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Experimenting with co-design in STI policy making

Alessandro Deserti[a] (iD), Francesca Rizzo[a] (iD) and Melanie Smallman[b] (iD)

[a]Department of Design, Politecnico di Milano, Milano, Italy; [b]Department of Science and Technology Studies, University College London, London, UK

ABSTRACT

Responsible Research and Innovation (RRI) has emerged in recent years, in Europe and across the world, as a model of scientific and technological advancement that is the result of the cooperation of actors that traditionally worked in an autonomous way. Advanced perspectives on RRI suggest how knowledge and solutions should be co-produced by diverse actors working in synergy, including civil society and citizens. This article introduces the notion of co-creation as a framework to operationalize RRI. The article discusses insights coming from ten labs across Europe, where experiments in co-design processes and tools are designing and testing solutions to societal challenges under diverse science, technology and innovation (STI) policies. Furthermore, it compares empirical insights with the debate on experimentation of co-creation practices in STI policy making and on the potentialities and limitations of design for policy. Moreover, the article discusses the restricted focus of RRI, which has primarily concentrated on scientific and technological research and science-based innovation, highlighting the need to include other forms of innovation (like social and human centered innovation) and perspectives to sustain the concrete uptake of RRI in diverse contexts.

1. Co-creation in RRI and STI policy making

In the late 20th Century, public policy controversies on issues from nuclear power and vaccination to urban development and climate change, shone the spotlight on the insufficiency of traditional models of policy making to take account of the uncertainty, contingency and complexity that are increasingly features of modern life. In particular, the traditional model of policymaking, with its assumption that experts are the unique legitimate actors able to produce and transfer relevant knowledge, came into question as the relative status of "expertise." The potential agency of "lay experts" in actively producing, interpreting and sharing information was brought into question after events such as Cherynobyl (Wynne 1998).

In parallel new insights coming from other fields ranging from environmental management and urban planning, to patient involvement in medical decision-making and as well as more in general in public services (Deserti and Rizzo 2014a) solicitate for more participatory approaches to science policy and scientific governance (Callon, Lascoumes, and Barthe 2001).

Filling the accountability gap between what citizens and concerned groups of people need or demand, and what the governments actually do has become one of the main challenges concerning policy making in our contemporary societies (Dalton 2008).

Both scholars and policy makers have emphasized how engaging with stakeholders and citizens in co-creation for policy making, allowing citizens to assume a legitimate pro-active public role as collaborators and creators, not mere passive policy targets (Benington 2010), can produce policies to be defined that are more consistent, sustainable and appropriate to the specific situated context in which a policy measure will be implemented (Voorberg, Bekkers, and Tummers 2015). As part of this move to "open up" decision making to wider citizen perspectives – particularly in science and innovation – the term RRI emerged from the European Commission (2014) with the specific aim of enabling societal actors (researchers, citizens, policy makers, business, third sector organizations, etc.) to work together 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.

Although the normative aspirations of what can be achieved from co-creation are high, empirical evidence of its impact on policy is still hard to find.

This is in part because impact upon policy is hard to measure since policymaking is a complex and not necessarily a linear or cyclical process, drawing on many sources and drivers; also drawing a direct line from a co-creation activity to policy is challenging (Culyer and Lomas 2006).

Many barriers are in place that obstruct co-creation practices in policy making and impede our ability to generate lesson learnt.

Being able to show participants that policy has been affected has been highlighted as important in a number of projects looking at RRI; otherwise engagement activities risk being seen by citizens as tools to collect information to back up decisions which have already been made (Kupper and Schuijer 2018). Despite this, there is also evidence that the outputs of participatory exercises still have little credibility within policymaking and when they are taken seriously, they struggle to be accommodated within the policymaking systems (Smallman 2019a, 2019b).

