current legal frameworks that regulate service delivery in the public sector. In the landscape of SISCODE's cases this is especially to be found in broadly differentiated welfare-systems with a historically grown landscape of welfare-associations. Again, this illustrates the importance of aligning co-creation for addressing social challenges with policy agendas and the aims of policy makers and public administration.

- Shared responsibility comes with important roles to carry in the process and the co-ownership of possible solutions;
- Respecting and getting to know the working styles people were used to in the past and build upon the working structures;
- Whose voices are heard? Different stakeholders have different views, but not everyone has the same volume when bringing in their opinions: certain activists may be particularly vocal, but the general public might have another view;
- Who decides about the character of the "common good"?

4.3.2. Sustainable social transformation through co-creation?

Among the cases from the field study as well as among the SISCODE experiments, numerous challenges were worked on that are related to ecological sustainability. The spectrum ranges from awareness raising for energy consumption (e.g. case-study - 10:10's Heat Seekers' Quest) to the co-development of policies for clean air (SISCODE co-creation journey Let's Talk About the Air) and to contributions to the sustainable transformation of cities, for example in the context of the FabCity Movement (SISCODE co-creation journey Remix el Barrio, SISCODE case-study Fab City Grand Paris) or in the context of the Sharing Cities Sweden programme (e.g. co-creation biography Sharing City Umea). Although the development of solutions for more ecological sustainability might not necessarily have to be

connected to co-creation, a proximity between both is, therefore, observable. . Partly, this can be explained by the strong connection between transdisciplinary research and sustainability (Jaeger-Erben et al, 2018). But beyond that, it is also the political framework that strengthens this connection. Already on the basis of the analysis of the case studies and innovation biographies, it became clear that there is a "strong link between innovation policies combining co-creation as part of collaborative governance with sustainability challenges on the urban and regional level" (D2.3, 2020, p. 122). The experiments further emphasize this observation. The influence of policy agendas that aim for more ecological sustainability can also be observed throughout the cases. Basically, supportive normative framework conditions for co-creation aimed at ecological sustainability emerge on two levels: **First**, politically set norms and related structural conditions can be relevant for supporting co-creation. Public funding programmes for projects on ecological sustainability result from political decisions and policy agendas. **Second**, there is the influence of ongoing social transformation based on the establishment of sustainability values and the goal of a new norm of a sustainable society. Pel et al. (2020) highlight the role of “discursive resonance” as an “empowering network constellation” (p. 315) in social innovation ecosystems. Pel et al. describe such discursive resonance as a "collective process that involves the whole communicative sphere through which socially innovative concepts gain political and scientific authority" (Voß, 2014; quoted in Pel et al., 2020). In co-creation ecosystems, it can be discursive resonance in relation to sustainability that can be particularly helpful in establishing co-creation as a new modus operandi for innovation processes in a certain context. If co-creation is tied to a diffusing narrative of collaborative sustainability innovation, co-creation can benefit from the sustainability discourse. Going one step further, co-creation can also benefit in this respect from mission-oriented innovation ecosystems, as Jütting (2020) describes and classifies them. These could focus on the sustainability-related target “dimensions [...] of people, prosperity, planet” (p. 12) or address them in an integrated way. If co-creation is perceived as an approach to combine these target dimensions in the sense of sustainable innovations, it is more likely to be established in respective contexts. The beneficial relationship between co-creation and sustainability is therefore basically mutual in this respect. Both aspects, political support and the role of societal norms and values, are likely to gain further relevance in the European context through the Sustainable Development Goals (SDGs) and the Green Deal, creating even more momentum for co-creation of ecologically sustainable innovations, pushed by the relations of sustainability goals to the EU pillar of RRI (OECD, 2018a). However, co-creation that addresses other sustainability goals should also continue to

benefit from international, national or local policy programmes related to the SDGs. Ultimately, on the empirical basis it is difficult to determine whether co-creation is a key to social transformation. In any case, co-creation takes place along the lines of social, (ecologically) sustainable transformation and is not seldom a means of choice for realising accepted, balanced and appropriated solutions. In this respect, co-creation might even be a particularly suitable means of not only developing transformative social innovation but also designing it in such a way that it becomes accepted, imitated and institutionalized social innovation (Howaldt & Schwarz, 2010).

4.3.3. Co-creation and policy agendas: dynamics of the political landscape creating momentum

In policy co-creation, the political framework is inevitably an important reference point. But even beyond those cases where co-creation leads to the concrete formulation of policies (e.g. SISCODE co-creation journey Let's Talk About the Air), this framework remains significant and can create momentum for co-creation. Dynamics of change in the political environment also play a central role here. For example, the SISCODE co-creation journey The Co-Design Canvas shows the importance of a policy agenda that aims at a societal transformation towards a more participatory, empowered society. Co-creation as a method for participatory innovation processes obviously fits in here. However, it remains open to what extent policy agendas and the associated goals are actually congruent with the goals of co-creation. Expectations of co-creation by citizens could, in case of doubt, be disappointed if participation is interpreted and realised differently by policy makers or public administration. In such cases, co-creation may face a trade-off between the expectations of policy makers and the expectations of other groups. In the case of The Co-Design Canvas, however, the difficulty was rather in establishing co-creation in the routines of policymaking and public administration.

Politics is generally influencing success and failure of co-creation. As the results of the SISCODE field research show, this influence is observable in several ways (D2.3, 2020, p. 120):

- "Access to funds on all political levels"
- "Legitimacy through political stakeholders, such as local politicians, scientific committees."
- "Promotion of political strategies/agendas/projects"
- "Expectation for problem solutions, e.g. new technological developments as a result of co-creation"

In general, this variety of political influence is also shown in a similar way in the SISCODE experiments. However, due to the focus and the challenges addressed, the importance of policy agendas and support of policymakers and public administration as a driving factor is particularly evident – in turn, where there was a lack of support, it was mentioned as a hindering factor. Since SISCODE, as a Horizon 2020 project in the Science with and for Society funding programme, enabled the co-creation experiments to be carried out, the SISCODE experiments also underline the particular relevance of public funding programmes as a possible enabler of co-creation in this respect. At the same time, this also shows the importance of EU policy behind Horizon 2020 for co-creation.

Furthermore, already the knowledge base (D2.1, 2019) revealed some findings indicating the importance of the political framework for the success of co-creation (D2.1, 2019, p. 32):

- "Consider the respective legal background, especially in cross-national initiatives"
- "Generate a deep understanding of public procurement and its legal regulations"
- "Co-creation may be in contradiction with current legal framework that regulate the service delivery in public sector"
- "Political support and management back-up need to be ensured, especially in co-creation efforts in policymaking"

Against the background of the learnings from SISCODE's experiments, it should again be emphasised that the dynamics of the political environment can be a major factor for the success and failure of co-creation. The results from the experiments have shown that restrictions in the wake of the Covid-19 pandemic can be a significant barrier to co-creation. The respective legal background as well as the structure of public procurement or the will for political support can be subject to dynamic change. It is therefore all the more important to emphasise that co-creation requires a supportive political framework. In particular, policy agendas towards more participation have proven helpful in the experiments. On the other hand, co-creation must take the given framework into account and, if necessary, find creative solutions in order to realise collaboration, possibly even despite regulations that might hinder collaboration and participation significantly.

4.3.4. Momentum for co-creation in a culture of innovation and cooperation: the role of networks and organizations

A momentum for co-creation in a culture of innovation and cooperation arises through networks and organizations as well as through communities. Thereby, the latter has to be wide and open for co-creation activities. Another point the SISCODE co-creation journey Remix el Barrio shows is the necessity of building cooperation. Especially among the local community and the co-creation initiator in order to co-create on equal terms. A so-called "community driven approach" is, in addition to it, a starting point to co-creative activities and pushes these activities forward. Furthermore, the above-mentioned synergies are also relevant to boost co-creation on an organizational level.

Moreover, the involvement of cities can be added as an instance for successful co-creation on a local scale.

Networks and organizations can be main collaborators and mediators of co-creation processes, which can be directly seen in SISCODE's co-creation journey Bodysound where an association was selected to mediate the co-creation process. Besides this, networking initiatives also have a crucial role in co-creation processes because they aim to involve stakeholders interested in the co-creation process and therefore create a momentum for co-creation activities.

Co-creation cases in the SISCODE sample are mostly realised by already existing organizations, units which had time to grow and test their strategies and tools and which already had some degree of visibility and acceptance in their local setting (see 3.2.2; Organizational learning, cross-fertilization and networks). Newly (co-)created early organizational forms, like co-created networks (e.g. NINUX), are an exception in the pool of cases and experiments analyzed. The SISCODE experiments in particular show that organizations that already have a strong collaborative culture are open to embracing co-creation. In turn, such organizations are often already part of networks with a focus on collaboration. Such networks, which could also be seen as communities of practice, like SISCODE partners ENoLL and ECSITE or the international FabLab community provide an environment, where co-creation seems to flourish and tends to be easily accepted as a new or complementing approach to participative innovation processes. Both, organizations and communities or networks with a particularly collaborative culture hence seem to be breeding grounds for co-creation. As such, they provide an important environment for creating initial momentum for co-creation.

Characteristics of cultures of innovation
Co-creation in a mature innovation system and culture: Several of the cases describe co-creation initiatives that are derived from and are embedded in distinct innovation systems that also consider RRI in innovation strategies and funding schemes.
Co-creation in an emerging innovation system and culture: Several of the cases describe co-creation processes that have been started under preconditions of a rather emerging innovation system and culture which means that support structures for innovation actors and actions are not yet distinctive, especially with regard to RRI.
Co-creation in an early-stage innovation system and culture: Some of the cases can be characterised as early-stage innovation systems and cultures where innovation actors and actions are not yet in place and bottom-up co-creation initiatives do not receive support from an advanced innovation system in the field.

Table 01 - Cultures of innovation (Eckhardt et al., 2020)

The comparative analysis of co-creation case studies and innovation biographies in SISCODE's work package 2 (D2.3, 2020) has made possible an early classification of differently developed innovation systems (Table 01). The distinction between 'mature', 'emerging' and 'early-stage' ecosystems reflects differently developed ecosystems that could foster co-creation at different stages of development, comprising "innovation actors (e.g. funders, initiators) and actions (e.g. policies, funding schemes), on all political levels (EU, national, regional, municipal)" (D2.3, 2020, p. 121). The SISCODE experiments generally underline this differentiation. There are experiments that have been described as benefiting from an established culture of innovation, such as the SISCODE co-creation journey Remix el Barrio in the Barcelona innovation system. There were also cases where a participatory innovation culture is currently growing (e.g. SISCODE co-creation journey The Co-Design Canvas) and those where participatory innovation processes have yet to become fundamentally established (e.g. SISCODE co-creation journey AI Agriculture). However, due to the strong embedding in established, collaborative organizations draw the attention stronger to the importance of the collaboration and innovation culture in the direct environment of co-creation processes. In the case of the SISCODE co-creation journey The

Co-Design Canvas, it is the museum itself and its network of museums that provides a culture of innovation and collaboration that is creating momentum for co-creation. Remix el Barrio is embedded in the already matured innovation system of Barcelona and, at the same time, part of IAAC's activities, an institute with a FabLab and the according connection to the international FabLab community. Just like IAAC and CUBE Design Museum, the other organizations that have conducted a SISCODE Co-creation Experiment provide an already collaborative framework. Some of these organizations had to tap the full potential of co-creation first (e.g. SISCODE co-creation journey ICT for Agricultural schools), others already had their own concepts of co-creation (e.g. SISCODE co-creation journey AI as Co-Spectator). But all of them were open to it due to their established culture of collaboration. Some experiments also benefited from a mature innovation system where stakeholders were quick to participate and to support. Others had to explore ways to create interest for co-creation. An example is provided by the SISCODE co-creation journey ICT for Agricultural schools, where stakeholders became interested in co-creation through interest in ICT. But what does this mean for successful co-creation processes in general? Ultimately, it is quite simple: the success of co-creation can benefit significantly from being embedded in a culture of collaboration and innovation. Ideally, of course, co-creation takes place in an environment where collaboration is the norm across all levels. In such a case, co-creation then benefits from a cross-level culture of innovation and collaboration. But there are also cases where individual pioneers drive co-creation. If these pioneers can count on the support of organizations or networks that recognise the value of co-creation and have an established culture of innovation and cooperation, the chances for successful co-creation seem to be particularly good. After all, the dynamics of the process also depend crucially on the will to participate. An important recommendation in this respect would then be to identify such organizations, communities or networks that are already experienced in collaboration and to convince them to become drivers of co-creation.

4.3.5. Socio-economic and demographic parameters creating momentum

Concerning socio-economic parameters, SISCODE experiments also take place in various socio-economic settings as SISCODE's field research. Thereby, these cases also face diverse socio-economic challenges: sustainability, restructuring of economic structures, demographic change etc. But, in contrast to SISCODE's field research, cross-cutting themes do not play a crucial role because these cases have a focus on a specific co-created practice. Another central point in SISCODE's field research is the role of communities. They can be related to socio-economic contexts and the interlinkage of them. Therefore, communities

pointed out as a central role in co-creation processes, what can be directly seen in SISCODE experiments in which networks and stakeholders as communities pattern dynamics in these processes. Socio-economic parameters thus create a momentum for co-creation, whereby these parameters introduce co-creative activities with a main focus on collaboration and socio-cultural chance for dynamic transition.

Concerning demographic parameters, SISCODE's field research is associated with both, only one country and more than one, whereas SISCODE experiments are often associated with only one country. This can be also seen in the level of action. Because projects of SISCODE's field research act on a lower (local, city, regional) as well as on a higher (EU, non-EU) geographical level, but SISCODE experiments not. In SISCODE experiments, the geographic level of action is on a lower geographical level. Thereby, especially citizens and residents are engaged to co-create on a local level; cities, neighbourhoods and urban districts on a regional level. As SISCODE's field research shows, also SISCODE experiments that are operating on the regional level have co-creation processes in one region in one country. The SISCODE co-creation journey Remix el Barrio for example emphasises that operating on a local level promotes a potential for local socio-economic development. Especially concerning co-creative activities.

Besides this, there are also territorial parameters that accelerate proceedings as co-creation processes. Thereby the necessity of understanding these processes came into light.

4.3.6. Role models for co-creation

Even if co-creation is already closely linked to the culture of the initiative/project, the initiator as well as the actors involved in it benefitted from others who are actively engaged in co-creation. This is the reason why others can be seen as "role models" for co-creation – initiatives/projects benefit from these role models by improving their co-creation experience and by deepening their knowledge on co-creation practices. Moreover, the knowledge of initiatives/projects and actors who have experience in conducting co-creation activities are used to integrate co-creation in the own specific field (cf. SISCODE co-creation journey Bodysound). But these role models for co-creation are rather inspiring examples that create new dynamics of co-creative activities. Moreover, these role models also act as supporters. Especially in initiatives/projects where co-creation is seen as an ideal, role models mitigate this often seen as unattainable ideal by making its staff more familiar with it. Thereby they acquire a deeper understanding of co-creation processes, what helps to understand co-creative practices.

Here it seems also of importance how far participative policymaking is diffused in the surrounding of the co-creation initiative.

4.3.7. A dynamic environment: New co-creation practices as a response to regulatory restrictions in the pandemic

The COVID-19 pandemic forced SISCODE experiments to respond to regulatory restrictions, for example to collaborate at distance, to overcome the impossibility of physical events and meetings (restriction on in-person meetings). Due to these regulatory restrictions, co-creation practices firstly slowed down and impacted the process, but then new solutions emerged and additional competencies were gained. Especially in exploiting the possibilities that online tools can provide (cf. SISCODE co-creation journey Bodysound). Coming back to SISCODE's field research, tools – not always explicitly renowned as digital tools – also support or enable co-creation practices. Tools that are explicitly declared as such are in SISCODE's field research on both levels: hard- and software. Thereby, hard- and software as digital tools support co-creative practices, are the output, co-creation or both. Especially with digital tools, co-creation activities became more flexible in integrating external actors. So more external participants took part in co-creation activities than originally thought, which resulted in many different competencies in this process. The pandemic has thus forced the co-creation actors to learn that digital tools (as well as the digital/virtual world) have a lot more to offer than expected and known. But the pandemic also brought challenges in attracting stakeholders (e.g. policy makers and citizens) together in digital/virtual meetings. Especially policy makers seem to be less available for digital co-creative activities, what SISCODE's field research did not expect because of the high availability of policy makers in co-creative activities. SISCODE experiments thus face the problem of keeping stakeholders engaged.

Moreover, the pandemic also forced SISCODE experiments to overthink their used co-creation tools/technologies. This is the reason why digital technologies such as webcams, laptops, digital platforms etc. became more important than initially planned and also used in SISCODE's field research. Its crucial role is thereby seen in the facilitation of digital "face-to-face" meetings in which moments of interaction are enabled as in physical ones. Thus, digital technologies became an alternative to other, non-digital co-creation methodologies. However, these digital technologies can also be challenging – especially for people who do not use digital technologies quite often, who do not have the competences to do so or for those who have limited access to digital technologies. Then, digital methodologies aren't suitable for the co-creation activity. Hereby it comes also to light that

digital co-creation activities only go well with a relatively small group of highly motivated stakeholders, what can be seen in the SISCODE co-creation journey The Co-Design Canvas.

Due to the COVID-19 pandemic, new information and ideas emerged toward co-creation. This results on the one hand in the highlighting of digital tools (as above is already mentioned) and on the other hand in transferring the co-creation activities in another suitable chronology, at a future date or cancel them. This is the reason why SISCODE's co-creation journey ICT for Agricultural schools had to postpone planned activities from March to September 2020. Moreover, the pandemic also brought the importance of other topics and challenges than in co-creative projects are addressed. This is the reason why mental health and well-being management became more popular.

In summary, it can be said that SISCODE experiments responded well to regulatory restrictions. But digital co-creation processes could not completely replace all intended physical meetings, which is specifically highlighted in the SISCODE co-creation journey The Co-Design Canvas.

From another perspective, the impact of contact restrictions in the course of the Corona pandemic enables a perspective on a setting in which co-creation had to respond to a dynamic environment in a dynamic way. Constantly changing framework conditions made adjustments in the practice of co-creation necessary, which would not have been necessary otherwise. The development of new tools and their establishment would not have been necessary without the environmental dynamics and the resulting dynamically occurring legal norms (contact restrictions). Such environmental factors can become a barrier. In the case of the SISCODE experiments, this was demonstrated by the impossibility of face-to-face co-creation. Especially in the case of co-creation of tangible artefacts, such as a boat in the SISCODE co-creation journey Caiaques as rio. At the same time, the majority of the co-creation experiments were able to respond successfully to the new framework conditions. More important at this point, however, is the positive effect of the dynamics that emerged: not only new digital tools were created. It also revealed that digital co-creation can reach broader target groups (SISCODE co-creation journey Caiaques as rio) or that new forms of experiments opened up through digital co-creation - for example in the SISCODE co-creation journey AI as Co-Spectator. Of course, all of these effects are very specific to each case and dynamic framework conditions might be a driver for co-creation in some cases while the same dynamics can be barriers in others. At this point, it remains open in principle to what extent the dynamic character of the SISCODE co-creation experiments was

particularly helpful for the adaptability of the projects. However, there are indications of this.

In general, the following characteristics of new co-creation practices as a response to regulatory restrictions in the pandemic have been identified within the SISCODE experiments:

- Several of the cases describe co-creation initiatives that are derived from and are embedded in new co-creation practices that also consider new information, ideas and digital technologies in further co-creative strategies.
- Every case started its co-creation process without regulatory restriction. But in the pandemic, new co-creation practices within new information and ideas emerged. Especially with regard to digital technologies.
- Some of the cases can be characterised as new early-stage co-creation practices where innovation is not yet in place but brought the importance of it

4.4. Institutionalisation

4.4.1. Institutionalizing co-creation practices in a culture of innovation and cooperation: the role of networks and organizations

The establishment of co-creative practices in specific contexts and ecosystems can strongly benefit from a participatory or collaboration-friendly environment. Both cases from SISCODE's experiments and cases from the SISCODE knowledge base show that an already established culture of cooperation or a collaborative innovation culture are conducive to the possible establishment of co-creative practices in innovation processes (see 3.2.2; Organizational learning, cross-fertilization and networks). At the more individual level of co-creation projects, it is first and foremost the actors from the environment who are closest to the project. In concrete terms, this initially concerns the respective organization or the constellation of organizations implementing the project. Such organizations are sometimes part of networks that focus on collaboration in wider terms or collaborative innovation processes in more specific terms. This includes the FabLab network in particular as seen in a couple of cases-studies, co-creation biographies and SISCODE co-creation journeys like FabCity Grand Paris, Remix El Barrio, Polifactory or Plastic in Plastic out and in an unspecified share of cases from overall 32.5% of the cases linked to makerspaces from SISCODE’s database of European co-creation cases (D2.1, 2019, p. 24). Co-creation projects implemented in the environment of such organizations show a particularly pronounced

openness towards co-creation practices if they are perceived as successful or promising. Particularly among the SISCODE experiments, there are various examples of such tendencies to establish co-creation practices. Here, it was especially the co-creation tools that were perceived positively and described to be taken up again. For instance, due to experiences made with co-creation and co-creation tools during the innovation process, in the co-creation journey of Partners of Experience, members of Thess-AHALL (the organization managing the journey) tapped into the potential of co-creation tools to shape future collaborative activities. While successfully implemented co-creation processes can in principle lead to the associated practices being established or at least taken up again, explicitly collaborative contexts tend to be more open for a possible establishment. This also shows the importance of values and norms for the successful establishment of co-creation. If co-creation conflicts with existing practices or is at least new, more persuasion and possibly clearer successes of the co-creation process are needed to establish co-creation. In contrast, co-creation in a participatory or co-creation-friendly environment can benefit from the fact that actors already recognise its collaborative approach as a value. Moreover, if collaboration is already the norm, co-creation tends to find entry more easily. This ultimately leads to a recommendation for the participation in co-creation processes of those actors who already recognise the value of co-creation or participation and are willing to drive its establishment without external incentives. In addition, it seems helpful if such actors see co-creation as valuable and are therefore willing to promote its dissemination and establishment out of their own, normative aspirations.