The problems policy sets out to solve and the role of science, technology and innovation in that solution is pre-determined and not open for discussion. This leads to potential misunderstandings, frustrations and failings, as public participants feel that they are simply being asked to market test the acceptability of technologies and Institutions appear to see public participation as an opportunity to gain trust for a pre-determined approach, rather than to rethink their policies and practices (Macnaghten and Chilvers 2014). Other phenomena such as social innovation have shown different

approach to problem framing based on context dependency and bottom up unmet citizens needs (Deserti & Rizzo 2019a).

The relationship to policy – in particular weak links to policymaking – are seen as further significant inhibitors of co-creation uptake in STI (Emery, Mulder, and Frewer 2015).

The study discussed in the paper has been conceived as a system of 10 co-creation labs across Europe to experiment with the before mentioned barriers. The 10 labs work as intermediary playground between small scale RRI projects and top down policy to facilitate knowledge exchange among actors and shorten the distance between the 2 levels. By applying codesign processes to develop local RRI projects, the experimentation introduces a context based and bottom up approach to problem framing; opens up the development of solutions to citizens as active experts; engages policy makers as co-producers of the solutions and support them to directly experiment with co-creation.

2. Policies as objects of design

According to Howlett (2014), a stream of policy studies is focused on policy design. Policy design is an area of policy studies which aims to bring together a number of policy actors to work in an organized fashion, to realize better outcomes from policymaking. The idea of having actors cooperate in a more structured manner as a way of improving results is close to the perspective of the design sciences, which has applied this approach to a variety of situations and sectors.

Furthermore, this approach also connects with design sciences in the very meaning of "design," and the situated nature of design activities. In Howlett's view: "Conceived of as both a process and outcome, policy design is very much situated in the 'contextual' orientation, which is characteristic of modern policy science." (Howlett 2014, p. 190)

What seems to be missing in the policy design school is a discourse that opens up the policy making process, from a process closed in a domain of experts to a process more human centered and open to the participation of external subjects, including non-experts. Design sciences have constantly expanded their domain of research and practice to include new objects of design: from tangibles to intangibles and from simple elements to complex systems (Norman and Stappers 2015, Buchanan 2001) to the current diffusion of the concept of Design Thinking (Brown and Kātz 2009). Along this process, policies have also become objects of interest for design (Bason 2014; Kimbell 2016, Blomkamp 2018), while policy makers and civil servants have become interested in understanding how design knowledge and processes may help develop better policies and tackle some of the unsolved issues in the policy making process.

In the field of public services and policies, we move from a debate closed within the domain of the public administration, which used to frame the question of policy making as a technical issue to be managed internally, to a new condition in which the role of nonpublic actors, from the for-profit or the nonprofit field, is growing. This is calling for a new approach toward complexity.

Even if the necessity to deal with complexity is well rooted both in Prigogine's thinking and in Cybernetics, the idea of embracing complexity is fairly recent, and connected with the systemic nature of many of the wicked problems (Rittel and Webber 1973) that we currently deal with. Having multiple actors interact, experimenting with

innovative ways of putting traditionally closed organizations in contact with external subjects, and shifting power from the center to the periphery and from inside to outside are all complex matters, interrelated and as complex as the issues to be handled.

From this perspective, the attitude toward policy design – like the attitude for any other complex object of design – may easily swing between the difficult attempt to embrace complexity and cope with it, and the temptation to go back to the draconian simplification suggested by the top-down policy making school. As soon as we move toward implementation, the complexity of the factors that must be managed if the policy is to be implemented on the ground lead to the structural mismatch between initial intentions and declarations and possible or real achievements. Design sciences and designerly approaches to policies emerge as particularly interesting right now because they seem apt to handling wicked and undefined problems (Buchanan 1992); because they introduce an experimental and flexible approach that uses iteration and prototyping as ways of verifying, selecting and honing possible solutions (Ulrich and Eppinger 2012); because they propose a human centered 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. With reference to this last point the "co" paradigm is emerging also in the design of more open and flexible programs across different fields of policy making. This opens to new perspectives in policy making, but at the same time poses quite a few challenges that are rooted both in some of the structural issues that we described and in contingencies that depend on contextual factors.

3. Ongoing experimentation

The paper is based on the initial results obtained from an ongoing experimentation at European level in 10 co-creation labs (January 2019 and ends in July 2020), developing innovative solutions to local and global societal challenges with design methodologies and tools as an approach to co-creation.

The assumptions behind the experimentation are twofold:

- A bottom-up approach to the development of solutions that are meant to tackle societal challenges is inherently bound to the notion of RRI;
- The adoption of design methodologies can support the operationalization of co-creation in RRI and STI policy making by introducing advanced modes of engagement, shifting from traditional consultation to codesign and co-production.

Each lab is implementing an innovation journey that combines Owen's (2007) design process and an experiential learning cycle, engaging scientists, researchers, innovators, local actors and stakeholders in a long-term co-creation experience that moves from understanding and reframing a problem, to co-designing, prototyping and testing a solution, and back to redesign in an iterative fashion (Figure 1).

The 10 labs have then designed their specific journeys based on the same co-creation process, but they have customized the tools to be used in each phase on the basis of their challenges, co-creation competences and stakeholder networks. Currently, all the labs completed the first design cycle and prototypes are under experimentation.

Table 1 presents an overview of the labs' challenges and the envisioned solutions that are currently feeding the prototyping phase.
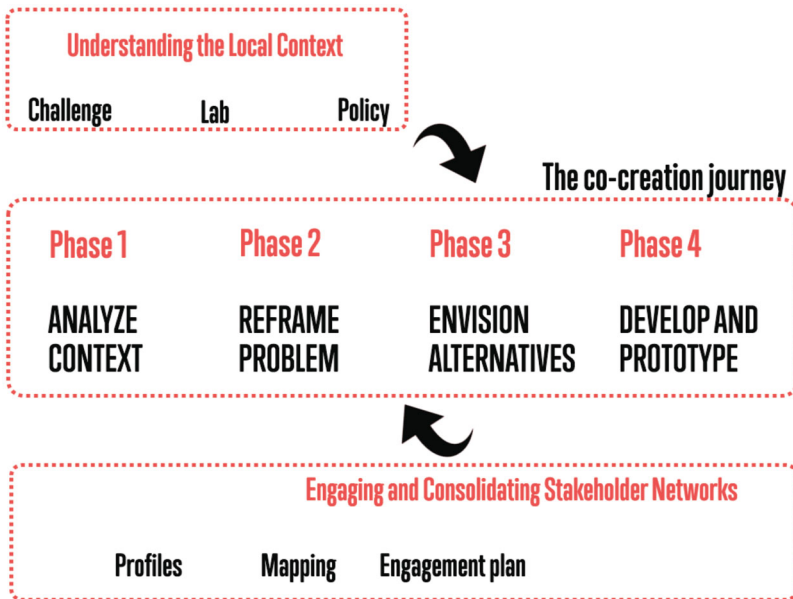

Figure 1. Overview of the experimented co-creation process.

Table 1. Co-creation labs' challenges and solutions.

Labs	Challenges	Solutions
Fab Lab Barcelona	How to identify and stimulate new synergies among the local community in order to co-develop educational, logistic and environmental supports for better redistributing, upcycling and composting food locally.	Symbiotic system for food surplus and bio waste valorization at a neighborhood scale.
Fab Lab Polifactory. Milan	How to improve the movement of children with cerebral palsy thanks to sound-based innovative solutions?	Bodysound. System of motor stimulation of the limbs based on the transformation of movement into sound.
Fab Lab Underbroen. Copenhagen	How can local micro entrepreneurs, SMEs, commercial resellers and citizens collaborate in a circular system plastic recycling production model in Copenhagen.	Plastic In, Plastic Out (PIPO). Circular system for local sourcing, recycling and production of sustainable polymeric building materials and products.
KTP – Cracow Technology Park Living Lab	How to improve the air quality in Cracow by motivating citizens to change their ecological attitudes and support decision makers with relevant instruments for the co-creation of new local policies.	Air Protection Program for the Malopolska region.
PA4ALL – Precision agriculture Living Lab. Novi Sad	How to introduce ICT in high-schools specialized in agriculture in a way that fosters the development of specific skills, greater connection to market needs and relevance for agriculture of the future.	ICT-based education program for high schools specialized in agriculture.