Concerning the role of networks and organizations, these developed relationships and collaborations (that have developed over years) also stabilize and sustain co-creation practices. Thereby especially the membership in the already mentioned FabLab network seems to be fruitful to institutionalize co-creation activities in the SISCODE experiments. Besides relationships and collaborations, also cross-sector partnerships came into light because these partnerships transit and institutionalize co-creation. But there are also legislative documents (from these networks, organizations and cross-sector partnerships) that structure rules, restrictions, instruments and also the institutionalization of co-creative activities. Thus, the institutionalization of co-creation profited from the crucial role of networks, organizations, partnerships as well as from legislative documents. The strength of this lies in the created synergies that result in institutionalized co-creation activities. However, it is clear that a lack of networks, organizations and partnerships make the co-creation practices quite more challenging.

4.4.2. The establishment of co-creation as a new norm of cooperation in the ecosystem: the long way towards transformation

While co-creation is taken up and continued especially in those environments where values of participation and collaboration are already established and determine practice, there are at the same time efforts to establish co-creation in new contexts. In the case of organizations or networks that are already participatory and collaborative, these are, for example, the wider environment and thus the ecosystem in which the projects are situated. However, while such aspirations are widely articulated, this seems to be where a major challenge lies. Particularly with regard to the SISCODE experiments, it is therefore often reported that rather small changes could be initiated. In the case of SISCODE's co-creation journey Bodysound, therefore, the importance of accounting for small changes through co-creation in the environment was emphasized:

> "It is important to look at small changes in the whole ecosystem and especially on the accumulative improvements that a pilot project such as BODYSOUND can have in stating the relevance of co-creation in healthcare and well-being and the special and crucial role that makerspace and fab labs can play in facilitating these processes. Some of the policy makers involved had never participated in activities like these before and positive feedback were collected from them. At the same time, the capacity of creating a "safe room" for users with specific needs, in particular vulnerable groups, to encounter other stakeholders like policy makers in leading positions was for sure a very relevant and trigger point."
>
> - Schmittinger et al., 2021, p. 65

Moreover, some of these changes could only be suspected and, moreover, mainly concern changes in the perception or mind-sets of specific human or collective actors. For the SISCODE co-creation journey The Co-Design Canvas by Cube Design Museum it was thus emphasized that it needs time to be able to assess the effect of the co-creation experiment on actors from the ecosystem. Overall, it thus remains speculative to what extent these changes can stimulate larger processes of change in contexts of co-creation. The goal of transforming non-participatory or non-collaborative contexts into collaborative and participatory contexts thus seems far away in most cases and requires a longer period of perseverance. If it is actually co-creation itself that proves its value through its success, then such a transformation may require a steady repetition of successful co-creation to sustainably encourage actors to change.

Co-creation practices do not necessarily enter spaces that were previously unoccupied. Policymaking processes in particular can be characterised by established routines. Clifton et al. (2020) provide the example of challenges of ICT-based co-production of public

services. Based on a literature review, they argue that their establishment could be impaired by various factors, namely a lack of "financial capacity" of government, a lack of "technical capacities" of government, "legal issues" or even the "government culture" itself, when it is enclosing "negative attitudes [...] towards ICTs" as it might be perceived as "a threat to their professional position" (p. 33f). In the context of the SISCODE experiments, the COVID pandemic made ICT-based approaches mandatory in the short term. As described before, the resulting need to dynamically adapt the means of co-creation led to new, ICT-based, methods and tools. In addition to the challenges that co-creation has to face in the context of policymaking due to its character as a new approach, various hurdles also arise in relation to ICT-based co-creation more specifically. The establishment of ICT-based co-creation in policymaking can therefore depend on the political framework conditions in the same way as co-production. At the same time, ICT-based solutions also offer new paths for the establishment of co-creation, as Clifton et al. (ibid.) also note for co-production. In particular, the lower-cost and lower-threshold option for collaboration, as it requires less effort in the physical space (e.g. journeys, finding a physical room), can be an enabler here, which was also shown in the SISCODE experiments as already described before.

4.4.3. Roles and actors: The ongoing will to change

As previously stressed Co-creation is defined by the people who Co-create and depends in its initiation, forthcoming and outcomes upon the motivations and engagement of the single stakeholders. The role-taking and functioning of the single actors is thereby equally noteworthy as their personal circumstances, their aims they connect to their motivation and their relation to the topic of the initiative. In order to institutionalize co-creation as a new norm or value, as laid out above, it seems to be important to convince key figures in key positions of the benefits of Co-creation.

Experiencing co-ownership seems to be another valuable aspect in consolidating co-creation as a societal practice. It has been shown that individual experiences of co-ownership depend upon the level of the citizen's engagement in the overall process.

Policymakers and public administration in particular can promote the establishment of co-creation in a respective context. Policies aimed at collaboration and participation seem to be conducive here. In this respect, changing mind-sets and creating awareness for the potential of co-creation among policymakers may be a good starting point for achieving supportive ecosystems for co-creation.

4.4.4. The sustainability of co-created innovation: trade-offs, power and interests

Co-creation as a method for innovation processes affects different dimensions of sustainability. In addition to the sustainability of co-creation practices as a new modus operandi of innovation processes in specific contexts, there is also the question of the sustainable establishment of the solutions, hence the innovations. This establishment of innovations depends on many factors. One of these factors is the connection of the innovation to the goals of actors who have sufficient power or resources to enable or noticeably promote its sustainable establishment. This is well illustrated by the example of policies. If the co-created innovations correspond to the contents of policy agendas, political support is more likely. In the case of Sharing City Umea, it is various co-creative sub-projects that benefit from the overarching policy programme of Sharing Cities. This link becomes even stronger when a policy is the intended output of co-creation. In the SISCODE co-creation journey Let's Talk About the Air, significant political support was evident in the formalisation of the output in a policy document. This observation is by no means unique to the field of policies. In principle, it is obvious to conclude that co-created innovations can be established all the better if key actors have an interest in them. Conversely, this means that it is advisable to identify the key actors and involve them as intensively as possible. This approach proved to be helpful in the majority of projects. However, it became problematic when these actors could not be involved for the project. Ultimately, a "strategic trade-off" as described by Christiansen (2019) for the practice of innovation-labs becomes apparent here. Is innovation as a solution to a challenge oriented towards the needs of end users or key actors? Of course, this does not have to be mutually exclusive and, accordingly, a trade-off does not always have to be taken into account as end users can also be key actors. This is illustrated by the case Ilona Robot, where the pre-defined solution – the implementation of a care robot – was the aim of both, the public administration and the involved business. However, in cases where significant power imbalances between stakeholders exist, a trade-off may be necessary here that can determine the success of the establishment. Hence, this is especially a challenge for co-creation that addresses the needs of marginalised groups.

4.5 Meso and macro dynamics of co-creation ecosystems

The comparative analysis of co-creation case studies and biographies (D2.3, 2020) provided a basis for deriving a tentative classification of innovation cultures relevant for the establishment of co-creation in practice. Additional results from SISCODE's experiments

and the comparative analysis with results from the field research (ibid.) now provide implications for a more profound distinction of different characteristics of such ecosystems. These criteria allow for the ideal-typical differentiation of co-creation ecosystems at different stages of development. The differentiation presented here thus represents a deepening of the previously developed Cultures of Innovation. The result is 6 different characteristics that can be used to describe and classify the character of an ecosystem in a specific context. Due to the ideal-typical character and the specific case selection of the SISCODE sample, these characteristics represent a non-exhaustive approach. Further research can pick up on this and might deepen or expand the characteristics.

4.5.1. Co-creation policies in the scope of the initiative

The policy context of a co-creation initiative is characterised by the interaction between the given political ideas, the policy-regimes and the political and public institutions present in the target context. The differences in the policy context determine decisively the character and the sustainability of co-creation. The political context may reflect a cultural anchoring of openness to participation and collaboration. In such cases, the chances for co-creation are good. At the same time, however, the political context can become a significant barrier through its power to define frameworks if support and freedom for co-creation are lacking or are even deliberately blocked. The existence of explicit innovation policies plays an important role here. At the same time, these must enable and take into account participatory, collaborative and thus responsible innovating.

Ideal type	Criteria for *co-creation policies in the scope of the initiative*
far mature	All policy levels/areas concerned recognize innovation policies as an important pillar towards the solution of present and arising challenges. Co-creation is already recognized as one element of these policies. There are certain strategy papers which serve as a framework for the co-creation initiative. Tools and instruments are common. A lot of policy makers support these policies and take responsibility. The structures of co-creation are partly professionalized/ institutionalized. Far mature co-creation policies are to be found especially in urban settings of bigger cities, i.e. where municipalities adopted a nation/EU-wide strategy to facilitate innovation.

medium mature	Wide parts of the policy landscape are aware of innovation policies and they are partly implemented. There are already some structures supporting co-creation in the field and certain policy makers are known as being interested in participative policymaking. The overarching policy agenda implements co-creation or participation in policy and recognises it as an important issue for the upcoming future.
somewhat existent	Innovation policy is existent in the policy ecosystem, but not in the field the co-creation initiative is settled in. E.g. this might be the case, where socio-political issues or district (social) work function upon participative principles, but technical/ecological questions are solved "the old way". This is reflected in the policy agenda: While co-creation or participative policies are a topic in certain fields it is not yet a cross-cutting topic in the respective policy context.
non-existent	There are no official strategy papers implemented in the policy system which affects the co-creation routine. There are no policy makers willing to drive co-creation forward. Co-creation is more of a bottom-up culture, where e.g. grassroots initiatives seek more co-determination. However, these actors try to establish contact to the policy context and first steps may be already taken.

Table 02 - Maturity scale - Co-creation policies in the scope of the initiative

4.5.2 Tradition/culture of co-creation in the scope of the initiative

Co-creation inevitably depends on different actors coming together to create something new. As basic and simple as this statement is, it is at the same time full of preconditions. Co-creation requires a context in which participation and collaboration are possible. Framework conditions play an important role here. Especially in strongly institutionalised processes, such as policymaking, the promotion of participation and the accompanying formalised opening of processes can be decisive. But also in general, co-creation can depend on the acceptance of participation in innovation processes and collaborative approaches in more general terms. Co-creation benefits even more if participation and collaboration are not only accepted but also positively received and, if applicable, represent

a social value. On the other hand, co-creation can encounter considerable barriers if innovation processes are traditionally initiated and realised top-down and the inclusion of stakeholders is usually not envisaged or even opposed. This also becomes particularly clear in policymaking processes: if the inclusion of citizens is not foreseen or even actively prevented, co-creation faces major challenges in this domain.

Ideal type	Criteria for *Tradition/culture of co-creation in the scope of the initiative*
Far mature	Legislative frameworks implement shared decision making in several fields, sharing knowledge is normal, knowledge asymmetries are reflected. Values of participation and collaboration are already established and determine practice. Participation is regarded as an essential societal pillar in wide parts of society. This means that the decision making entities rely on participation as well as the general public does. Co-creation is embedded in a social context (network, organization…) where the will to uptake new co-creation practices is high.
Medium mature	Authorities/ decision making entities rely on participation to inform the public and to consult them in some parts of the decisions to be made. The participation does not get beyond the stage of consultation. The public seems "participation fatigue". Co-creation is embedded in a social context (network, organization…) where the will to uptake new approaches to participation and collaboration is high. Thereby also communities play a crucial role. Especially in pattern co-creative dynamics to collaborate.
Somewhat existent	Participation is more of a one-way-street than an established practice. E.g., grass-roots initiatives rely on participative structures in their self-directed work or the public is instrumentalised to legitimize decisions after they were already made or for political reasons. Co-creation is embedded in a social context (network, organization…) where there is a general interest in collaborative or participative approaches. This can be also seen in communities who have a general interest in participating in co-creative practices.

Not existent	The traditional practices of solving things are top-down, there are nearly no experiences in shared decision making. Collaborative or participative approaches are generally perceived sceptical, reluctant or even dismissive. There are communities who are more sceptical about something new (like co-creative activities) than open to experiment and try it out.

Table 03 - Maturity scale - Tradition/culture of co-creation of co-creation in the scope of the initiative

4.5.3 Progressive culture

While co-creation benefits very directly from a tradition or culture of co-creation in the more immediate context, there is also the question of the broader context and the conditions under which such a culture can develop and become established. Just as other innovation processes, the success of co-creation is influenced by the innovation-friendliness of its environment. Innovation brings something new and, if successfully diffused and established, generally leads to some kind of change depending on its character. This may call established values and norms into question. At the same time, progressive norms and values appear helpful here. This applies to the establishment of co-created innovations as well as to the application of co-creation itself as an innovative new social practice of innovating.

The co-creation cases that have been analysed in SISCODE are often aimed at the creation of social innovation and even social innovations with transformative aspirations (e.g. towards climate neutrality or ecological sustainability). It is precisely such innovations as the output of co-creation that require an environment that is at least not fundamentally hostile to the new. If an environment is less progressive and thus less innovation-friendly, higher barriers have to be overcome. The following ideal-typical manifestations of progressive culture of ecosystems represent the entire conceivable range. In the practice of the cases in focus of SISCODE, co-creation was not confronted with the most challenging variant. This can have different reasons. It seems likely that particularly regressive or preservative contexts may leave no room for co-creation. In fact, however, it cannot be ruled out that co-creation is also used for regressive goals, for example. However, since the SISCODE sample is in no way representative, but explorative, it ultimately remains open to what extent co-creation takes place or can take place in a particularly regressive environment. In the sense of an ideal type (Weber 1980), especially the variant of a non-existent progressive culture is an exaggeration and may not occur in its pure form. Nevertheless, particularly this variant -

just as with the other ideal types – allows to derive recommendations for encountering barriers (see chapter 21.6.4).

Ideal type	Criteria for *Progressive culture*
Far mature progressive culture	Society is generally open to questioning norms (of interaction, doing things, innovating, policymaking, living etc.), overcoming routines and to take new pathways for innovation (e.g. considering/accepting design-approaches, new knowledge etc.). Dynamic, progressive, participative, transitive/transformative policy agendas explicitly address/support co-creation. Design methods and principles are widely spread and applied, user-centred design approaches are well-known and a common practice of innovation.
Medium mature progressive culture	Parts (e.g. milieus, classes, generations) of society are generally open to questioning norms (of interaction, doing things, innovating, policymaking, living etc.), overcoming routines and to take new pathways for innovation (e.g. considering/accepting design-approaches, new knowledge etc.). Dynamic, progressive, participative, transitive/transformative policy agendas emerge and generally provide possible links and leeway for co-creation. Design methods and principles are known and sometimes applied. Specific user-centred approaches may or may not be a practice of innovation among others.
Somewhat existent progressive culture	Single, but rather fragmented, groups of individuals or individuals are generally open (e.g. open minded) to questioning norms (of interaction, doing things, innovating, policymaking, living etc.), overcoming routines and to take new pathways for innovation (e.g. considering/accepting design-approaches, new knowledge etc.). Dynamic, progressive, participative, transitive/transformative policy agendas are relatively scarce and only provide rare leeway for co-creation. Design methods and principles are barely known and seldom applied. Specific user-centred approaches are an unusual practice of innovation.

Non-existent progressive culture	Single groups or individuals may or may not be interested in questioning norms (of interaction, doing things, innovating, policymaking, living etc.), overcoming routines and to take new pathways (e.g. considering/accepting design-approaches, new knowledge etc.). Majority of society is interested in preservation of traditional, established norms and values. Dynamic, progressive, participative, transitive/transformative policy agendas are non-existent or even dismissed/counteracted. Design methods and principles are not known and not applied or only applied or known by a few, individual actors outside of the cultural mainstream. Specific user-centred approaches may or may not be taken up in individual cases. There is a general tendency among decision-makers to reject such approaches.

Table 04 - Maturity scale - Progressive culture

4.5.4. Discursive resonance of the co-creations topic

Pel et al. (2020) describe discursive resonance (cf. ch. 2.1.1.4) as a highly empowering factor for SI initiatives. “Concepts” (incl. methods and tools, “organizational models”), “narratives”, and “knowledge” related to social innovation diffuse in an ecosystem beyond the” local embedding” (ibid., pp. 315ff) when discursive resonance is present. In such a context, social innovation benefits from an environment in which it is recognized and perceived. Relying on our results in SISCODE, this can be also said when referring to the establishment of a co-creation routine and new mode of operation. Just like social innovation, co-creation can benefit from discursive embeddedness in its respective context and ecosystem. At the same time, co-creation can also benefit from discursive resonance of adjacent topics. For instance, there does not have to be a specific discourse around co-creation for it to benefit from discursive resonance. Already narratives around topics of ecological sustainability, such as circular economy, can be a supportive factor here, laying the ground for the uptake of co-creation when it is considered as an approach to operationalize sustainable innovation processes.

Ideal type	Criteria for *Discursive resonance of the co-creation topic*
Far mature	In the ecosystem, the overall topic of the co-creation routine and co-creation as a possibility to find solutions is known and recognized. This is reflected in the Interdiscourses (e.g. media), expert discourses (e.g. sciences, academia) and also in everyday, elemental discourses. E.g. "circular economy": Local newspapers report about endeavours to implement circular economy ideas in the city and names the relevant stakeholder – the academic system makes it a further subject of discussion and may organize events – also in some segments of everyday life, circular economy is a topic somehow and "rings a bell" in peoples conscious. The discursive resonance of co-creation reflects a general tendency towards social values of democratic participation and self-determination. Co-creation benefits from this normative embedding and is on its way to becoming the norm of innovating.
Medium mature	The topic of Co-creation is a familiar concept to parts of the target context. Especially in expert-discourses and parts of the population concepts attached to the co-creation routine are known. The discursive resonance of co-creation in these domains (e.g. science, policymaking) reflects a general appreciation of co-creation as a means for democratic participation and self-determination. Co-creation benefits from this normative embedding and is supported by actors from these domains.
Somewhat existent	If the overall topic of the co-creation routine has some resonance in the target context, this may be especially the case in expert discourses or within activists and supporters of the respective causes. However, the idea has not yet spread into the everyday elemental discourses and "regular people" may have never heard of the concepts dealt with in the co-creation initiative. The appreciation of co-creation as a means for more democratic participation and self-determination is thus limited to very limited societal domains and groups or even. Co-creation may not yet be known or understood in other societal domains.

Non-existent	At this stage, the target context is neither familiar with co-creation, nor with the topic of the co-creation-initiative to be carried out. This seems to be the case, if the process is externally planned and brought into a pre-existent surrounding. Moreover, also socio-economic standards and the geographical level play a crucial rule in being familiar with co-creative activities or not – rural areas, for example, seem to be less familiar with it. The stakeholders from the context need to be informed about the topic on the one hand, and on the other hand they need to get familiar with co-creation, too.

Table 05 - Maturity scale - Discursive resonance of the co-creation topic

4.5.5. Co-creative capacity amongst stakeholders

Co-creation is fundamentally dependent on the participation of stakeholders of the addressed challenge. A varying composition of experiences, skills and motivation among stakeholders in an ecosystem affects the realization of co-creation. If stakeholders are not motivated, they may not participate and their specific skills and experiences may be missing. At the same time, experience and skills are diverse and can complement each other (see chap *3.2.2 Co-design as an established attitude, and structural formalization of co-creation*). For example, some policymakers may be experienced in delegating decision-making power in participative processes and might act as role-models. Some civil society representatives may bring specific skills in conducting participatory processes. Therefore the co-creative capacity of stakeholders in each context needs to be considered. Hence, Co-creation ecosystems can be characterized by different levels of capacity for collaboration, co-creation and participation and can be categorized accordingly.

Ideal type	Criteria for *Co-creative capacity amongst stakeholders*
Far mature	Stakeholders are eager to participate and experienced in participative processes. “New” ways of doing things come easy to them and they are willing to try new instruments and methodologies. They have an idea of what is important in co-creation regarding communication and modes of co-working. The initiators have little problems with the acquisition of participants. However, possible participants are also critical and due to past good and bad experiences with Co-creation they may leave the process, if it is not purposeful or they sense a kind of a token event. Moreover, as a response to regulatory restrictions in the pandemic, more externals participated in co-creative activities. Digital tools make the process more flexible and result in a high participation of more externals due to the missing travel movements.