Table 1. Continued.

Labs	Challenges	Solutions
Thess-AHALL – Thessaloniki Active & Healthy Ageing Living Lab	How to break the social exclusion walls and welcome older adults and chronic patients back to the society.	Partners of Experience. Participatory research and life-long learning program for older adults and chronic patients.
Ciência Viva science center. Lisbon	How to create interesting, mobilizing, safe and accessible experiences to make citizens more aware of the potentialities of the river in Lisbon.	Build your own boat/Bring your own boat. A yearlong workshop for the construction of life-sized, usable watercrafts, supported by the science fair about river access and ocean literacy.
Cube design museum and lab. Kerkrade	How to ensure the quality of life of people of all ages living and growing up in the context of an ageing society, now and in the future, drawing on the self-organizing potential of the community in co-creation with policy makers.	Future Citizens Lab x Ransdaal. Conduction of design labs to implement the use of social currency and "socoins" as a way to support bottom up social innovation.
Science Gallery Dublin	How to improve mental health and well-being management with young people in a secondary school setting.	Open Mind. Empowering the young people to understand the importance of hobbies for their mental health.
Traces science and science communication association. Paris	How to organize interactions between research, education, civic right and policy making in order to identify ways to raise awareness of algorithmic decision making within general cultural activities.	Creation of a collective intervention to reflect on how Automated Decision Support can be a target for educational/cultural activities.

3.1. Monitoring and assessment methodology

In order to monitor the ongoing experimentation activities, draw insights from them and finally assess and compare results, researchers have set up a monitoring and assessment framework that combines quantitative and qualitative data. The framework adopts a logic model to capture the causal relationships between resources, activities, outputs and outcomes in the experiments conducted in the co-creation labs, as we wanted to understand the direct results of the activities done in the labs, but also the indirect outcomes, with a particular view to the transformation of established practices and organizational change. Two major challenges were accurately considered: the use of the methodology for small-scale experiments and the sheer difficulty of measuring outcomes.

As the assessment is often required and takes place when impacts still need a long time to be possibly achieved, the same timeframe in which outcomes and impacts can be measured poses relevant problems. In this regard, the assessment framework takes stock of the impossibility to measure impacts within the duration of a short-term experimentation (1Y) and proposes to shift from an if-then logics to a what-if logics to describe impacts that might be achieved through the adoption and the scaling up, out and deep of the innovations developed during the experimentation.

The need to capture both quantitative (outputs) and qualitative (outcomes) results of the experimentation, as well as the need to understand possible long-term impacts, is reflected in a system of monitoring and assessment tools positioned along the whole structure of the logic model (Figure 2):
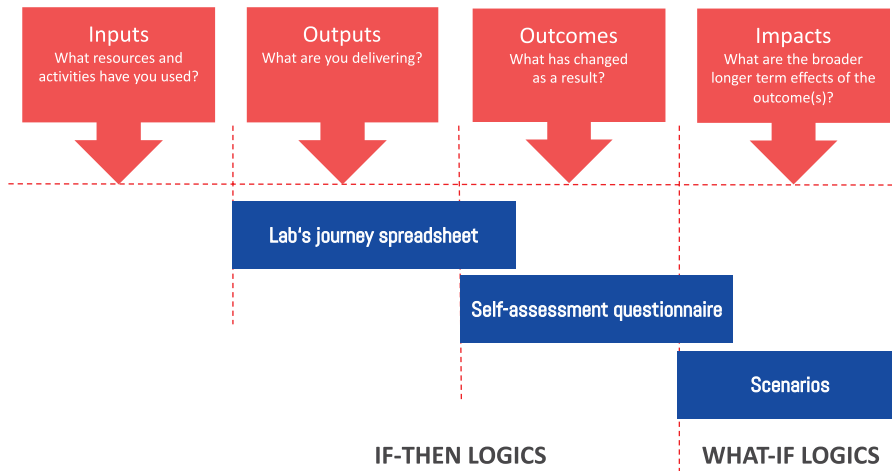
Figure 2. Monitoring and assessment framework and tools.

Table 2. Implications and recommendations for practitioners.

Issues	Implications/recommendations
Individualising the challenge	Challenges to be faced may be broad but must be grounded in the local context. Experiments show that this kind of challenges engage citizens, bond the network of actors and stakeholders, and result more interesting for policy makers, while solutions under development become "boundary objects" for discussion.
Involving citizens	The problem setting phase is crucial to create trust and avoid engagement activities that are seen by citizens as ways to back up predetermined decisions. Experiments show that citizens feel engaged and are willing to keep on being involved when the problem they are collaborating to solve is bound to their unmet needs and issues for which they feel their participation and "lay expertise" is providing a concrete contribution.
Involving policy makers	Experiments show that sharing the challenge with policy makers and engaging them in co-creation activities from the beginning is important to obtain legitimation. Nevertheless, experiments also show that policy makers are difficult to be involved in the process from co-design to co-production and that they usually prefer to take part in the process when concrete results are already there and can be used if they fit with their agenda.
Developing co-design competences	Experiments show that knowledge about co-creation does not necessarily imply the capacity of an organization to conduct co-design activities. Co-design processes and competencies are particularly relevant to go beyond sheer ideation. To support capacity building in the labs, training before starting the co-creation journeys and learning-by-doing/learning-by-reflecting during the experimentation have been put in place with positive results.
Developing an overall vision of the co-creation process	Experiments show the importance of having an overall vision of the co-creation process and sharing it with the actors and stakeholders involved. Experiments show that the engagement of citizens and "non experts" is easier in ideation, while implementation tends to remain in the hands of experts if. As this may lead to a feeling of losing ownership and to mismatches between intentions and results, it is important to put in place co-production strategies. In this, the role of prototyping is crucial.
Engaging in prototyping	All actors and stakeholders should be engaged in different ways either in prototyping solutions and in experimenting with them. Experiments show that taking part in co-production helps all the involved stakeholders, including policy makers, to better understand both opportunities for the uptake or scaling up of the solution and constrains that may hamper its implementation, and reflect on enablers and obstacles to come out with implementable outcomes.

- A primarily quantitative monitoring tool (lab's journey spreadsheet) through which labs document each activity tracking the number and typology of participants, the time spent and other variables, and can elaborate synthetic reflections;
- A qualitative assessment tool (self-assessment questionnaire) that uses indicators intertwining co-creation with RRI that the labs compile at given times during the experimentation, showing the knowledge acquired and the transformations occurred;
- A narrative of possible or desirable futures (scenarios) based on results and insights drawn from the experimentation.

The RRI indicators used in the self-assessment questionnaire have been derived from the MoRRI project indicators[1], adapting some of them to the institutional/organizational scale. In the following, the article discusses the initial qualitative results coming from field and action research conducted in the labs. The analysis of the information gathered so far already supports quite interesting insights, which will be further verified and consolidated as the interactions with policy makers will intensify during the prototyping phase. Table 2 provides a summary of key issues and recommendations for practitioners drawn from the ongoing experimentation.