Medium mature	In the field, "crowd pullers" and enthusiastic "lone wolfs" are happy to take part in shared decision-making processes. However, their conditions are not the best, as they are not supported by a wider system. E.g. if teachers want to make co-creation a topic in their classes, but headmasters are not willing to release them from the regular school routines.
Somewhat existent	"lone wolfs" who are motivated, but the actual end-users are not easy to reach. This might be due to personal circumstances and/or their low overall expectations in the process. Another example is the pandemic that brought challenges in attracting stakeholders together in digital formats. Hereby the motivation in being available is less because of the impersonality.
Non-existent	The initiators have high difficulties to get in touch with the relevant stakeholders, high rejection towards co-creation. Especially in times of the pandemic, these difficulties – concerning digital co-creative activities – came to light. Relevant stakeholders have to be highly motivated in these activities.

Table 06 - Maturity scale - Co-creative capacity amongst stakeholders

4.5.6. Infrastructure of co-creation

Having time and a physical space proved to be important resources for co-creation (cf. D2.3, pp 55-56). The physical space, where co-creation takes place in terms of an accommodation where people can come together to co-create, is a first step into institutionalising a co-creation routine. They may be understood as a creative leeway, where stakeholders are taken out of their daily routines and placed into another surrounding, which may support them into letting go of their entrenched working modes. On the other hand, they need time to do so. Time which they cannot spend on their job, with their families or in leisure. Therefore, the time especially end-users who are in most of the cases not paid for their participation needs to be beneficial for them in one way or another.

Ideal type	Criteria for *Infrastructure of co-creation*
Far mature	Professionalized infrastructure, Co-creation has a permanent, well equipped space where stakeholders can come together. Decision-makers on several levels like public administration and policymakers explicitly support the use of the established space for co-creation, for example as a Lab. Actors from diverse societal sectors and social groups support the maintenance, expansion or equipping of the space with resources at their disposal on a regular basis. Time aspects are considered carefully and the conditions for all actors in the co-creative activity are the same.
Medium mature	Semi-professionalised: the co-creation activities have space in general, but this room is not dedicated for such activities in the future. Therefore the physical space is rather insecure and stakeholders don't know whether there will be a space for future activities or not. Public administration and policy-makers are generally positive about the use of the respective space for co-creation, but provide support only sporadically or on a temporary basis. Supporters from other sectors of society are positive about using the space for co-creation and support on an irregular basis. The timely-resources of the participants are also not clear. E.g. some participants are released from work or school in order to participate, others are not. Some participants are paid for their appearance, others bring in their expertise for free. There is an imbalance in the equal distribution of resources which affects the time-resource.
Somewhat existent	There are a few initiatives, carried by motivated individuals or groups, who took over spaces in a self-directed way. This may be an empty building or a space in the neighbourhood. They have first events to which they invite external stakeholders. Public administration or policymakers support the use of this space only selectively. Supporters from other sectors of society are scarce and unevenly distributed. Concrete commitments or active support by externals are the exception. There may or may not be expressions of will or potential for more support. The time that stakeholders spend is their free-time and also the invitees are there for their private interest.

Non-existent	At this stage, there is no room yet, where people can come together and initiatives meet in private spaces of single individuals or reside in rooms from others (e.g. charitable institution, church, welfare organization). Support from public administration, policymakers and other sectors of society is not available or depends on contributions from motivated individuals. Opportunities for expansion may or may not exist but tend to be uncertain. The process is completely self-organized and people dedicate their private time for the cause.

Table 07 - Maturity scale - Infrastructure of co-creation

4.6 Implications for Policy Makers

The explanations in the previous chapters show that co-creation depends on a variety of very different framework conditions at different levels. A key learning from the chapter on Framework Conditions of Co-Creation Ecosystems is first that these different factors are interrelated. It is therefore important to recognize and understand **context-specific factors**. Just as Christiansen (2019) emphasizes the importance of trade-offs to be decided individually for the success of Labs, decisions in different ecosystems must be guided by their context-specific conditions. However, this does not mean that recommendations are not possible. It simply requires a more differentiated perspective. Based on the results presented in this chapter, it was possible to derive a first set of characteristics that can be used to assess and understand the maturity of ecosystems for co-creation. An important message for policy-makers is to first reflect upon the question: How mature is my own co-creation ecosystem at the moment? The outcome of this analysis can help to define achievable goals and milestones and prevent an overburdening of involved actors with too ambitious expectations. It can also help to define pilot projects for which a specific co-creation strategy applies and for which a new set of tools and methodologies is used.

A key objective of the co-creation process owner should be to formatively evaluate contents and methods as the two key aspects continuously throughout the process: Have we achieved the goals defined for the different steps? And how has the co-creation approach worked out, what can we do better next time?

In the following, some criteria and warning signs of ecosystems at different maturity levels are detailed. The aim is not to name individual examples. Much more, the elaborated ideal types based on the characteristics from chapter 2.5 represent ideal-typical constellations that do not have to occur in reality and probably will not occur. The aim here is to derive

recommendations based on these constellations that are transferable to as many of the diverse ecosystems in practice as possible.

4.6.1 Far mature collaborative ecosystem

We found **high developed contexts of collaboration especially in urban settings** as in bigger municipalities that dedicated themselves towards a culture of collaboration. The SISCODE co-creation journey *Remix el Barrio* offers an example of such an advanced collaborative ecosystem. At the same time, ideal-typically far mature collaborative ecosystems are an extreme and thus such contexts in full expression are rather unlikely. This ideal type is ultimately a form in which driving contextual conditions are present without cutoffs. In practice, there will probably always be diviring interests and attitudes towards collaboration, participation, hence also co-creation. However, if co-creation manages to develop into a routine and even becomes a new norm for the process of innovation some contexts will come closer to this ideal type - similar to the Barcelona ecosystem.

Far mature ecosystems of co-creation are situated in an environment where societal values and norms are supportive at different levels. Here, co-creation is part of social discourses and is perceived by major parts of society. The practice is widely recognized and accepted as an innovation practice. This framework is also characterized by a progressive culture that is positive about social innovation and new forms of innovation processes. This is expressed, on the one hand, in a will to participate in co-creation and to support co-creation across all areas of society and, on the other hand, in a political context that shares these values and norms and creates support infrastructures, which at the same time are framed by the formalization of such social norms of co-creation into legal norms. Due to the strong social anchoring of values of participation and democratic values, in these contexts the political ideas and the policy regimes rely greatly on an active civil society, presupposing their participation in processes of policymaking. This is reflected in a variety of official documents (e.g. policy agenda, legislative documents). Although all signs point toward a successful and sustainable implementation of co-creation in these contexts, it seems that certain barriers and risks derive from the high-professionalization of structures for co-creation. As co-creation is established as a practice, it may be already overstretched in some ways and all parties attached experience a kind of a positive or negative “participation fatigue”. Out of the regulations and standardizations, a narrow leeway is left over for grassroots-initiatives or stakeholders who want to plan their processes themselves. Furthermore, there is a risk of exploiting the public’s expertise without being reciprocal

about it. **What is more, "the regulars" who show up to the processes might tend to stay the same, especially in a narrow scope. This way, some voices, especially of marginalized people, might remain unheard.**

To take countermeasures, policy makers might:

- **Provide leeway and support** also for initiatives who do not want to use official structures
- Being **self-reflective and sensible towards power-asymmetries** in the process of co-creation
- Being **sensible towards biases in co-creation** and insist on the diversity of stakeholders

The establishment of co-creation as a widely accepted and applied innovation practice can also lead to the impression that no further effort is needed. If support infrastructures are in place and innovation processes are successfully and widely realized co-creatively, the impression could arise that further political support is not necessary. At the same time, co-creation is also situated in a dynamic environment and thus depends on consistently supportive framework conditions, which are continuously adapted to these dynamics. On the one hand, actors must continue to provide active support even in times of crises or changing priorities. **Policymakers and public administration must not only promote co-creation but also participate in it.** In addition, environmental factors can lead to co-creation being impaired. An important example is the Corona pandemic with its accompanying contact restrictions. **Co-creation projects can respond to** such **environmental changes and even draw creative momentum from them.** At the same time, however, hurdles may arise that cannot be overcome without additional support. It is therefore important that **political support is provided not only for the implementation of co-creation, but also for its continuation**. As a form of collaboration between a wide variety of social actors from a wide variety of fields, ongoing efforts are needed to maintain the necessary framework conditions. It therefore seems important that:

- **Support infrastructures are designed and established for the long term**. Legal norms can play an important role here if participation is stipulated and thus becomes obligatory.
- **Support programmes must continue to be maintained** when co-creation is already widely established, in order to continue to enable new approaches and new initiatives and to be able to react to obstructive dynamics.

- **Participation in co-creation processes must also become the norm for policy makers**. As societal decision makers, not only their support of co-creation and participation is needed, but also their own participation in co-creation.

4.6.2 Medium mature collaborative ecosystem

While far mature ecosystems are still an extreme and thus rather exceptional, the type of medium mature ecosystems is closer to practice. In such contexts, co-creation is already being taken into account and applied. However, it is not the dominant modus operandi of innovation processes and is thus only widespread in individual social sectors or subsectors, tends to be discussed only there and is also preferred only partially. Thus, there is basically room for more support in all areas and for establishing or at least further diffusing co-creation. These ecosystems might be especially present in **contexts of inert structures,** where participation is wanted by wide parts of the society, but a rigid set of established structures and a narrow landscape of organizations prevent new solutions from flourish.

When a medium mature collaborative ecosystem is characterized by path dependencies and an inert capacity for change, **policy can play a critical role in activating change toward more collaborative and co-creative innovation practices**. Several examples from the analyses show that progressive and participatory policies can set a crucial framework to foster diffusion and uptake of co-creation:

- **Co-creation benefits from a policy environment** in which p**articipation and self-determined decision-making** by citizens are desired and encouraged.
- If **policy agendas towards more participation explicitly mention the potential of co-creation**, they also offer a concrete approach to operationalize RRI as well as a link to methods and conceptual discourses; in this way, co-creation can diffuse from societal sub sectors into the mainstream, hence benefit from the policy framework.

In this type, however, the political environment of co-creation is usually characterized by diverging interests, and accordingly there will also be public institutions and policymakers who do not want to promote participation and co-creation in innovation processes and thus RRI. It therefore seems particularly **important that policymakers and public institutions forge partnerships beyond the boundaries of the political sector.** Civil society associations in particular can play a significant role here. Equally, however, it is important to engage other innovators. Whether in the co-creation of policies or in the co-creation of services or

other products, innovation processes ultimately benefit from the participation of a wide variety of actors in transdisciplinary settings. In the sense of discursive resonance (Pel et al. 2020), this can create an environment in which the value and potential of co-creation for innovation processes is recognized. Transnational institutions and policies in particular can play a key role here. The realization of co-creation in practice is already often promoted by EU Programmes. If the awareness of the efficiency of co-creation processes in the member states and their regional and local contexts grows through successful practice examples, the dissemination of co-creation could benefit significantly.

4.6.3 Somewhat existent collaborative ecosystem

In somewhat existing collaborative ecosystems, the situation is fundamentally similar to that in medium-mature collaborative ecosystems: infrastructures and support for co-creation are fragmented and not widespread. Participation is not a widespread value and accordingly not a norm in innovation processes. RRI and co-creation may be more dependent on expert discourse and individual social groups - for example, civil society initiatives. However, **a key difference is that the vast majority of actors in the social context do not use, prefer, or even prevent co-creation**. At the same time, however, fragmented structures that can foster co-creation are identifiable, and thus actors that can promote RRI, operationalized as co-creation, can participate in the genesis of a more conducive ecosystem for co-creation.

More than in medium mature forms of co-creation ecosystems, **the identification of willing actors and the establishment of collaboration and cooperation is therefore necessary**. Similar to medium mature ecosystems, these can be especially civil society initiatives that already pursue collaborative and participatory approaches. It can also be important to involve experts who are already engaged in a discourse on co-creation. The most important goal in such contexts must ultimately be to create more awareness of the potential of RRI and co-creation for accepted and sustainable innovations. In such contexts, a base of actors and activities already exists that practice co-creation and RRI. It is therefore primarily a matter of finding these actors and bringing them together. Here, policies can, again, play a strong role in contextualizing and promoting RRI and co-creation, as well as highlighting the potential and initiating supportive, broad-based discourses.

At the same time, these are often **contexts with experience of crisis and compulsion to take action.** This means that out of the experience of undergoing a crisis (e.g. following the

financial crisis or a local crisis on the labor/real estate market or in the political system, the urgent need to change arose.

4.6.4 Non-existent collaborative ecosystem

In non-existent collaborative ecosystems, there is an overall lack of structure, values and norms of collaboration, and a broad base of actors interested in co-creation and RRI. The practice of co-creation is thus also an exception, and collaborative or participatory approaches are generally rare. Hence, RRI is also, at best, a concept taken up by experts, single social groups or individuals. In line, in these contexts envisioned change is rather citizen/end-user driven as they seek to have a say in the development of solutions or decisions from which they are affected the most.

A discourse around co-creation and RRI is not carried out on a broad scale and may be completely absent or only observable in single domains - for example, in the work of individual experts with impact in other contexts beyond their own national, regional, or local context. Thus, this ideal type also represents an extreme and will remain rather the exception in practice, even in individual areas. In such extreme cases or in ecosystems that are similar to this extreme ideal type**, fundamental political programmes for opening up innovation processes might be a necessary first**:

- Policies should aim to i**nitiate a social discourse on participation, co-creation and RRI**.
- If possible, policies should also **enable pilot projects and create awareness** for co-creation and RRI in the political and public sphere
- Where appropriate, it could be necessary to s**timulate an open discourse around existing practices and possible pathways for change**.

Overall, in such contexts, it seems important to address existing values and norms and, in particular, traditional forms of progress and to renew them in the longer term. This may require additional means, such as the use of digital technologies, which can trigger an interest in RRI and participation in innovation processes. Overall, it seems particularly important in such contexts that **a progressive and collaborative culture is initially triggered** in the first place. Traditional dispositions toward political decision-makers or public administration can play a role here. For co-creation to be successful, **public and political actors must also be perceived as collaborators at eye level** and may initially be prepared to move away from top-down logics.

5. Instances of SISCODE's model of co-creation ecosystems for RRI

One of the declared intents of SISCODE was indeed observing how policies and policymaking can be transformed by being closely involved in and exposed to participatory practices ignited by real needs from the societal context, increasing their implementability and effectiveness, while attaining higher levels of social responsibility, accountability, and acceptability (Bezzi et al. 2019). Broadening the view moving from the single experiments performed in the co-creation labs to the larger policy landscape is important, as the institutional framework in which the co-creation process takes place can also condition the way in which the solutions are developed. This can lead to making the process explicit and inclusive of the different institutional actors, so as to achieve change, which can take place as much at the level of the organization as at the broader level of the context or ecosystem in which the organization operates.

Each of the real-experimentations that took place within SISCODE's co-creation labs was analysed as a case study, providing a solid ground for advancing our reflection. From the analysis of the existing cases, the biographies and the pilots as case studies derived an array of **descriptors**, as coherent units of meaning concurring to describe **specific influencing factors and dynamics of co-creation**. The discussion that follows is structured according to the main descriptors identified (Table 08). Descriptors are clusters of factors and dynamics, depicting the variety with which co-creation in RRI develops in innovation ecosystems. It is through the combination of factors synthesised by each descriptor that variants and dynamics of ecosystems emerge, with their multiplicity and diversity.

No	Descriptor	Underlying topics	Key issues discussed
01	**Infrastructure and context of co-creation**	• Infrastructures • Environment • Policies	The infrastructure of co-creation defines all kinds of tangible and intangible structures that may support or hinder co-creation in the environment. They can range from physical spaces and buildings to digital platforms and collaborative spaces. Also existing policies and regulations together with (long-term) support activities have an impact on the application and success of co-creation and its embedment.
02	**Knowledge exchange, learning and organizational**	• Knowledge exchange • Organizational learning	Co-creation may trigger learning processes and the building of new capacities within an organization that have been observed in SISCODE both as learning-by-doing processes and peer-to-peer learning.

	transformation	• Organizational change • Organizational transformation • Flexibility	From these new capacities going beyond the project, eventually organizational change and transformation was triggered as a result. Current structures and the overall flexibility and openness of a system fundamentally influence this process of change and transformation.
03	**Culture of co-creation**	• Progressive culture • Culture of co-creation	The overall culture of the environment significantly impacts on the opportunities and barriers to embed co-creation within an ecosystem. Both the specific culture in relation to co-creation and the culture that might be more or less progressive and therefore support or hinder the integration of co-creation and its aspects. A progressive culture in general may support the overcoming of routines towards novel pathways for innovation and the establishment of a co-creation culture and facilitate the interaction among stakeholders as well as the initiation of co-creation processes.
04	**Monitoring, assessment and adaptation**	• Monitoring and assessment • Self-evaluation • Adaptation	Monitoring and assessment is a common issue in proving the efficacy and effectiveness of single solutions as well as an overall approach. The complexity and effort required to set up and conduct assessment activities are to be considered as well as their results that may require a (partly) adaptation of the processor the entire initiative.
05	**Formalization of practices**	• Familiarity, • Embedment of practices, • Formalization	The familiarity with certain practices and their following formalization and embedment. This formalization does not only depend on the level of familiarity but also on the capacity of an organization to adapt and react to ongoing processes and changes by establishing new practices. On the other hand, active application and experimentation with new practices can trigger a learning-by-doing process leading at first to a certain degree of familiarity that then may be turned into their formalization.
06	**Governance, interaction among actors and mediation**	• Governance models • Roles of actors Dynamics among actors, • Mediation • Communities • Networks	In relation to governance models two key factors are to be investigated relating to the distribution of power among stakeholders and the level of involvement. The discourse touches bottom-up and top-down dynamics and the specific role of actors within these dynamics. Here, drivers and barriers of constant engagement and participation are discussed as well as the immediate dynamics emerging from the interaction among stakeholders that may derive from or lead to the

			creation of communities of interest and networks. The implications of such networks and communities going beyond the single initiative are discussed in this descriptor.
07	**Tangibility, role of single initiatives and prototypes**	• Implementation • Concrete solutions • Scaling • Replication	Specific initiatives, topics and prototypes of co-creation experiments can function as boundary objects both to develop a concrete solution and as a tangible object for testing co-creation, enhancing capacity building and long-term impact and transformation within an ecosystem. The implementation, scaling and replication of a specific solution can extend this role as a boundary object beyond the single initiative.

Table 08 - descriptors and key issues addressed.

5.1 Infrastructure and context of co-creation

Dedicated spaces and environments play a pivotal role in the establishment of an environment that enables exchange, making and learning (Kokko & Hirsto, 2021; Giannakos et al., 2017). When introducing co-creation, such making and learning-through-making processes do not only require guidance and support, but a space that enables learning (Kokko & Hirsto, 2021).

A **dedicated space**, whether physical or digital, to carry out co-creation activities has been identified as a **point of reference** for all participants and stakeholders. Co-creation activities taking place in a dedicated space are perceived as more established and in turn their embedment and institutionalisation may be facilitated (Eckhardt et al., 2020).

A dedicated environment can also support the **clear distinction of co-creation from other approaches and practices** supporting its perceived benefits on one hand while, if associated with negative experiences or undergoing a difficult period, it can also trigger negative impressions.

Adopting a different system in terms of hierarchies, co-creation needs to establish a **safe space for all involved participants** (Ind & Coates, 2013). To create this safe space and balance power relations among actors, both the physical or digital space where co-creation takes place and the mediation among stakeholders (see chap 5.1.6).

Especially relating to the Covid-19 pandemic, the **transition from physical to digital spaces** has been mentioned as a point of attention to be taken in consideration also in terms of creating a safe space even without direct human interaction. Also the eventual lack of digital

skills or missing familiarity with tools and software needs to be considered to allow participants to access and exploit the co-creation space (see also 5.1.6).

A key factor when speaking about the environment and context of co-creation in a wider sense is the **political and institutional landscape of operation**. When favouring collaboration and being open towards new approaches it can support co-creation and its spaces can enhance embedment and scaling up processes. On the contrary, its decisional power and influence on the overall environment enables the political regimes and institutions also to be an important barrier to the application of co-creation. Apart from the establishment of policies that favour participative and collaborative decision making, mature co-creation ecosystems are characterised by constant dialogue and exchange with leading political institutions.

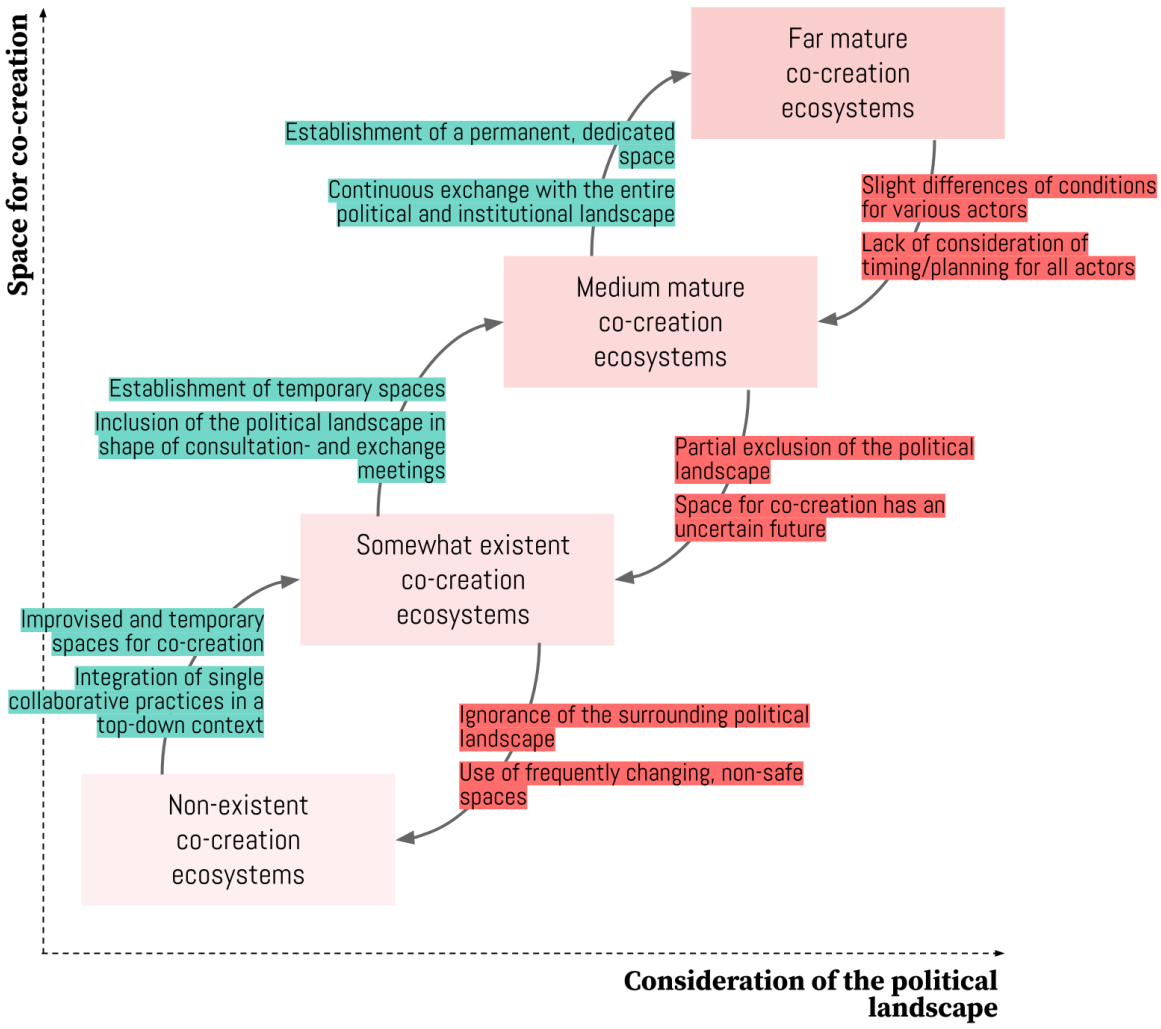

Fig 11 - Dynamics and maturity levels - infrastructures of co-creation.

5.2 Knowledge exchange, learning and organizational transformation

A result of co-creation is the **building of capacities within the entire ecosystem** not only referring to single groups or organizations but taking into account the dynamics among them and the potential for cross-fertilization or hindering (Bogers and Horst, 2013). Especially a series of **soft- and relational skills**, like empathy or facilitation competencies, emerged as fundamental to maximise the effectiveness of co-creation activities (Lubicz-Nawrocka, 2019). Looking at the overall process, mindful, mind-opening conversations in which persons with various backgrounds, perspectives, and scholarship contributed, were productive and led to the generation of innovative ideas. Proving to be key resources to support innovation, constructive dialogues and confrontation concur in building a vibrant environment that nurtures and catalyses innovation. From the point of view of organizations and stakeholders, when inclusive and effective participation integrates communities and other societal actors, it **triggers valuable dynamics of knowledge exchange and peer-to-peer learning** (Cross et al., 2003). This results to be highly beneficial in **building new capacities and spreading them across organizations and ecosystems**, supported by the knowledge and experience exchange of similar cases and best practices. The exchange and confrontation favoured the acquisition of new expertise linked for example to the capacity to successfully manage and facilitate the relation among heterogeneous groups, balancing power and dominance. As a consequence, the constant exchange that occurs within the co-creation process and its iterative cycles enables **cross-fertilization through sharing knowledge and capabilities**. This can provide competitive advantages deriving from collaboration instead of competition (Paswan & Wittman, 2009). Finally, the co-creation process can lead to identifying flaws regarding how co-creation itself is conducted, both in terms of structures and processes. As a consequence, it can trigger reflection on the current practices feeding a transformation in the organizational culture, favouring a reframing and revision of established mindset and habits. In other words, cultural change occurs through adopting new practices rather than vice-versa.

Therefore, in terms of **transformative change and organizational learning**, the span varies from the acquisition or exchange of knowledge, skills and capacities, to the retainment and appropriation of tools and other resources to be scaled and implemented beyond the project.

Relating to **organizational transformation** the overall flexibility and the capacity to react to changing circumstances as well as the availability to integrate new approaches and methods depend not only on the single organization involved, but on the surrounding ecosystem itself. Influencing factors are its overall culture (Alves et al., 2016; Herington et al., 2009; see chap 5.1.3), its scale, mindset, regulations and legislation (see chap 5.1.1). Dynamic and often small organizations like fab labs have proven to be particularly fertile ground with their culture being already based on horizontal structures, collaborative working and adaptation. Larger and structured institutions on the contrary may be hindered by legislations and structures and, if successful, require more time to achieve in-depth change. The project dimension can be a potential driver to trigger this change: The possibility to apply co-creation in a limited and extraordinary context grants immersion into a new practice and the opportunity for a step-by-step integration to carefully explore effects and consequences. It still implies the possibility to formalize practices that have been proven successful on a broader level (see chap 5.1.5).

The **change of mindset** required and the questioning and renovation of existing practices mark organizational transformation towards a more mature co-creation ecosystem. In some cases, a drastic change can be necessary and require the modification of the practices, ways of working and underlying culture of an organization.

The **interaction of organizations and institutions at different levels of maturity** in respect to capacities for co-creation imply both the possibility of enhancing or decreasing the level of the single entity depending on the evolution of the dynamics among the parties.

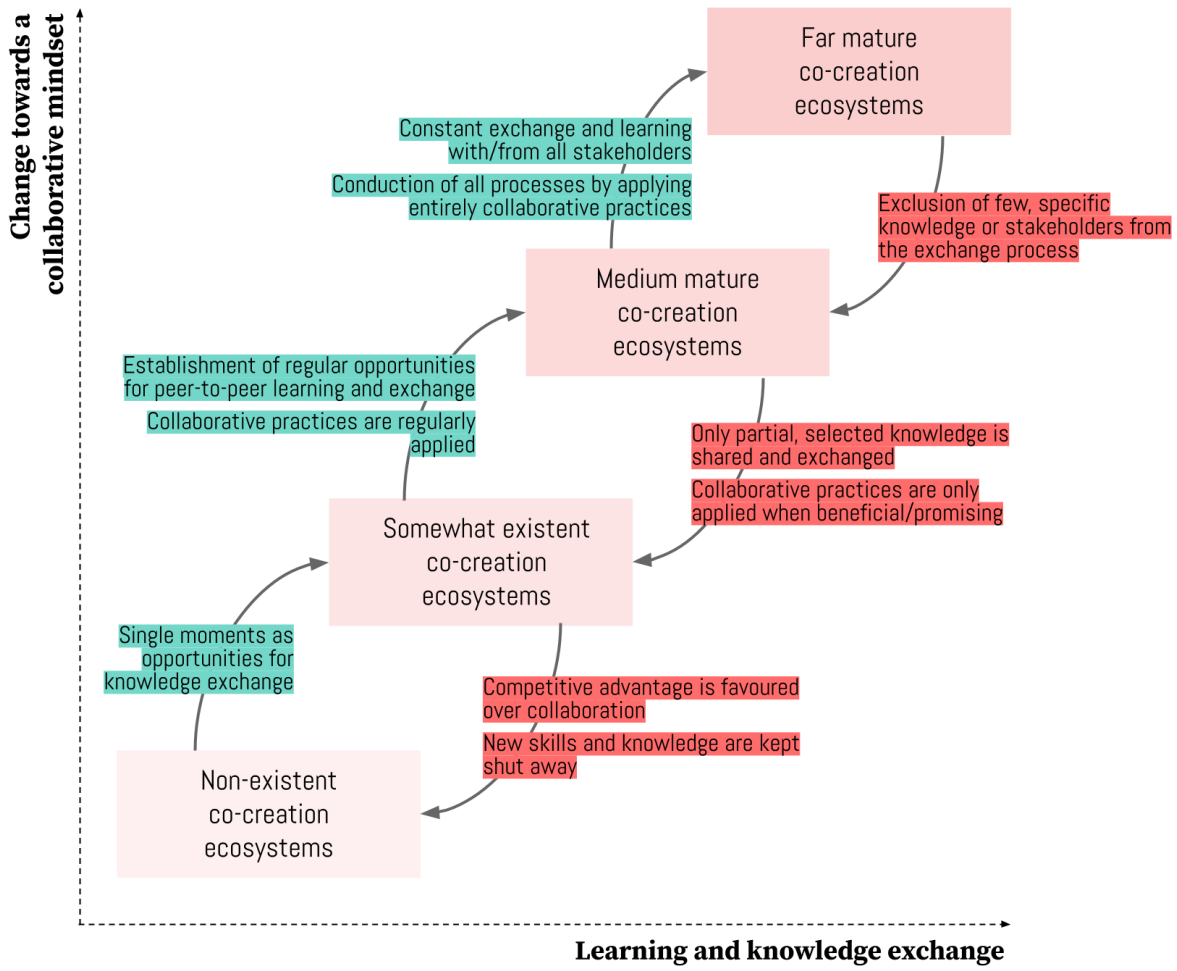

Fig 12 - Dynamics and maturity levels - Knowledge exchange, learning and organizational transformation.

5.3 Culture of co-creation

The culture of co-creation describes the ideas, behaviours and particularities of groups and societies in relation to co-creation and its key characteristics. In this respect, some aspects of the culture present in ecosystems at the point of introducing co-creation are to be analysed as well as the cultural aspects and characteristics of co-creation itself. The **cultural context where co-creation takes place** is as fundamental as the infrastructural one (Akaka et al., 2013; see 5.1.1) to enable its core principles of participation and collaboration. Cultural conditions that are particularly favorable can boost co-creation. On the other hand, institutionalised processes and strictly organized top-down regulations can hinder both the embedment of co-creation and its application. This leads to the complication or even elimination of practices like stakeholder engagement that are core elements of co-creation.

The **progressiveness of the environment** is a key factor both in introducing co-creation as a practice and establishing a culture of co-creation. The overall innovation-friendliness and

the openness to change and adopt new approaches is key (Slater & Tonkiss, 2013) since both co-creation and innovation have a transformative aspiration which aims to trigger development and transition to new cultural values. Furthermore, a progressive culture can already be closer to a culture of co-creation favouring collaboration, exchange and inclusion.

The **general familiarity with co-creation, its practices and potential results** can not only facilitate its introduction and a step-by-step integration in the overall culture, it also influences the overall presence, **the discursive resonance**, that co-creation has in an ecosystem (Pel et al., 2020). A discursive embeddedness of the topic can lead to increased familiarity and facilitate the formalization, cultural change and overall presence and awareness of the topic on a broader level.

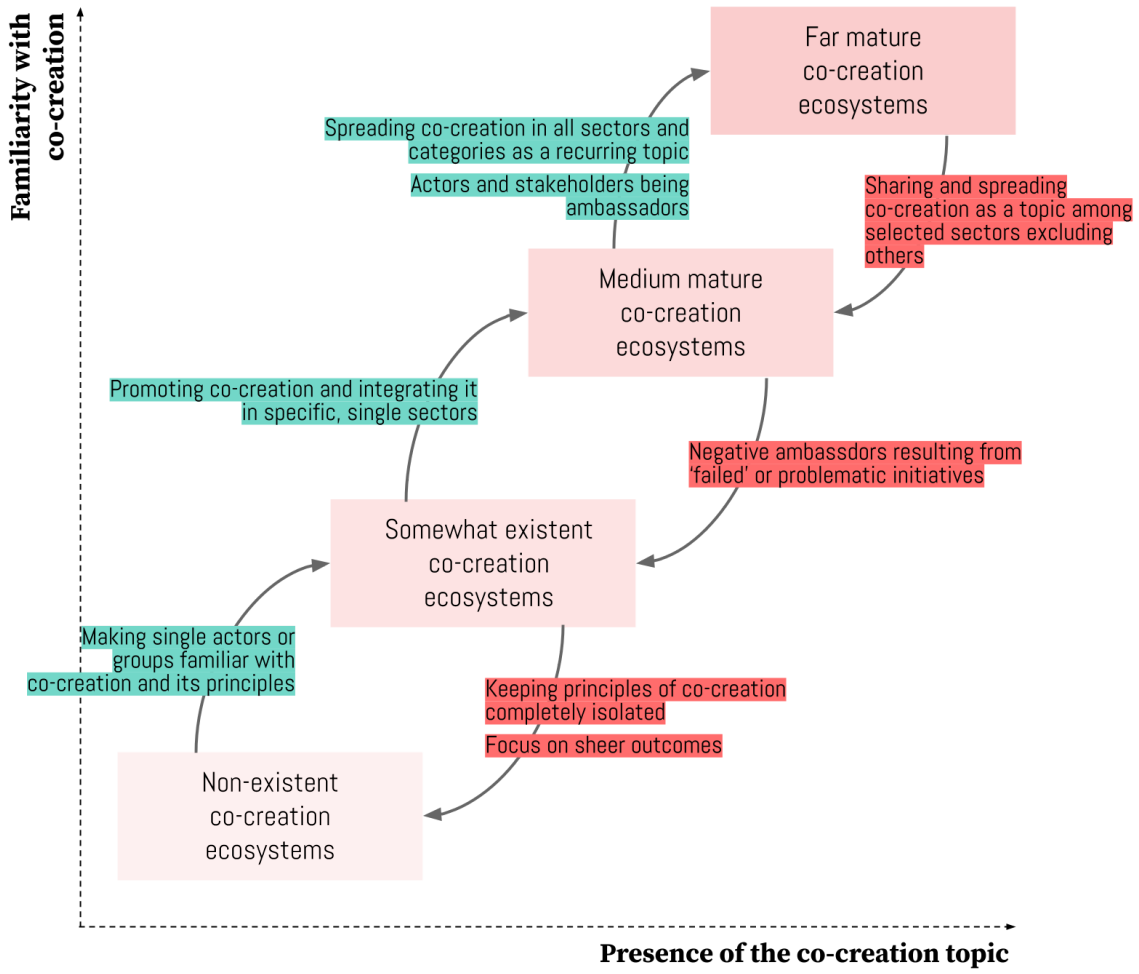

Fig 13 - Dynamics and maturity levels - Culture of co-creation.

5.4 Monitoring, assessment and adaptation

Monitoring and assessment as well as the implied need for adaptation of initiatives was identified as an acute and crucial issue in both central fields of SISCODE, RRI and co-creation (Decoster et al. 2006; Hansen and Allansdottir 2011; Kurath and Gisler 2009; Loeber et al. 2011). It extends over **different levels** from the evaluation of the direct outputs of co-creation to short-term outcomes like the adaptation of tools and activities to long-term impacts like the permanent transformation of processes and practices and the way in which value is created.

The scope of monitoring and assessment goes beyond the sheer functioning of the process and its adjustment, especially for co-creation experimented on a small-scale, evaluation and impact assessment is crucial to assess and communicate results and make considerations on further implementation and scaling. This exceeds the developed solution and the created value itself extending to the **impacts and transformations triggered within the ecosystem**. In this respect, it can be directly related to the dimension of the prototype and initiative as a boundary object for broader impact (see chap 5.1.7).

The **complexity of assessment practices** can be traced back on the previously stated individuality and context dependency that characterise both innovation- and co-creation initiatives and the capacities present in relation to monitoring and assessment (Mulgan, 2006; Schmittinger et al., 2021). All these aspects make assessment activities **complex, demanding and time-consuming** from their planning and set up to the monitoring itself and the evaluation of results, but crucial both for carrying out an effective co-creation process reacting to the dynamics occurring in the surrounding ecosystem and the self-reflection and evaluation of impact on a broader scale.

In addition, similar to the overall co-creation process, monitoring and assessment requires a **general structure and frame as a formalized methodology** that supports in setting up strategies and plans for assessment **providing tools and methods that can be chosen and adapted according to the specific needs and dynamics**. In this respect, it can be directly related to the dimension of *Knowledge exchange, learning and organizational transformation* as the capacity to plan, set up, conduct and evaluate assessment activities. These capabilities as well as the activities themselves can lead to increased motivation among stakeholders, perceived additional value and recognition of assessment activities as an opportunity of learning and knowledge acquisition in themselves through change of perspectives and self-reflexive practices.

A **missing culture of assessment** or the sheer focus on quantitative data can hinder the implementation and embedding of assessment practices for co-creation often characterized by its qualitative aspects. Also, the process of adaptation may require **breaking out of long-established structures and planned activities**. The presence of rigid and regulated structures, especially present in large or public organizations can be a barrier to adaptation and flexibility due to both the surrounding legislative framework and the strict and fixed mindset that often characterises this type of organization.

The practice of **adaptation** refers to the need to design new strategies and processes reacting to the results of the evaluation with an adaptation of the process. This in turn is related to the dimension of *Co-creation culture* as the **openness both to the adoption of a new approach to evaluation and the reaction to the results of assessment activities by adapting according to its results.** It is required to ensure that the various actors' needs are met, the stakeholders' engagement is ensured and the addressed challenge is effectively tackled. This may be done by reconsidering single activities or even modifying entire initiatives and changing elementary directions. The recognition of the need for adaptation and the resulting process is a direct result of evaluation activities.

The need for change at the base of this process results from the **interaction of multiple actors and stakeholders among each other and with the context** within the overall ecosystem. Considering the complexity and multiplicity of influencing factors, these dynamics can be partially forecasted, but not entirely foreseen. The effective dynamics may differ from the expected ones due to factors that have not been considered or that were not yet present previously and therefore require the continuous monitoring, evaluation and adaptation of activities and the process as a whole.

The **provision of a general framework** that already inherits the flexibility of adaptation to the general context and situation as well as throughout the process like the SISCODE learning framework was identified as a powerful tool (Real et al., 2019; Real et al., 2020). Equipping organizations with a general guidance and a variety of pre-selected methods and tools to be used and assessed for their efficacy and adapted according to the specific needs was identified as a starting point for a learning-by-doing process of acquiring new capacities in relation also to their adaptation. This was observed especially in relation to initiators of co-creation initiative with no or few experience in co-creation or dealing with entirely new actors or stakeholder groups.

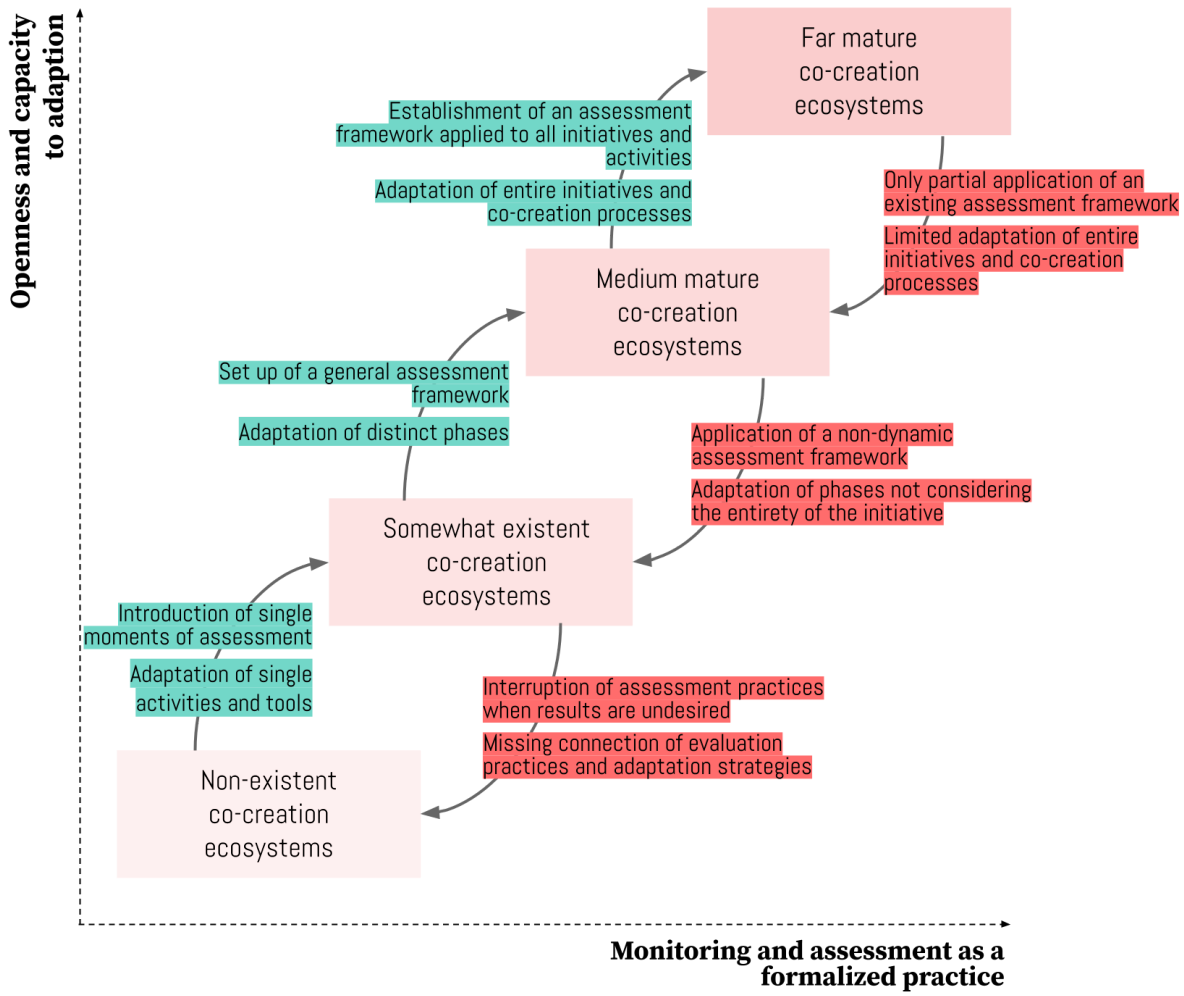

Fig 14 - Dynamics and maturity levels - monitoring, assessment and adaptation.

5.5 Formalization of practices

A paramount principle of RRI is that innovation can become more responsible thanks to the concrete inclusion of multi-level stakeholders and users from multiple backgrounds throughout the process of designing solutions (Gurzawska, Mäkinen & Brey, 2017). In this sense, the reasoning on the analysis conducted demonstrates that the actual proneness and ability to effectively apply co-creation as a practice and involve multiple actors in the design process is often bound to **familiarity with practices both in terms of knowledge and capacities for their application** (see chap 5.1.2) and the formalization of the new practices for their embedment and regular application related to the planning, conduction and evaluation of co-creation activities and the involvement of external actors in the organization where the co-creation takes place.

In terms of formalisation, ecosystems range from very informal application to a clearly structured and formalized application, which can be established both bottom-up or

top-down. In between these poles, several degrees of practice and combinations can occur. This considering that even when co-creation is an established, highly integrated practice, its application strongly depends on the overall **structure of the ecosystem and its governance**. Therefore, the formalization may occur both on a micro scale with practices being formalized within a single organization or entity or on a macro scale with the establishment of regulations and policies that prescribe the regular application in specific conditions.

On the one hand, an **unstructured application can result in more flexible approaches** where practices such as volunteering and informal organization are favoured, frequently leading to serendipitous outcomes. This case is frequent especially in small- and medium-scale organizations. In context used to more explorative and open-ended approaches and informal and flexible implementation, fuzzy and dynamic processes featured by fewer constraints are recognised as triggers for often unexpected results and serendipitous solutions. The application and experimentation with co-creation can lead to increased familiarity and structural formalisation of practices, especially in smaller organizations, often through a learning-by-doing process. Here, additional knowledge and capacities may derive from the cross-fertilisation with stakeholders from various domains shaped as novel scholarship, expertise, methods, approaches, and tools can easily be shared and scaled within and beyond the organization, becoming an asset to broader communities (see chap 5.1.2).

These two dimensions of a macro- and micro level are directly interconnected. The **formalization of practices on a smaller scale may influence policies** favouring or hindering co-creation in larger ecosystems. In turn, larger and more structured organizations or institutions as well as entire policy landscapes impact significantly on the micro level. When co-creation is not an established practice and mindframe, the size, nature, and governance of the organization often situates the co-creation practice to a particular project and team in a circumscribed process, hindering the scaling from the project-specific dimension to that of the institution as a system where co-creation is embedded as a cultural mindset. However, the replication at the project-scale can lead to an opening to the practice and the results obtained by its application, enabling the institution to understand the dynamics and possible benefits. When effective and successful, a punctual replication within the safe space of well-defined contexts can make an institution progressively more familiar and open towards co-creation, setting favourable circumstances for an uptake beyond the project- scale of the overall organization. Therefore, in bigger organizations a **small-scale co-creation experiment can function as a trigger** for a

step-by-step embedment, starting from punctual activities and single projects which involve entities such as single teams or departments to be then scaled up to other departments and entities (Janamian et al., 2016).

One key factor not only in the introduction but also in the formalization of practices is their **diversity in respect to the established ones and the novelty** of particular stakeholder groups involved. Transitions to new practices and the formalization of ones similar to the existing ones are facilitated by the similarity and the familiarity with similar approaches while in very different contexts, an intermediate step or a step-by-step introduction can facilitate and enable the transition process. One opportunity is the previously described example of using single projects as triggers and an opportunity for step-by-step introduction.

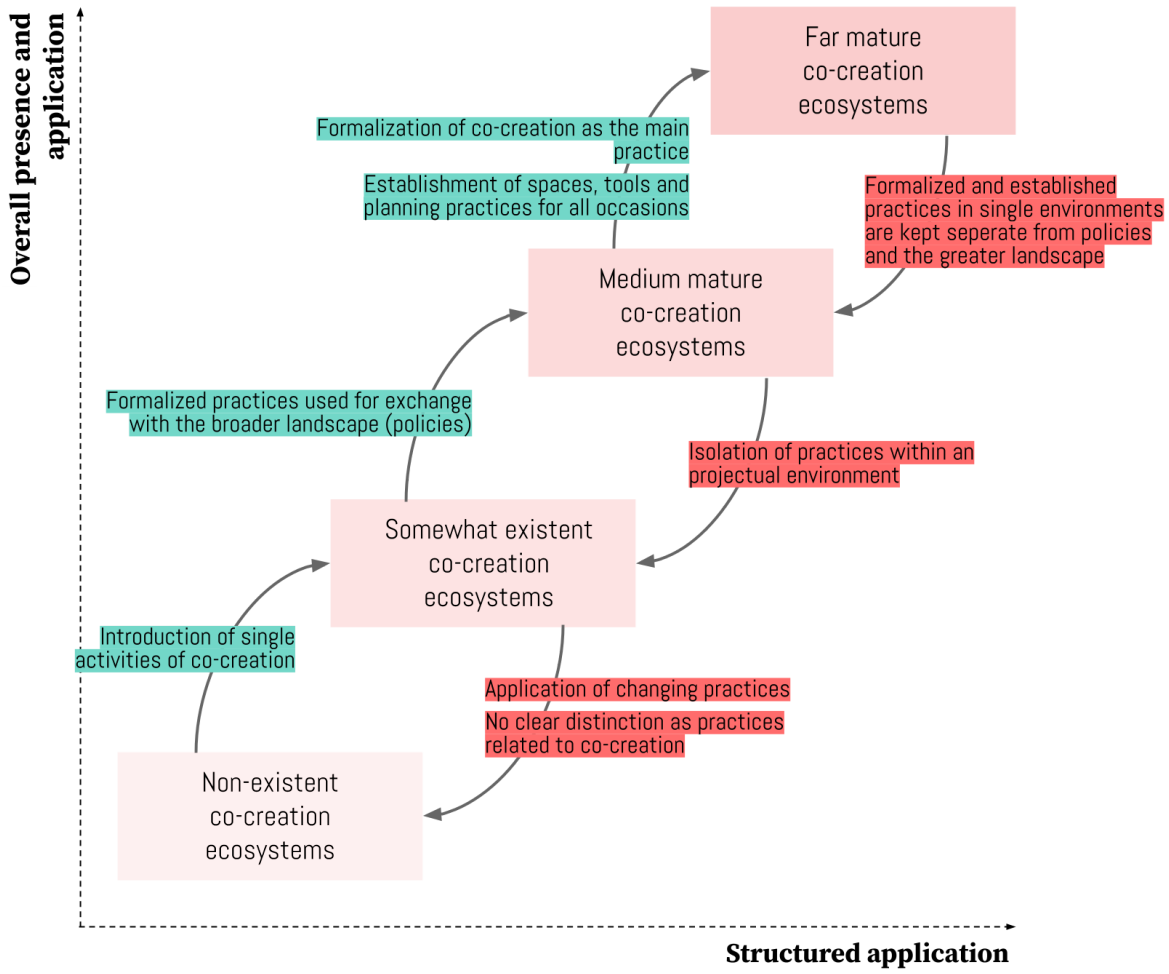

Fig 15 - Dynamics and maturity levels - Formalization of practices.

5.6 Governance, interaction among actors and mediation

The involvement and role of stakeholders and actors of the ecosystem in the co-creation process is fundamental for the entire approach (Ramaswamy & Ozcan, 2020). The variety of skills and capacities, knowledge and interests as well as the approach towards active participation and collaborative development raise a series of issues in relation to the engagement and management of stakeholders and the dynamics among them.

The **issue of governance** has been identified as a delicate topic in projects related to co-creation as the balancing of a horizontal distribution of power while ensuring the presence of the necessary competencies for responsible yet collaborative decision making (Ansell & Torfing, 2021). Here, the structure and nature of both the organizations where the co-creation initiative takes place, and of the stakeholders involved can affect its practice. The discourse of power distribution deals with the capacity of **finding a balance between bottom-up and top-down decision making**, while soliciting broader or punctual involvement and participation along the co-creation process, depending on the development phase and task to accomplish. Here, decisive power can truly empower and enable actors to integrate their needs and wants in the final solution and defines to what extent co-creation can be embedded as a practice on the long-term (Voorberg et al., 2017).

A fundamental premise to be considered in terms of **roles that stakeholders have in a co-creation ecosystem** is that on the one side **roles can vary** according to the phase of co-creation, and on the other the **contribution of specific stakeholders may change** throughout the process depending on their skills and expertise. However, the need for a clear division and distribution of governance can be finalised to the management of mechanisms such as collective decision making and budgeting, aiming at incentivising and retributing the stakeholders effectively involved in the activities. That said, the participatory practice often favours and to certain extents even encourages an **alternation or overlapping of certain roles**. While recognising that a clear identification of the roles provides a clear institutional and governance setting, ensuring the efficacy of the project, it is also recognised that roles as that of the mediator and facilitator can be played by different actors according to the specific phase of the co-creation and need. The collaborative approach instead of a top-down approach can apply not only to the development of a solution but to the process and its planning itself, allowing the involved stakeholders to co-create the process, influence the activities, and have an impact in terms of decision making.

In terms of **full involvement of stakeholders**, the term does not necessarily refer to involvement in all activities, along the process, but rather to an **effective and actual engagement**. Given this premise, the ecosystems can span from a constant involvement to a more punctual one, where it makes sense and is relevant for both the initiative and the stakeholder, considering the willingness and availability of the latter to contribute to that phase of the process. Nevertheless, independently from their involvement in a specific moment, it is crucial to communicate the progress of the co-creation, maintaining high the motivation of all the stakeholders involved along the process, and providing them with the chance to make informed decisions.

With stakeholder involvement being a core aspect of both co-creation and RRI, the **creation and cultivation of networks and communities** was identified as highly beneficial for the development of responsible and effective solutions and the co-creation of value (Svendsen and Laberge, 2005).

During the first steps of defining potential partners, the general openness to identify and engage new communities and build networks can be related to the overall dimension of *Culture of co-creation* (see 5.1.3). Networks and communities are directly connected to the **definition of their involvement** and the distribution of power among the involved communities and networks in relation to the agreement on **incentives and reciprocal benefits**. They may both be involved as established networks or created from scratch gathering actors around a specific topic to shape a community of interest. The affiliation to a community can make engagement more effective and the establishment of common goals increases a sense of responsibility and motivation stimulating regular interaction. New partnerships and connections present the need of clearly outlining goals and benefits to enable a collaborative mindset.

The dynamics among stakeholders can not only lead to the formation of communities and alliances but also to **competition and conflicts of interest** (Pera, Occhiocupo & Clarke, 2016) hindering the co-creation process and not allowing to fully exploit the capacity of the single stakeholders and groups.

Moreover, the importance of the **co-creative capacity of the involved stakeholders** and actors needs to be mentioned. The dimension of knowledge exchange, learning and overall capacity to co-create does apply to the entire ecosystem and all of its actors. Previous experiences in co-creation initiatives can be beneficial in the application of co-creation and enhancing the building of capacities of other actors. On the other hand, previous

experience and knowledge can also limit the freedom and creativity of groups when they decide to stick to well-known practices, tools and ideas.

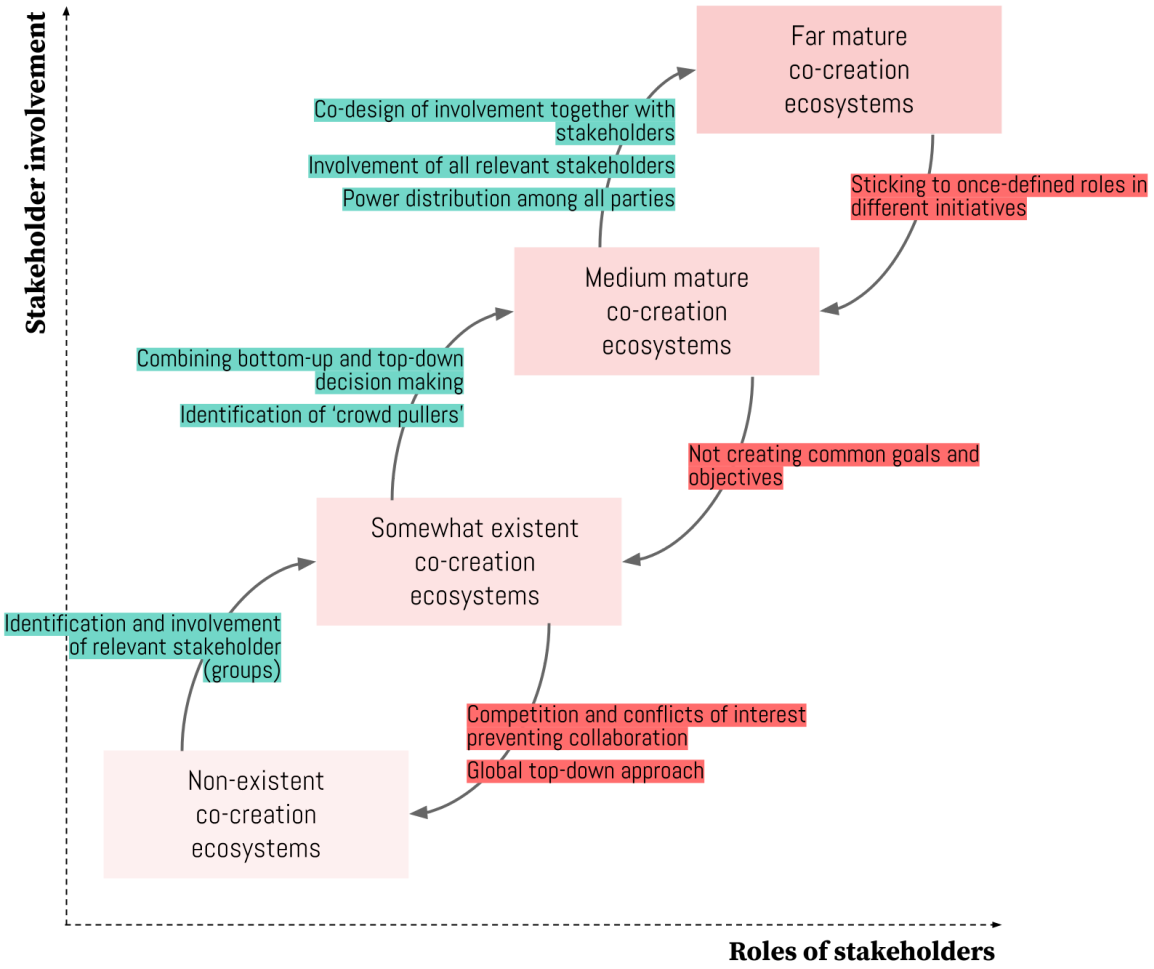

Fig 16 - Dynamics and maturity levels - Governance, interaction among stakeholders and mediation.

5.7 Tangibility, the role of single initiatives and prototypes

Prototypes and implementations as a direct outcome of a co-creation has been identified as a multifunctional means going far beyond the development of a solution eventually triggering further reflections on the prototype itself or processes of learning and knowledge exchange (Coughlan, Suri & Canales, 2007; Bogers & Horst, 2013). The role of prototypes in design was pointed out by Zimmerman, Forlizzi & Evenson (2007), who highlighted how artefacts that are being designed can function as means for concretizing an envisioned future, making it tangible and connecting it to concrete actions and directions.

Prototypes, especially when developed on a smaller scale, can be **scaled or replicated** to achieve broader impact in respect to the initial, restricted environment. This allows the testing and experimentation with risky and disruptive solutions in a restricted, local

environment to then aim at scaling them on a regional, national and international level. It takes the role of a testing object, the term prototype originally referred to a first draft of a product to be later mass-produced as a representative version to test reactions, application contexts and interactions (Stappers & Giaccardi, 2017). Outcomes of co-creation can adopt a similar role. In relation to scaling and replication of specific solutions, another opportunity for severely context-dependent solutions is the replication of scaling of the specific co-creation methodology instead of its results.

SISCODE declared the bridging of the gap between ideation and implementation as one of its main objectives and has found implementation processes as a key aspect when looking at co-creation from an ecosystem perspective. The prototyping and implementation does on one hand produce a tangible outcome of the co-creation process that can become an object of discussion and mediation among stakeholders not discussion principles and general points of view, but concrete objects and processes (see 5.1.6). Prototypes were identified as boundary objects in this sense reaching far beyond their scope as prototypes of a specific solution (Rizzo et al., 2018). They may not only function as an **object of mediation** but as a concrete example of application of co-creation as a best practice that can also **boost the learning mechanism when building new capacities and exchanging knowledge on co-creation around a concrete example** (Coughlan, P., Suri, J. F., & Canales, K., 2007; see 5.1.2). This may lead to a further promotion of the approach in cases of successful application and enhance the embedment and formalization of co-creation practices with bottom-up dynamics. These dynamics are closely interconnected and may support or hinder a variety of factors described in the previous paragraphs like the exchange of knowledge and learning processes (5.1.2), the establishment of a culture of co-creation (5.1.3), the formalization of practices (5.1.5) or the dynamics among actors and stakeholders (5.1.6). The identification of these interrelations make prototypes, concrete solutions and single, even small-scale, initiatives a powerful tool within co-creation ecosystems.

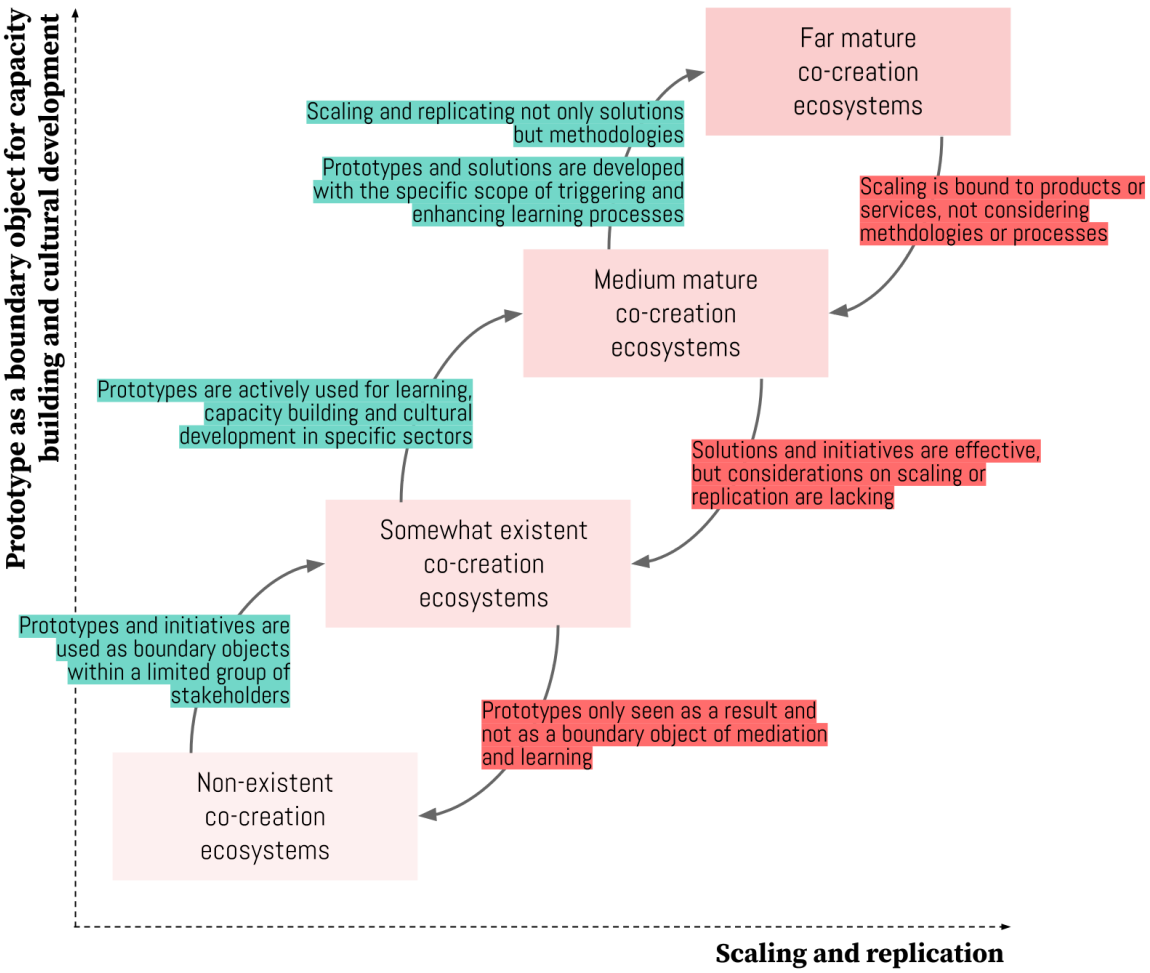

Fig 17 - Dynamics and maturity levels - Tangibility, the role of single initiatives and prototypes.

All of the descriptors detailed in this chapter are interconnected and dependent on one another. The enhanced or reduced maturity of an ecosystem in relation to one of the descriptors may also influence other factors as shown in the graphic below (Fig 18).

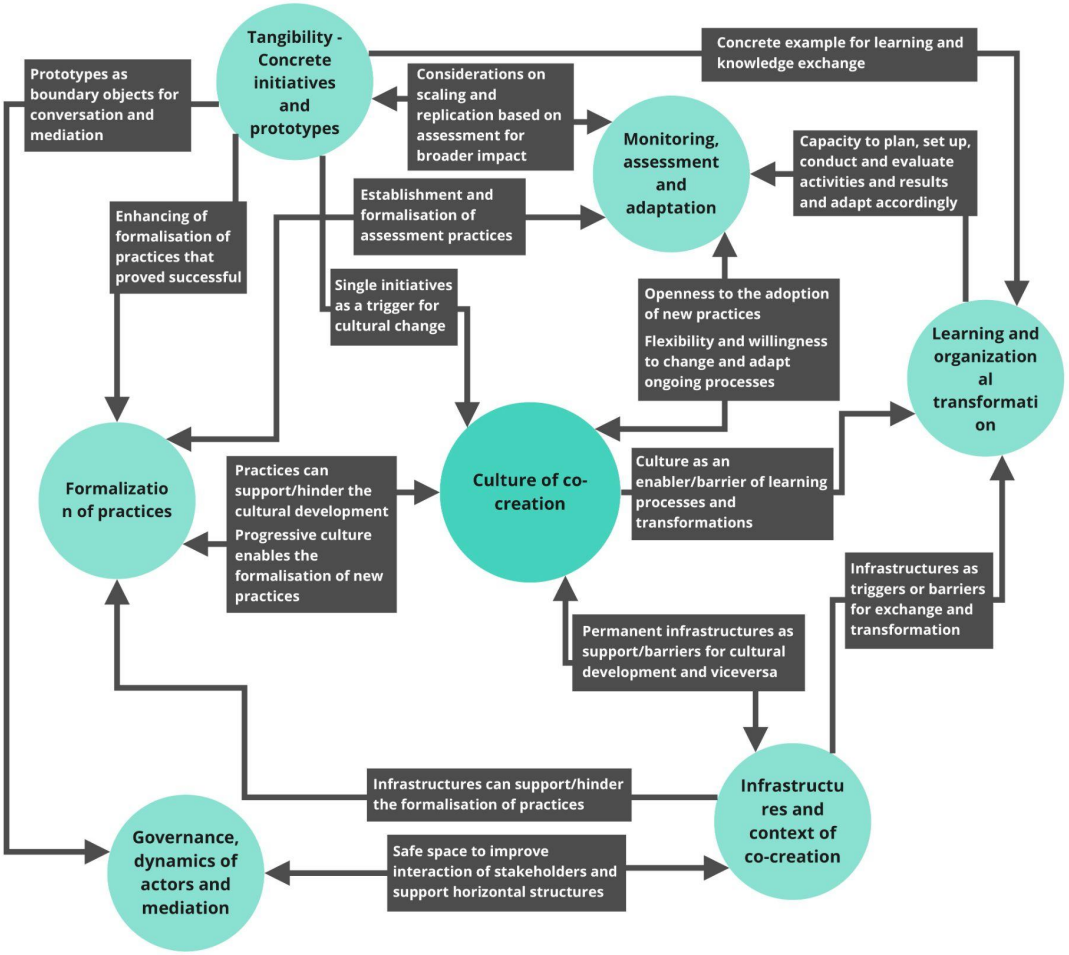

Fig 18 - Interrelation and connection of the single descriptors.

6. Implications, recommendations and reflections

SISCODE's experimentation set up and tested new ways of better connecting single innovations to the strategic directions that lead to new products and services. The project established ten co-creation labs across Europe to understand how to use co-creation to build stronger links between product/service and policy innovation. These co-creation labs acted as an intermediary playground between small-scale experiments of responsible innovation and top-down policies: they tested new ways to facilitate knowledge exchange among actors and stakeholders, shortening the distance between bottom-up and top-down approaches. By applying co-design processes to local responsible innovation projects, the experimentation has tried to: introduce a context-based and bottom-up approach to problem framing; open up the development of solutions to citizens and other stakeholders, bringing in their expertise; engage policymakers in providing strategic directions for the envisioned solutions and support them to experiment with co-creation directly.

The idea that policies for innovation and single innovations take shape in two different playgrounds is at the base of the theoretical framework applied to SISCODE's experimentation (see Fig. 19). The first one works in a top-down fashion, is primarily focused on macro-scale visions, and aims to provide mechanisms for incentivizing and directing innovation. The second one works in a bottom-up fashion, is primarily focused on small-scale experimentation, and aims to develop innovations that, if successful, can be subsequently diffused throughout different scaling mechanisms. The disconnection between the two playgrounds can frequently lead to situations in which both policies for innovation and single innovations fall short on the ground. In the top-down playground, innovation policies may take shape in an environment that is detached from actual practices and are thus unable to consider factors on the ground, which may hamper implementation. In the bottom-up playground, the difficulty of making innovation possible and successful also stems from its distance from the policy agenda and the enabling and support mechanisms. In both cases, the capacity to better include society is put at risk: grassroots innovation that is close to the real needs of people is unable to scale up, while policies are unable to intercept people's needs and sustain innovation.

SISCODE investigated how co-creation can serve as a "glue" that better connects the development of new products and services to the development of (innovation) policies. In this perspective, co-creation can be used for innovating both products/services and policies, achieving two interconnected results: on the one hand, new solutions that better respond to the needs of society; on the other hand, policies that stem from innovative processes and are more likely to be effectively implemented. SISCODE tried to address one of the structural problems of the policy-making process that has been widely discussed: the difficulty in managing the implementation phase and the resulting mismatch between intentions and results[2]. As this is at the same time a policy issue and a typical design problem, SISCODE's labs used (co)design knowledge to support the experimentation, looking at solutions and policies as objects of design. In particular, the project relied on the overlap between a design cycle and an experiential learning cycle. All the ten co-creation labs implemented an innovation journey combining Owen's design process (2007) with Kolb's experiential learning cycle (1983). They engaged scientists, researchers, innovators, local actors and stakeholders in a long-term co-creation experience that moved from understanding and reframing a problem to co-designing, prototyping and testing a solution, and back to

[2] For an overview of the topic, see: AA.VV. (2018). *CO-CREATION IN RRI PRACTICES AND STI POLICIES,* Deliverable 1.2 of the SISCODE project, European Commission. In particular, see Chapter 1. The policy making process between ideal and real.

redesign iteratively. This design/learning cycle represents the generic structure of a design and an organizational learning process. Therefore, in SISCODE it connected co-design activities with organizational learning by adopting appropriate design tools, co-creating solutions, introducing and integrating new knowledge, and connecting with policy-making. This approach led to the establishment of SISCODE's co-creation labs as local networks of actors concurring to the co-design and co-production of contextualized solutions (e.g., a policy, a product, a service, a process) in which the learning process (and the transformation it triggered) involved the whole network.

At the same time, all the co-creation labs involved policymakers in the process, sometimes more directly when policies have become the very object of design (this is, for example, the case of the experimentations conducted by the Krakow Technology Park in Poland and by the Biosense Institute in Serbia), and sometimes more indirectly to understand how solutions could be designed including sustainability and scaling up/out mechanisms (which is the case of all the experimentations carried out in SISCODE).

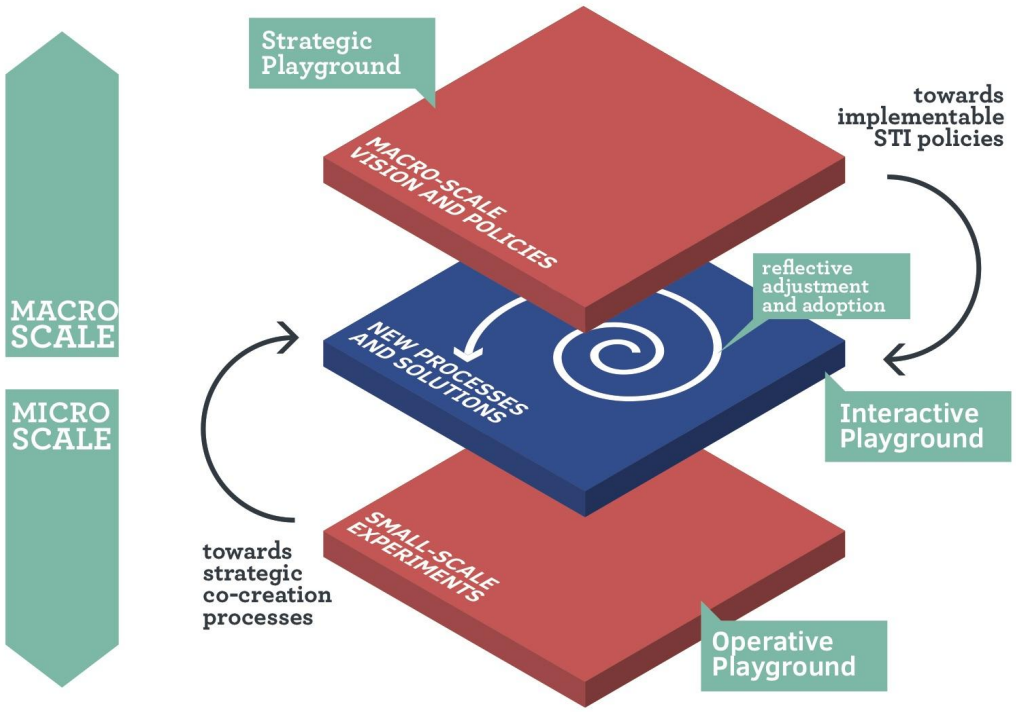

Fig 19 - SISCODE's playgrounds.

To connect the development of new products and services to the development of (innovation) policies, the project hypothesized the necessity to create an intermediate interactive playground, where to test new co-creation processes and tools that facilitate the interconnection between the strategic and the operative playground, and among the macro-,

meso- and micro-scale. This interactive playground was actually implemented, together with several tools that have been tested and made available in open repositories[3].

SISCODE's experimentation made use of these processes and tools, in ways that Deliverable 3.4 describes in detail, also considering the shift from in-presence to at-distance interaction throughout the Covid-19 pandemic (Real et al., 2020). During the experimentation, a few points of attention highlighted at the beginning of the project were monitored (Rizzo et al., 2018). At the same time, the SISCODE project put in place an agile monitoring and assessment framework (see Schmittinger et al., 2021) that gave the possibility to reflect on the experimentation and draw many insights that are at the core of the following implications, recommendations and reflections .

Integrating product/service and policy ideation and implementation calls for combining top-down and bottom-up approaches.

The gap between ideation and implementation is a long-standing question in policy making, intrinsically bound to the complexity of problems, which does not allow for the easy identification of causal links, or the interaction of multiple actors with possibly diverging goals and mindsets across different levels of governance. Some of the approaches proposed to bridge this gap, which suggest avoiding complexity and establishing authoritative top-down relations, have not proven successful due to the very nature of some of the issues to be handled (which are complex in nature), and to the emerging need of better including the voice of citizens and other stakeholders. Other approaches consider almost impossible to forcefully align micro-implementation with intentions elaborated at higher levels of governance and suggest that proceeding "backwards", taking the point of view of citizens and service deliverers, may provide great help in increasing the success rate of policy implementation (Rizzo et al., 2018). SISCODE's experimentation showed that while both approaches respond to specific logics, taken in isolation they prove insufficient and unfit for the complexity of today's policy landscapes. In particular, the experimentation showed that there is a need to constantly balance top-down and bottom-up approaches, recognising their respective shortcomings and combining them in the proposed intermediate interactive playground, in which strategic visions and high-level political goals and intentions can meet with practicalities embedded in new product/service development, and vice-versa. In this interactive playground, policy makers were able to interact with grassroots initiatives in which (responsible) innovation was being concretely implemented with the involvement of

[3] See SISCODE's learning repository: https://www.siscodeproject.eu/repository/contents/tools, and SISCODE's interactive guidebook https://siscodeproject.eu/guidebook/

citizens, civil society and other organisations. Nevertheless, SISCODE's experimentation identified a number of challenges in establishing connections between innovation processes and innovation policies. In particular, as Kurath and Gisler (2009) and Smallman (2020) have highlighted, bottom-up initiatives may fail to connect with policies because of their completely grassroots and independent nature. In fab lab Copenhagen (Underbroen), the team reported difficulties in connecting the experiment to the policy framework on circular economy, one of the City's highest priorities, partly due to the citizen-led nature of the project. Moreover, policy makers can include grassroots initiatives in policy experimentation without the necessary competences, processes and tools. For instance, in the Cube Museum's experimentation in the village of Voerendaal in the Netherlands it emerged that public engagement is very much part of the official policy of the municipality. However, policy makers struggled to give room for and ownership to bottom-up initiatives without giving up their public responsibility. Policymakers were keen to work with external stakeholders and citizens, but they were afraid of the extra workload, sceptical about the outcome or not convinced that co-creation was the right approach. This ties in with research arguing that the political and institutional structures and cultures within which participation is situated affect impact (Wynne 2006; Biegelbauer and Hansen 2011; Smallman 2020), but also highlights that as well as attitudes and procedures, more concretely, the skill sets and knowledge bases of policymakers also need attention and development. For this reason, SISCODE provided valuable tools in the already-mentioned repositories, but also a learning programme for policy makers in the form of a MOOC[4]. The interaction between single innovations and innovation policies also brings us to the necessity to look at the context in which innovation takes place, which is reflected in the importance of the innovation ecosystem, and in the possibility to use co-creation as a tool to make it evolve towards higher degrees of responsibility, as described in the previous chapters.

The outputs of co-creation need to 'fit' within the machinery of policymaking

SISCODE's experimentation confirmed a paradox in the move towards co-creation, which was already individualised in the literature review performed at the outset of the project (Rizzo et al., 2018). On the one hand, for co-creation to offer genuine alternatives to business as usual, it needs to be distinctively different from other modes of policy advice; on the other hand, if they are too 'alternative' they risk being ignored or neglected. Public

[4] Co-creation for policymakers: an introductory course. https://www.pok.polimi.it/courses/course-v1:Polimi+CCP101+2021_M3/about

participation tends to generate a variety of views that are difficult to synthesise into clear outcomes or conclusions that would be policy relevant and a basis for collective decision making. Advice from SISCODE is that it is necessary to provide support and tools meant to incorporate the results of co-creation into the machinery of policymaking. In this respect, the intermediate layer between grassroots initiatives and high-level political visions and goals that the project set up constituted an arena to test new processes and tools meant to enable effective participation and create actionable policy advice. This brings us back to the already-mentioned knowledge and tools that SISCODE made available in its repositories and MOOC, and to how (innovation) policies can be differently designed and connected to product/service innovation.

Policies can be seen as objects of co-design

In a moment in which the need for more open and flexible programmes is emerging across diverse fields of policy making, design sciences offer already experimented practices and tools meant to increase the degree of participation of citizens and stakeholders. Looking at policies as objects of design gives the possibility to have actors cooperate in a more structured manner and improve results considering the diversity of local conditions and circumstances (Rizzo et al., 2018 - chapter 1.6). Designerly approaches emerge as being particularly interesting in today's policy landscapes because they seem apt at handling wicked and undefined problems; because they introduce an experimental and flexible approach that uses iteration and prototyping as ways of verifying, selecting and honing possible solutions; because they propose a human centred perspective while considering other factors; because they go beyond a pure utilitarian and problem-solving attitude; and because they suggest a new practice-based approach to co-creation. Given all these characteristics, design for policy is emerging not just as an addition to the repertoire of policy tools but as a new framework that offers a whole new way for policymaking to be done. Nevertheless, as policies are new and complex objects of design, for which experience is still limited, particular caution must be adopted in making promises and anticipating results. Relevant advice that we can draw from SISCODE's experimentation and analysis of cases is to consider not only the promises that design holds for policymaking, but also the caution that is needed to deal with new actors and objects of design. In particular, the quite different ways in which innovation practitioners and policymakers deal with problems must be carefully managed. Moreover, SISCODE's experimentation showed that the adoption of co-creation processes and tools that are meant to support a more open and participatory policy design process may require competences that are not in place. This calls for a specific

focus on the experimentation of these new processes and tools, on their adoption and inclusion into the extant practices, and on the need to make them fit into specific contexts of use.

Context matters: co-creation processes and tools must fit in the context in which they are adopted

Literature shows that cultural and organisational factors may frequently hamper innovation and the implementation of (innovation) policies. Structural questions bound to established cultures, mindsets and practices of diverse sectors, places, systems and typologies of organisations must be considered, while policy implementation may require sectoral, systemic and organisational transformation, which must be carefully handled[5]. SISCODE aimed not only at identifying solutions and best practices, but also at understanding how they could be modified, appropriated and embedded in new contexts, and finally diffused and scaled-up. In particular, SISCODE's experimentation showed that context-dependency must be carefully considered when evaluating the adoption of approaches, practices and tools. One of the main challenges of SISCODE's co-creation labs was the development of co-creation journeys capable of adapting SISCODE's design-based learning framework to diverse innovation processes that are in place in different organisations and local contexts, and that fit with different sectors and challenges. One relevant problem was to find the right balance between the need to allow for the comparison of the different experiments conducted in the co-creation labs, and the need to adopt context-based processes and tools. For satisfying the first need, the adoption of a single process and set of tools would have been necessary, while for satisfying the latter a situated approach, supported by customised processes and different sets of tools, would be required. SISCODE managed the trade-offs between the two approaches with a mixed-up solution: on the one hand a co-creation process characterised by common macro-phases that can be freely organised in sub-phases, and on the other hand the adoption of a limited set of common tools that synthesised the outcomes of each phase, combined with customised sets of tools bound to the different problems to be handled and the characteristics of the local contexts. Moreover, SISCODE experimented diverse combinations of "generative" co-design tools, primarily focused on co-creating new solutions and networks, with tools that come from the field of RRI or citizen and stakeholder engagement, primarily focused on "extracting" knowledge from the public, and on building consensus among actors or providing them with the possibility to express

[5] For an overview of this topic and a review of literature, see: AA.VV. (2018). *CO-CREATION IN RRI PRACTICES AND STI POLICIES*, Deliverable 1.2 of the SISCODE project, European Commission. In particular, see Chapter 1. The policy making process between ideal and real.

their different points of view. Therefore, SISCODE adopted a toolbox that enabled its co-creation labs to design and modify their processes autonomously, adapting the general design/learning framework to their local context. The need for adaptation and customisation required an approach that is not only an explanation of how to adopt a selection of tools. Instead, SISCODE proposed a conscious design of the design processes in which such co-creation tools are adopted. For this reason, SISCODE did not make use of a unique limited set of tools for all the co-creation labs, but of a broad set of available tools among which to choose, making sense of the most appropriate ones depending on the situation at hand. A standard process and set of tools to support co-creation is likely to be ineffective or difficult to adopt and integrate within organisational and institutional settings, as the way in which public participation is embraced by policymakers, citizens and other actors and stakeholders appears to be context specific. SISCODE's experimentation showed that it is essential to understand and analyse the specificity of each context and issue to be handled to better define what sort of tools to use in co-creation processes. This principle informed the design of SISCODE's Interactive Guidebook, a digital repository where tools can be sorted put in a "cart" to create a customized set, depending on the specific co-creation process to be implemented[6]. The guidebook is meant to be a part of the legacy of the SISCODE project, as an empirical synthesis that combines findings and insights on co-creation ecosystems with findings drawn from the experimentation conducted in the co-creation labs. All the insights and pathways to overcome the identified barriers in planning and conducting co-creation initiatives in a RI context are translated in the structure and functioning of this guidebook. Moreover, the existing plethora of tools and toolboxes was analysed, selecting the most relevant elements according to the SISCODE approach to facilitate access by integrating them in the guidebook. Moreover, it is important to notice that in SISCODE's experimentation each co-creation lab was left free to integrate the broad set of tools provided by the project with other tools. This choice was meant to give the possibility to build on extant knowledge and experience, giving the possibility to also adopt tools that the lab was already familiar with or considered useful for its specific context and challenge. In the case of the Cube Museum, the process and the set of tools developed and tested has become a specific outcome of the experimentation that has been published in the form of a practical book for policymakers[7]. This open approach proved to be highly

[6] The guidebook is accessible at: https://siscodeproject.eu/guidebook/. For an overview of the aims and structure of the guidebook, see: Schmittinger, F., Mariani, I., Deserti, A. and Rizzo, F. (2021). *INTERACTIVE GUIDEBOOK*, Deliverable 5.2 of the SISCODE project, European Commission.
[7] Köppchen, A., Smeenk, W. and Bertrand, G (2020) The co-design canvas. An empathic co-design tool with societal impact. Available at https://siscodeproject.eu/resources/

functional to the possibility of conducting experiments in fairly different places across Europe, and to test the efficacy of co-creation in the development of innovative solutions for quite diverse challenges and sectors. Moreover, according to the reflections made by many co-creation labs, this approach gave the possibility to introduce new knowledge integrating it with the extant knowledge and practices of the organizations taking part in the experimentation (Schmittinger et al., 2021). At the same time, it is important to notice that in SISCODE's experimentation the flexibility of the co-creation process has not only been pointed out as a positive aspect, but also as an attention point to be considered in terms of having to deal with the uncertainties of an open-ended process. In particular, one relevant issue that emerged is how to manage (expectations of) concreteness within an open and transforming process. SISCODE's co-creation labs found the adopted co-design-tools essential to achieve this concreteness. One thing that is important to mention is that, despite their importance, processes and tools alone did not prove sufficient to ensure the effectiveness of co-creation. In this respect, the capacity to manage human interactions while setting and conducting co-creation activities emerged as particularly relevant questions. SISCODE’s co-creation labs pointed out this aspect in relation to a set of necessary soft skills, such as empathy, that appear fundamental in relation to the effectiveness of co-creation and that can entirely change the outcomes. This aspect highlights the importance of the human factor, and the necessity to build specific capacities for co-creation beyond the application of methodologies and tools.

References

Abson, D. J., Von Wehrden, H., Baumgärtner, S., Fischer, J., Hanspach, J., Härdtle, W., Heinrichs, H., Klein, A. M., Lang, D. J., & Martens, P. (2014). Ecosystem services as a boundary object for sustainability. *Ecological Economics*, *103*, 29–37.

Akaka, M. A., Schau, H. J., & Vargo, S. L. (2013). The Co-Creation of Value-in-Cultural-Context. In R. W. Belk, L. Price, & L. Peñaloza (Eds.), *Research in Consumer Behavior* (Vol. 15, pp. 265–284). Emerald Group Publishing Limited. https://doi.org/10.1108/S0885-2111(2013)0000015018

Alves, H., Fernandes, C., & Raposo, M. (2016). Value co-creation: Concept and contexts of application and study. *Journal of Business Research*, *69*(5), 1626–1633.

Ansell, C., & Torfing, J. (2021). Co-creation: The new kid on the block in public governance. *Policy & Politics*, *49*(2), 211–230. https://doi.org/10.1332/030557321X16115951196045

Armstrong, M., Cornut, G., Delacôte, S., Lenglet, M., Millo, Y., Muniesa, F., Pointier, A., & Tadjeddine, Y. (2012). Towards a practical approach to responsible innovation in finance. *Journal of Financial Regulation and Compliance*.

Asante, K., Owen, R., & Williamson, G. (2014). Governance of new product development and perceptions of responsible innovation in the financial sector: Insights from an ethnographic case study. *Journal of Responsible Innovation*, *1*(1), 9–30.

Biegelbauer, P., & Hansen, J. (2011). Democratic theory and citizen participation: Democracy models in the evaluation of public participation in science and technology. *Science and Public Policy*, *38*(8), 589–597. https://doi.org/10.3152/030234211X13092649606404

Bitsch, L., Rekve, K., & Neuhaus, S. (2021). *The landscape of Science, Ethics and Public Engagement & their Potential for the Future*.

Bogers, M., & Horst, W. (2014). Collaborative Prototyping: Cross-Fertilization of Knowledge in Prototype-Driven Problem Solving: Collaborative Prototyping. *Journal of Product Innovation Management*, *31*(4), 744–764. https://doi.org/10.1111/jpim.12121

Bourne, L. (2016). Targeted communication: The key to effective stakeholder engagement. *Procedia-Social and Behavioral Sciences*, *226*, 431–438.

Bruce, P., & Shelley, R. (2010). Assessing stakeholder engagement. *Communication Journal of New Zealand*, *11*(2), 30–48.

Carayannis, E. G., Barth, T. D., & Campbell, D. F. (2012). The Quintuple Helix innovation model: Global warming as a challenge and driver for innovation. *Journal of Innovation and Entrepreneurship*, *1*(1), 1–12.

Carayannis, E. G., & Campbell, D. F. (2010). Triple Helix, Quadruple Helix and Quintuple Helix and how do knowledge, innovation and the environment relate to

each other?: A proposed framework for a trans-disciplinary analysis of sustainable development and social ecology. *International Journal of Social Ecology and Sustainable Development (IJSESD)*, *1*(1), 41–69.

Carlborg, P., & Kindström, D. (2014). Service process modularization and modular strategies. *Journal of Business & Industrial Marketing*.

Christensen, J. (2019). *Running a lab is all about the trade-offs. States of Change*. https://states-of-change.org/stories/running-a-lab-is-all-about-the-trade-offs

CIMULACT. (2016). *European R&I Agenda – Contributions from 30 Citizen Consultations*.

CIMULACT. (2017). *Citizens as co-creators of responsible research agendas for a sustainable future*.

Clifton, J., Díaz Fuentes, D., & Llamosas García, G. (2020). ICT-enabled co-production of public services: Barriers and enablers. A systematic review. *Information Polity, Preprint*, 1–24.

Commission, E. (2014). *Rome declaration on responsible research and innovation in Europe*. European Commission Brussels.

Commission, E. (2016). *Open Innovation, Open Science, Open to the World: A Vision for Europe*. European Commission Brussels.

Coughlan, P., Suri, J. F., & Canales, K. (2007a). Prototypes as (design) tools for behavioral and organizational change: A design-based approach to help organizations change work behaviors. *The Journal of Applied Behavioral Science*, *43*(1), 122–134.

Coughlan, P., Suri, J. F., & Canales, K. (2007b). Prototypes as (Design) Tools for Behavioral and Organizational Change: A Design-Based Approach to Help Organizations Change Work Behaviors. *The Journal of Applied Behavioral Science*, *43*(1), 122–134. https://doi.org/10.1177/0021886306297722

Cross, R., Parker, A., Prusak, L., & Borgatti, S. P. (2003a). Knowing what we know. *Networks in the Knowledge Economy*, *208*.

Cross, R., Parker, A., Prusak, L., & Borgatti, S. P. (2003b). Knowing what we know. *Networks in the Knowledge Economy*, *208*.

Decoster, D., Michaux, V., Murray, M., Murtagh, B., Niarchos, C., Thuriot, F., & Walsh, J. (2006). The governance of local development: An assessment of organizational capacity in North West Europe. *Planning, Practice & Research*, *21*(2), 163–178.

Directorate-General for Research and Innovation (European Commission). (2020). *Citizen Science elevanting research & innovation through societal engagement. Factsheet—Publication Office of the European Union.*

Eckhardt, J., Graetz, C., Kaletka, C., Klimek, T., Krüger, D., Maylandt, J., Schulz, A. C., & Wascher, E. (2020). *Comparative Analysis (D2.3) SISCODE Deliverable*.

https://siscodeproject.eu/wp-content/uploads/2020/11/Masterdokument_D2.3-Comparative-Analysis-Report.pdf

Eckhardt, J., Kaletka, C., & Klimek, T. (2019). *SISCODE Knowledge Base (D2.1) SISCODE Deliverable*. https://ec.europa.eu/research/participants/documents/downloadPublic?documentIds=080166e5c1fca367&appId=PPGMS

Emery, S., Kendall, H., & Frewer, L. J. (2014). *Independent Evaluation of the Public Engagement with Research and Research Engagement with Society (PERARES) Project*.

European Commission. (2016). *Open Science, Open innovation, Open to the world. A vision for Europe (Directorate-General for Research and Innovation)*.

European Commission. (2020a). *Communication from the European Commission: A new Era for Research and Innovation*.

European Commission. (2020b). *Research & innovation valorisation channels and tools. Boosting the transformation of knowledge into new sustainable solutions. Directorate-General for Research and Innovation.*

European Commission. Directorate General for Research and Innovation. (2017). *Science, research and innovation performance of the EU, 2018: Strengthening the foundations for Europe's future.* Publications Office. https://data.europa.eu/doi/10.2777/14136

European Commission. Directorate General for Research and Innovation. (2020a). *100 climate-neutral cities by 2030 - by and for the citizens: Report of the Mission board for climate neutral and smart cities.* Publications Office. https://data.europa.eu/doi/10.2777/46063

European Commission. Directorate General for Research and Innovation. (2020b). *A climate resilient Europe: Prepare Europe for climate disruptions and accelerate the transformation to a climate resilient and just Europe by 2030.* Publications Office. https://data.europa.eu/doi/10.2777/69766

European Commission. Directorate General for Research and Innovation. (2020c). *Caring for soil is caring for life: Ensure 75% of soils are healthy by 2030 for food, people, nature and climate : report of the Mission board for Soil health and food.* Publications Office. https://data.europa.eu/doi/10.2777/821504

European Commission. Directorate General for Research and Innovation. (2020d). *Conquering cancer: Mission possible.* Publications Office. https://data.europa.eu/doi/10.2777/045403

European Commission. Directorate General for Research and Innovation. (2020e). *Mission Starfish 2030: Restore our ocean and waters.* Publications Office. https://data.europa.eu/doi/10.2777/70828

European Commission, Directorate-General for Communications Networks, Content and Technology. (2016). *Open innovation 2.0 yearbook 2016*.

https://ec.europa.eu/digital-single-market/en/news/open-innovation-20-yearbook-edition-2016

Ferguson, L., Chan, S., Santelmann, M., & Tilt, B. (2017). Exploring participant motivations and expectations in a researcher-stakeholder engagement process: Willamette Water 2100. *Landscape and Urban Planning*, *157*, 447–456. https://doi.org/10.1016/j.landurbplan.2016.08.014

Figueiredo Nascimento, S., Cuccillato, E., Schade, S., & Guimarães Pereira, A. (2016). Citizen engagement in science and policy-making. *Luxembourg: Publications Office of the European Union*.

Galvao, A., Mascarenhas, C., Marques, C., Ferreira, J., & Ratten, V. (2019). Triple helix and its evolution: A systematic literature review. *Journal of Science and Technology Policy Management*, *10*(3), 812–833. https://doi.org/10.1108/JSTPM-10-2018-0103

Geels, F. W. (2005). *Technological transitions and system innovations: A co-evolutionary and socio-technical analysis*. Edward Elgar Publishing.

Geraldi, J., & Söderlund, J. (2016). Project studies and engaged scholarship: Directions towards contextualized and reflexive research on projects. *International Journal of Managing Projects in Business*.

Giannakos, M. N., Divitini, M., & Iversen, O. S. (2017). Entertainment, engagement, and education: Foundations and developments in digital and physical spaces to support learning through making. *Entertainment Computing*, *21*, 77–81.

Grissemann, U. S., & Stokburger-Sauer, N. E. (2012). Customer co-creation of travel services: The role of company support and customer satisfaction with the co-creation performance. *Tourism Management*, *33*(6), 1483–1492. https://doi.org/10.1016/j.tourman.2012.02.002

Gudowsky, N., & Peissl, W. (2016). Human centred science and technology—Transdisciplinary foresight and co-creation as tools for active needs-based innovation governance. *European Journal of Futures Research*, *4*(1), 1–10.

Guimón, J. (2019). *Policy initiatives to enhance the impact of public research: Promoting excellence, transfer and co-creation*.

Gurzawska, A., Mäkinen, M., & Brey, P. (2017). Implementation of Responsible Research and Innovation (RRI) practices in industry: Providing the right incentives. *Sustainability*, *9*(10), 1759.

Hägele, H. (2019). *European Network of Public Employment Services: Co-creation of services*.

Halmos, A., Misuraca, G., & Viscusi, G. (2019). From public value to social value of digital government: Co-creation and social innovation in European Union initiatives. *ProProceedings of the 52nd Hawaii International Conference on System Sciences| 2019, CONF*.

Hansen, J., & Allansdottir, A. (2011). Assessing the impacts of citizen participation in science governance: Exploring new roads in comparative analysis. *Science and Public Policy*, *38*(8), 609–617. https://doi.org/10.3152/030234211X13111546663377

Herington, C., Johnson, L. W., & Scott, D. (2009). Firm–employee relationship strength—A conceptual model. *Journal of Business Research*, *62*(11), 1096–1107.

Hiller, M., & Hupe, P. (2002). *Implementing public policy: Governance in theory and practice*. Londres: Sage Publications. Recuperado de goo. gl/fqZ7NH.

Howaldt, J., & Schwarz, M. (2011). Social innovation–social challenges and future research fields. In *Enabling Innovation* (pp. 203–223). Springer.

Ind, N., & Coates, N. (2013). The meanings of co-creation. *European Business Review*.

Jaeger-Erben, M., Kramm, J., Sonnberger, M., Völker, C., Albert, C., Graf, A., Hermans, K., Lange, S., Santarius, T., & Schröter, B. (2018). Building capacities for transdisciplinary research: Challenges and recommendations for early-career researchers. *GAIA-Ecological Perspectives for Science and Society*, *27*(4), 379–386.

Jakobsen, S.-E., Fløysand, A., & Overton, J. (2019). *Expanding the field of Responsible Research and Innovation (RRI)–from responsible research to responsible innovation*. Taylor & Francis.

Jalonen, H., Narbro, A., Pyörre, S., & Salminiitty, R. (2020). *Co-creation of Service Innovation in Europe: Project Management*.

Janamian, T., Crossland, L., & Wells, L. (2016). On the road to value co-creation in health care: The role of consumers in defining the destination, planning the journey and sharing the drive. *Medical Journal of Australia*, *204*(S7). https://doi.org/10.5694/mja16.00123

Jones, P. (2018). Contexts of co-creation: Designing with system stakeholders. In *Systemic Design* (pp. 3–52). Springer.

Kaletka, C., Eckhardt, J., & Krüger, D. (2018). *Theoretical framework and tools for understanding co-creation in contexts (D1.3) SISCODE Deliverable*. https://siscodeproject.eu/wp-content/uploads/2018/11/Theoretical-Framework-and-Tools-for-Understanding-Co-Creation-in-Contexts_D1.3.pdf

Kaletka, C., Markmann, M., & Pelka, B. (2016). Peeling the Onion. An Exploration of the Layers of Social Innovation Ecosystems. Modelling a context sensitive perspective on driving and hindering factors for social innovation. *European Public & Social Innovation Review*, *1*(2).

Kaletka, C., & Schröder, A. (2017). A global mapping of social innovations: Challenges of a theory driven methodology. *European Public & Social Innovation Review*, *2*(1), 78–92.

Koen, P., Ajamian, G., Burkart, R., Clamen, A., Davidson, J., D'Amore, R., Elkins, C., Herald, K., Incorvia, M., Johnson, A., Karol, R., Seibert, R., Slavejkov, A., & Wagner, K. (2001). Providing Clarity and A Common Language to the "Fuzzy Front

End." *Research-Technology Management*, *44*(2), 46–55. https://doi.org/10.1080/08956308.2001.11671418

Kokko, A. K., & Hirsto, L. (2021). From physical spaces to learning environments: Processes in which physical spaces are transformed into learning environments. *Learning Environments Research*, *24*, 71–85.

Kolb, D. (1984). *Experiential Learning: Experience As the Source of Learning and Developmenf (Englewood Cliffs*. NJ: Prentice Hall.

Kurath, M., & Gisler, P. (2009). Informing, involving or engaging? Science communication, in the ages of atom-, bio- and nanotechnology. *Public Understanding of Science*, *18*(5), 559–573. https://doi.org/10.1177/0963662509104723

Lamy, P., Brudermüller, M., Ferguson, M., Friis, L., Garmendia, C., Gray, I., Gulliksen, J., Kulmala, H., Maher, N., & Plents, F. M. (2017). Investing in the European Future We Want: Report of the Independent High Level Group on Maximising the Impact of EU Research & Innovation Programmes.[online] European Commission. *Directorate-General for Research and Innovation, European Commission*.

Lehtinen, J., & Aaltonen, K. (2020). Organizing external stakeholder engagement in inter-organizational projects: Opening the black box. *International Journal of Project Management*, *38*(2), 85–98. https://doi.org/10.1016/j.ijproman.2019.12.001

Leydesdorff, L. (2012). The Triple Helix, Quadruple Helix, …, and an N-Tuple of Helices: Explanatory Models for Analyzing the Knowledge-Based Economy? *Journal of the Knowledge Economy*, *3*(1), 25–35. https://doi.org/10.1007/s13132-011-0049-4

Loeber, A., Griessler, E., & Versteeg, W. (2011). Stop looking up the ladder: Analyzing the impact of participatory technology assessment from a process perspective. *Science and Public Policy*, *38*(8), 599–608. https://doi.org/10.3152/030234211X13111546663296

Lubicz-Nawrocka, T. (2019). Creativity and collaboration: An exploration of empathy, inclusion, and resilience in co-creation of the curriculum. *Student Engagement in Higher Education Journal*, *2*(3), 199–213.

Maak, T. (2007). Responsible Leadership, Stakeholder Engagement, and the Emergence of Social Capital. *Journal of Business Ethics*, *74*(4), 329–343. https://doi.org/10.1007/s10551-007-9510-5

Matland, R. E. (1995). Synthesizing the Implementation Literature: The Ambiguity-Conflict Model of Policy Implementation. *Journal of Public Administration Research and Theory*. https://doi.org/10.1093/oxfordjournals.jpart.a037242

Maylandt, J., Wascher, E., Kaletka, C., Klimek, T., Graetz, C., Schulz, A. C., & Krüger, D. (2020). *Case Studies and Biographies Report (D2.2) SISCODE Deliverable*. https://siscodeproject.eu/wp-content/uploads/2020/11/D2.2-Case-Studies-and-Biographies-Report_small.pdf

Mazzucato, M. (2019). Governing missions in the European Union. *Independent Expert Report*.

Meijer, I., & van de Klippe, W. (2020). 7 Monitoring Responsible Research and Innovation in the European research area. *Assessment of Responsible Innovation: Methods and Practices*, 171.

Moore, M.-L., Riddell, D., & Vocisano, D. (2015). Scaling out, scaling up, scaling deep: Strategies of non-profits in advancing systemic social innovation. *Journal of Corporate Citizenship, 58*, 67–84.

Mulgan, G. (2006). The process of social innovation. *Innovations: Technology, Governance, Globalization, 1*(2), 145–162.

Nambisan, S., & Nambisan, P. (2013). Engaging citizens in co-creation in public services. *IBM Center for Business Development*.

Näsholm, M. H., & Blomquist, T. (2015). Co-creation as a strategy for program management. *International Journal of Managing Projects in Business, 8*(1), 58–73. https://doi.org/10.1108/IJMPB-10-2013-0063

Nazarko, Ł., & Melnikas, B. (2019). Operationalising Responsible Research and Innovation–tools for enterprises. *Engineering Management in Production and Services, 11*(3).

O'Brien, L., Marzano, M., & White, R. M. (2013). 'Participatory interdisciplinarity': Towards the integration of disciplinary diversity with stakeholder engagement for new models of knowledge production. *Science and Public Policy, 40*(1), 51–61.

OECD. (2009). *Construction of an experimental and co-creation research methodology for co-operative governance in territorial development policies*. OECD Publishing.

OECD. (2017). *Policy Jam, Observatory of Public Sector innovation*.

OECD. (2018a). *OECD Open Government Data Report: Enhancing Policy Maturity for Sustainable Impact*. OECD Publishing.

OECD. (2018b). *OECD Science, Technology and Innovation Outlook 2018*. OECD Publishing.

OECD. (2019). *OECD Digital Government Review of Sweden: Towards a Data-driven Public Sector, Opening up government data in Sweden: User engagement and value co-creation*. OECD Publishing.

OECD. (2020). *STIP Compass: International Database on Science, Technology and Innovation Policy (STIP)* (Edition December 17, 2020). https://stip.oecd.org

Owen, C. (2007). Design thinking: Notes on its nature and use. *Design Research Quarterly, 2*(1), 16–27.

Paredes-Frigolett, H. (2016). Modeling the effect of responsible research and innovation in quadruple helix innovation systems. *Technological Forecasting and Social Change, 110*, 126–133. https://doi.org/10.1016/j.techfore.2015.11.001

Paswan, A. K., & Wittmann, C. M. (2009). Knowledge management and franchise systems. *Industrial Marketing Management*, *38*(2), 173–180.

Payne, A. F., Storbacka, K., & Frow, P. (2008). Managing the co-creation of value. *Journal of the Academy of Marketing Science*, *36*(1), 83–96. https://doi.org/10.1007/s11747-007-0070-0

Payne, S. L., & Calton, J. M. (2017). Towards a managerial practice of stakeholder engagement: Developing multi-stakeholder learning dialogues. In *Unfolding stakeholder thinking* (pp. 121–135). Routledge.

Pel, B., Wittmayer, J., Dorland, J., & Søgaard Jørgensen, M. (2020). Unpacking the social innovation ecosystem: An empirically grounded typology of empowering network constellations. *Innovation: The European Journal of Social Science Research*, *33*(3), 311–336.

Pera, R., Occhiocupo, N., & Clarke, J. (2016). Motives and resources for value co-creation in a multi-stakeholder ecosystem: A managerial perspective. *Journal of Business Research*, *69*(10), 4033–4041.

Peris-Ortiz, M., Ferreira, J. J., Farinha, L., & Fernandes, N. O. (Eds.). (2016). *Multiple Helix Ecosystems for Sustainable Competitiveness*. Springer International Publishing. https://doi.org/10.1007/978-3-319-29677-7

Phillipson, J., Lowe, P., Proctor, A., & Ruto, E. (2012). Stakeholder engagement and knowledge exchange in environmental research. *Journal of Environmental Management*, *95*(1), 56–65.

Ramaswamy, V., & Ozcan, K. (2020). *The co-creation paradigm*. Stanford University Press.

Ranga, M., & Etzkowitz, H. (2013). Triple Helix Systems: An Analytical Framework for Innovation Policy and Practice in the Knowledge Society. *Industry and Higher Education*, *27*(4), 237–262. https://doi.org/10.5367/ihe.2013.0165

Real, M., Petsani, D., Ajdukovic, A., Praça, G., Bertrand, G., Köppchen, A., Machowska, M., Wlocdarczyk, A., Rasmussen, A., Christensen, S., Merzagora, M., Ghilbert, A., Crispell, J., Sedini, C., & Bianchini, M. (2019). *Co-creation journeys (D.3.1) SISCODE Deliverable*. https://ec.europa.eu/research/participants/documents/downloadPublic?documentIds=080166e5c11f812a&appId=PPGMS

Real, M., Schmittinger, F., Pistofidou, A., Juarez Calvo, M., Nørregard Rasmussen, A., Hertz Jansen, M., Sedini, C., Cipriani, L., Gelsomini, M., Maffei, S., Bianchini, M., Wlocdarczyk, A., Machowska, M., Gabriel, A., Stojacic, I., Konstantinidis, E., Mantziari, D., Petsani, D., Bamidis, P., … D'Arcy, G. (2020). *Experimentation Report. Lab's Journeys as Case Studies (D3.4) SISCODE Deliverable*. https://siscodeproject.eu/wp-content/uploads/2021/01/D3-4-Co-creation-journeys-as-Case-studies-final_small_2.pdf

Rizzo, F., Deserti, A., Crabu, S., Smallman, M., Hjort, J., Hansen, S., & Menichinelli, M. (2018). *Co-creation in RRI practices and STI policies (D1.2) SISCODE deliverable*.

Rossi, F., Caloffi, A., Colovic, A., & Russo, M. (2020). *Public innovation intermediaries and digital co-creation. Research contribution to the OECD TIP Co-creation project*.

Salancik, G. R., & Pfeffer, J. (1978). A Social Information Processing Approach to Job Attitudes and Task Design. *Administrative Science Quarterly, 23*(2), 224. https://doi.org/10.2307/2392563

Schade, S., Tsinaraki, C., Manzoni, M., Berti Suman, A., Spinelli, F. A., Mitton, I., Kotsev, A., Delipetrev, B., & Fullerton, K. T. (2020). *Activity Report on Citizen Science 2020 – discoveries from a five year journey* (EUR 30551 EN). Publications Office of the European Union.

Schein, E. H. (2010). *Organizational culture and leadership* (Vol. 2). John Wiley & Sons.

Schmittinger, F., Deserti, A., Rizzo, F., & Crabu, S. (2021). *Assessment Report (D3.5) SISCODE Deliverable*. https://siscodeproject.eu/wp-content/uploads/2021/03/SISCODE_D3.5_Assessment-report_small.pdf

Schön, D., & Argyris, C. (1996). Organizational learning II: Theory, method and practice. *Reading: Addison Wesley, 305*(2).

Sgueo, G. (2020). Using Technology to 'Co-Create'EU Policies. *European Parliamentary Research Service*.

Slater, D., & Tonkiss, F. (2013). *Market society: Markets and modern social theory*. John Wiley & Sons.

Sloan, P. (2009). Redefining stakeholder engagement: From control to collaboration. *Journal of Corporate Citizenship, 36*, 25–40.

Smallman, M. (2020a). 'Nothing to do with the science': How an elite sociotechnical imaginary cements policy resistance to public perspectives on science and technology through the machinery of government. *Social Studies of Science, 50*(4), 589–608. https://doi.org/10.1177/0306312719879768

Smallman, M. (2020b). 'Nothing to do with the science': How an elite sociotechnical imaginary cements policy resistance to public perspectives on science and technology through the machinery of government. *Social Studies of Science, 50*(4), 589–608. https://doi.org/10.1177/0306312719879768

Smallman, M., & Patel, T. (2018). *RRI Research Landscape (D1.1) SISCODE Deliverable*. https://siscodeproject.eu/wp-content/uploads/2018/11/RRI-Research-Landscape_D1.1.pdf

Stappers, P. J., & Giaccardi, E. (2017). Research through design. In *The encyclopedia of human-computer interaction* (pp. 1–94). The Interaction Design Foundation.

Star, S. L., & Griesemer, J. R. (1989). Institutional ecology,translations' and boundary objects: Amateurs and professionals in Berkeley's Museum of Vertebrate Zoology, 1907-39. *Social Studies of Science*, *19*(3), 387–420.

Stilgoe, J., & Lindner, R. (2015). *Analytical Report on the Dimension of Research and Innovation Governance*.

Stilgoe, Jack, & Guston, D. H. (2017). Responsible research and innovation. *The Handbook of Science and Technology Studies*, 853–880.

Svendsen, A. C., & Laberge, M. (2005). Convening stakeholder networks. *Journal of Corporate Citizenship*, *19*(91104), P1–P18.

Tharp, B. M., & Tharp, S. M. (2019). *Discursive design: Critical, speculative, and alternative things*. MIT Press.

Tuominen, T., Edvardsson, B., & Reynoso, J. (2020). Institutional change and routine dynamics in service ecosystems. *Journal of Services Marketing*.

Vargo, S. L., & Lusch, R. F. (2004). Evolving to a New Dominant Logic for Marketing. *Journal of Marketing*, *68*(1), 1–17. https://doi.org/10.1509/jmkg.68.1.1.24036

Vesnic-Alujevic, L, & Scapolo, F. (2019). *The Future of Government 2030+: Policy Implications and Recommendations*. Publications Office of the European Union.

Vesnic-Alujevic, Lucia, Stoermer, E., Rudkin, J.-E., Scapolo, F., & Kimbell, L. (2019). *The future of government 2030+: A citizen centric perspective on new government models*. Publications Office of the European Union.

von Hippel, E. (1987). Cooperation between rivals: Informal know-how trading. *Research Policy*, *16*(6), 291–302. https://doi.org/10.1016/0048-7333(87)90015-1

Von Hippel, E. (2007). Horizontal innovation networks—By and for users. *Industrial and Corporate Change*, *16*(2), 293–315.

Von Schomberg, R. (2011). Towards responsible research and innovation in the information and communication technologies and security technologies fields. *Available at SSRN 2436399*.

Von Schomberg, R. (2013). A vision of responsible research and innovation. *Responsible Innovation: Managing the Responsible Emergence of Science and Innovation in Society*, 51–74.

Voorberg, W., Bekkers, V., Flemig, S., Timeus, K., Tõnurist, P., & Tummers, L. (2017). Does co-creation impact public service delivery? The importance of state and governance traditions. *Public Money & Management*, *37*(5), 365–372. https://doi.org/10.1080/09540962.2017.1328798

Voorberg, W. H., Bekkers, V. J. J. M., & Tummers, L. G. (2015). A Systematic Review of Co-Creation and Co-Production: Embarking on the social innovation journey. *Public Management Review*, *17*(9), 1333–1357. https://doi.org/10.1080/14719037.2014.930505

Warin, C., & Delaney, N. (2020). Citizen science and citizen engagement. Achievements in Horizon 2020 and recommendations on the way forward. *Directorate-General for Research and Innovation Science with and for Society*.

Weber, M. (2002). *Wirtschaft und gesellschaft: Grundriss der verstehenden Soziologie*. Mohr Siebeck.

Windrum, P., Schartinger, D., Rubalcaba, L., Gallouj, F., & Toivonen, M. (2016). The co-creation of multi-agent social innovations. *European Journal of Innovation Management*.

Windsor, D. (2010). The role of dynamics in stakeholder thinking. *Journal of Business Ethics*, *96*(1), 79–87.

Wynne, B. (2006). Public Engagement as a Means of Restoring Public Trust in Science – Hitting the Notes, but Missing the Music? *Public Health Genomics*, *9*(3), 211–220. https://doi.org/10.1159/000092659

Zimmerman, J., Forlizzi, J., & Evenson, S. (2007). Research through design as a method for interaction design research in HCI. *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*, 493–502.

Zwart, H., Landeweerd, L., & van Rooij, A. (2014). Adapt or perish? Assessing the recent shift in the European research funding arena from 'ELSA' to 'RRI.' *Life Sciences, Society and Policy*, *10*(1), 11. https://doi.org/10.1186/s40504-014-0011-x

Annex 1 - Analysis grid for case studies and innovation biographies

The grid was applied to analyse the innovation biographies written on existing cases within WP2 and the case studies of the labs documenting the experimentation of SISCODE (WP3). It was used to extract the main insights according to the three main dimensions of stakeholder engagement, co-creation and outcomes.

SISCODE CO-DESIGN FOR SOCIETY IN INNOVATION AND SCIENCE

Grid for analysis of co-creation biographies

Introduction

This document aims at providing guidance on the implementation of the analysis expected within TASK 5.2: Dynamics of co-creation ecosystem (WP5). The aim of this task is to describe the dynamics of **transformation that occur at the micro level of co-creation ecosystems** in terms of (i) the changes they require and imply in the networks of the stakeholders involved, in their internal processes, culture, and organisations; and (ii) the effective outcomes they co-produce. This task relies on the knowledge created in WP2 and WP3 by triangulating results from the 12 innovation biographies and from the experiments conducted in the 10 SISCODE co-creation labs. This focus allows us **to analyse and gain first-hand knowledge on the factors that affect co-creation at the micro level, i.e. primarily organizational processes.**

To do so, we identified three analytical domains concerning transformation that can occur at the micro level of co-creation processes, that is:

ANALYTICAL DOMAIN	DESCRIPTION
I - Engaging	Stakeholder engagement
II - Organizing	Internal processes, culture, and organisation: the co-creation mind-set
III - Scaling	Outcomes and value of co-creation processes beyond the project (scalability and replicability)

The major hypothesis under the identification of the three analytical domains mentioned above concerns the idea that adopting co-design approaches should support the operationalization of co-creation in RRI and STI policy making. An adoption meant to elicit

both the implementation of novel engagement strategies and boosting a shift from an organizational culture based on top-down consultation to more participatory, bottom-up practices, where co-design and co-production are at stake.

Hence, the three macro-areas detailed below serve as analytical probes to explore the transformation occurring at the micro level of organization engaged in co-creation initiatives by triangulating evidences from the 12 innovation biographies (see deliverables 2.2 and 2.3) and the 10 experiments conducted in the 10 SISCODE co-creation labs (see deliverable 3.4).

1. The analytical grid

Please avoid copy-and-paste but thoughtfully elaborate an analysis of the case proposed, following the guiding questions and the hints in the description – they are written in blue, and you can delete them when the answer is complete.

AUTHOR & EMAIL CONTACT OF THIS ANALYSIS	NAME OF THE "INNOVATION BIOGRAPHY"

1.1. Domain n. 1: Stakeholder engagement

Here, the aim is to capture stakeholders engagement process (i.e. of policy makers and regulatory bodies[8]; research community[9]; education community[10]; business and industry[11]; citizens and civil society organisations[12]), and to identify transformations (and the drivers of these transformations) in the organizational culture of engagement, that can be described as a shift towards the adoption of more intensive participatory engagement practices, as well as the embedding of those practices making them routines.

Guiding question / issue to be addressed	Description *[instructions in blue - to be deleted when answering]*
- *Are the stakeholders simply mobilized as actors to collect information to back up or confirm decisions which have already been made?*	- Describe actions and procedures aimed at engaging stakeholders and relevant actors, to involve them during different stages of the co-creation process. In doing so, consider that engagement procedures should encourage

[8] It refers to policy officers, research centre directors and funders. It includes anyone who makes decisions about the shape of research and innovation — whether locally, nationally or internationally.
[9] This covers researchers, research managers and everyone involved in the research and innovation system, such as science communicators, research technicians and other support staff.
[10] Those concerned with education — from primary school to university — including teachers, students, families, and science centres and museum staff.
[11] RRI is relevant to any business with research and innovation at its foundation, from SMEs to transnational companies, including networks, incubator hubs, and other supporting organisations.
[12] This diverse group includes individuals and organisations, such as trade unions, NGOs and the media.

- *Or are the engagement practices fully embedded within the organization and research culture and the aim of the engagement is really to capture and fulfil the needs?*	stakeholders to engage with, discuss and scrutinize science, technology and innovation. - Identify the role played by external stakeholders engaged in the process of co-creation, in terms of: o i) "Knowledge providers": i.e. individuals who can be considered as sources of knowledge.; o ii) "Knowledge broker" with other relevant fields or communities not directly involved in the co-creation process: i.e. people who act as intermediaries or linkage subject, using interpersonal contacts to stimulate knowledge exchange, the development of new solutions to face issues at stake in the co-creation processes, as well as the co-definition of (potential) application of solutions / outcomes of the co-creation processes.; iii) "Testers" of the solutions in a real-life settings (e.g. experts, individual citizens, end-users, practitioners, policymakers). [insert your answer of 150-250 words here]
- *How is the engagement distributed along the co-creation journey?* - *How was the engagement initiated, and what has been done to keep actors engaged and motivated making them an active part of the project?*	- Provide an account according to the following levels of co-creation: i) "Inclusive co-creation activities": stakeholders are involved in almost all phases of the co-creation journey; ii) "Punctual co-creation activities": external stakeholders are actively co-creating but rather in specific phases of the co-creation journey; iii) "Consultative co-creation activities": external stakeholders are rather asked for their opinion on a certain aspect from single or across the development phases (e.g. end-users might only be consulted for their opinion on a prototype). [insert your answer of 150-250 words here]
- *In which ways pre-existing norms and routines of the organization hosting the co-creation activity influenced the practices of engagement?*	- Provide an account on the organizational mind-set and conventions about engagement practices and what elements hindered/supported the co-creation activities. [insert your answer of 150-250 words here]
- *Have incentives and strategies been developed (e.g. symbolic, material, reputational incentives) to support the active and long-term participation of stakeholders in the co-creation process?*	- Provide an account on strategies and resources to enhance the active and long-term participation of stakeholders in the co-creation process [insert your answer of 150-250 words here]
- *What did the engagement of external stakeholders provoke*	- Detect changes (and describe them) in the ways the organization as a whole address Science, Technology and

within the organization hosting the co-creation activity?	Innovation issues due to the experience matured along the concerned co-creation initiative (e.g. the conclusive reflections of P4All in deliverable 3.4, see footnote[13]). [insert your answer of 150-250 words here]
- *Which kind of novel and unusual stakeholders have been engaged through the concerned co-creation initiative?*	- Detect if the co-creation process has enabled the engagement of stakeholders with whom the organization had not previously collaborated (e.g. policymakers, private research centers). [insert your answer of 150-250 words here]

1.2. Domain n. 2: Internal processes, culture, and organisation: the co-creation mind-set

Here, the aim is to capture the internal processes of organizing and carrying-out co-creation processes, as well as the organizational culture, norms and values that could orient, and hinder/boost co-creation processes in itself. Overall, this section should detail and address internal organizational dynamics occurring at the micro level, which can act as drivers/barriers for the adoption of co-creation methodologies to operationalize RRI within the concerned organization.

Guiding question / issue to be addressed	Description
- *Analysis of the formal structure of the organization in which the co-creation initiative is developed/hosted. Is the application of co-creation "formal", "informal", based on a volunteering basis, and so on?* - *Which kind of governance practices and tools have been adopted?*	- Identify and describe which are the best governance tools and methods (e.g. internal policies and agreements, decision making platforms) for managing the co-creation initiative. Also describe what has been done to fine-tune the internal organization, to improve the resilience and to optimize the sustainability of the co-creation process. [insert your answer of 150-250 words here]
- *Was there an overlapping or a clear differentiation of organizational roles detected within the co-creation initiative under scrutiny?*	- In analyzing this dimension, consider the organization roles listed below, the relationships between these roles in terms of interactions throughout the overall co-creation process, and how these roles are performed during the co-creation practices: ○ The role of initiator;

13 Extract of conclusive reflections of PA4ALL in D3.4: "The PA4ALL team learned that co-creation in science will bring long-term positive results. Through co-creation we can shape the future potential of agriculture in Serbia, just by interconnecting different important stakeholders. On an individual level co-creating can facilitate scientific research by providing precise directions and insights on a specific topic from an individual or organisation who is already involved in it. The flow of information is facilitated, lack of experiences does not impose a threat. On an organisational level, co-creating brings synergy, better organisational structure and deep engagement of the actors. PA4ALL understood that co-creating can bring together stakeholders from different levels of administration, therefore it could improve policies on city, region and even country level."

	○ The role of funder/investor (see p. 11, deliverable 2.2 for the description of the co-creation roles mentioned above); ○ The role of participant. [insert your answer of 150-250 words here]
- *Have co-creation processes been shaped by a variety of interactions among different people, each with distinct motivations and interests?*	- Explore the relationships between motivations for initiating and for taking part in co-creation processes, problem identification, and purposes of co-creation with the overall mission of the organization in which the co-creation process is developed. [insert your answer of 150-250 words here]
- *Is co-creation an overall working attitude within the organisation, or is it adopted more selectively and punctually, for instance within specific projects, or only for single stages of a development process?* - *Is the process of co-creation well-structured in clear phases, implying continuous "from-to" between such phases? Or is it conducted in a more open and serendipitous way?*	- Describe how the co-creation process is performed, also pointing out which tools and methods have been used and to which scope. - Describe if and how the application of co-creation has changed throughout the project e.g. from a more open towards a more structured, strategic application [insert your answer of 150-250 words here]
- *Which kind of novel organizational arrangements have been enabled by means of implementing co-creation approaches? E.g. innovative ways for managing internal communication, internal agreement for facing conflicts and divergent visions over the same issue.*	- Describe any process of organizational learning, e.g. if tools adopted in the concerned co-creation process have become integral part of the organizational routines. - Describe dynamics of organizational change at the level of routines, procedures and organizational practices. [insert your answer of 150-250 words here]
- *Has the co-creation strategy been able to ensure a progressive change in the way the overall organization addresses challenges concerning relationships between science, technology and society?*	- Describe the degree of "penetration" of co-creation within the overall organization. - Describe if co-creation developed within the initiative under scrutiny has had an impact on the organization beyond the project? This can be referred to daily organizational practices, practices applied in other projects, routines, strategies and planning or simply the way how specific tasks are carried out. These aspects mainly refer to the "scaling deep" of co-creation, that is the magnitude of embeddedness of co-creation practices within the organization. [insert your answer of 150-250 words here]

1.3. Domain n. 3: Outcomes and value of co-creation processes

Here the aim is to describe the specific outcomes (both in terms of tangible and intangible outcomes) emerging from co-creation processes, and to provide insights about the effectiveness of the prototype/lessons learned from prototyping. In doing so, a special attention should be drawn to any considerations or effective implementation in terms of scaling or replication of the prototype / final solution toward other contexts, as well as on the assessment and self-assessment practices adopted within the co-creation initiative.

Guiding question / issue to be addressed	Description

- *Which kind of specific outcomes are at stake in the co-creation process under scrutiny?*	- Describe for which purposes the concerned co-creation initiative has been developed:
	  ○ Define/tackle societal issues;
	  ○ Guide research orientation;
	  ○ Create dialogue around policy making;
	  ○ Crowdsource ideas;
	  ○ Gather data for science projects;
	  ○ Policy making;
	  ○ Define and build a service, or a material / technological solution (even just in terms of prototype)
	[insert your answer of 150-250 words here]

- *Which culture and practices of assessment, self-assessment and self-reflexive approaches for monitoring and evaluating processes and outcomes of co-creation were applied?*	- Describe evaluation of the co-creation phases and concerned tools for performing assessment (e.g. surveys, questionnaires, or more open methods like interviews or focus groups. - Describe if the evaluation framework for collecting feedback and measuring the projects' success is realized by team members (e.g. the lead partner), external experts, or if the evaluation is even co-created – at least to a limited extent [insert your answer of 150-250 words here]
- *Has the prototype or final solution been scaled or replicated, migrating to contexts other than the one where it was developed through co-creation?*	- Describe if the prototype or the final solution triggered the interest of people, groups and communities not previously involved in the co-creation process - Describe if the prototype or final solution enabled the shaping of the novel partnerships - Describe if the initiative has reflected on or experimented with scaling or replicating their prototype or final solution

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