4. Findings and lessons learnt

4.1. Bridging the gap between 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. It is intrinsically bound to the complexity of problems, means that it is difficult to find causal links or to help multiple actors (possibly with diverging goals and mindsets) interact across different levels of governance (Hill and Hupe 2002). Approaches to bridging the gap between policy ideation and implementation have focused on either avoiding complexity and establishing authoritative top-down relations (Van Meter and Van Horn 1975) proceeding "backwards" and assuming that the point of view of citizens and service deliverers may provide great help in increasing the success rate of policy implementation (Mégie 2010). Both approaches are logical but in isolation prove insufficient and unfit for the complexity of today's policy landscapes. The idea that political goals and intentions can be smoothly operationalized and turned into policy objectives and programs through a more systematic control of policy processes and tools is over-simplistic. On the other hand, assuming the implementers' perspective alone and involving citizens and other stakeholders in the policy design process may introduce risks associated with transforming empirical difficulties in normative statements, or rather a defensive preservation of the status quo (only doing what is feasible with current knowledge and resources), and underestimating the potential to overturn legitimate political intentions.

In exploring ways to combine both these approaches in our intermediate "playground," our experimentation identified a number of challenges in establishing connections between bottom-up initiatives and top down policies. In particular,

Smallman (2019b) have previously highlighted, bottom-up initiatives may fail to connect with policies because of their completely grassroots and independent nature that brings a lack of political engagement and credibility as a form of expertise. For example, in fab lab Copenhagen (Underbroen), the team reported difficulties in connecting the experiment to the City's policy framework on circular economy, even though this is one of the highest priorities for investment in the city. This, they reported, was at least partly due to the citizen-led nature of the project. Policy makers can include bottom-up initiatives in policy experimentation, but they do not have the necessary competences and procedures (capacity issue) to conduct such experiments. For instance, in the Cube Museum's pilot 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. While the policy-makers were keen to work with external stakeholders and citizens, they were afraid of the extra workload, skeptical 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 (Beigelbauer and Hansen 2011; Smallman 2019b) 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.

Conversely, we also found that bottom-up initiatives may take place in saturated contexts where they have to fight to emerge and show impacts. For instance, fab lab Barcelona reported how policy makers invited the project team to contact them and ask for collaboration once "the project starts having results." This reinforces the points made in previous studies about the value of embedding participatory approaches into policy projects from the start or for policy driven participatory projects, but is a particular challenge that is only likely to increase with the growth of participatory actions.

4.2. The reality of "policy cycles"

Sequential policy cycles are part of a "textbook conception" (Nakamura 1987) introducing an ideal representation of the policy making process. It has also been criticized for its over-rationalisation of the policy process (Everett 2003). Nevertheless, the idea that policies can be rationally driven – from identifying problems, to developing solutions, to implementation – has resulted in various tools to be developed that adopt this model and focus on identifying and addressing instances of deviation. Our experiments have highlighted the problems with this way of viewing policy further. For instance, our experiment in the Science Gallery in Dublin involved a variety of stakeholders to address mental health issues in young adults. They highlighted how the transition between child and adult mental health services can be unorganized and traumatic, and that there needs to be more joined-up thinking between the two services – a finding entirely in-keeping with current moves to joined up service provision, but highlighting how contradiction between ideal and real policy-making processes emerges and persists in specific sectors, despite the long tradition and experience of

policy makers in trying to address these issues. In other cases, contradictions emerge as a consequence of the attempt to introduce co-creation as a transversal practice or as a meta-policy to inform the policy making processes. In Copenhagen, Underbroen's policy framework analysis pointed out the gap between future waste management plans and the opportunities, initiatives and models currently in place. Similarly, in Milano, the Polifactory team is working on developing healthcare solutions with a patients' association. At the municipal level, Milano has developed the Sharing City policy, which is defined as "an ecosystem where the different actors are solution holders in a virtuous process of co-design, co-development, and co-management of practices, spaces, goods, and services." But in practice, the policy does not allocate specific funds to implement participatory innovations. While again it is perhaps unsurprising to find a gap between policy and practice, it is this process of co-creation that brought the differences to light.

4.3. Context matters: policy models and approaches, as well as programs and measures, cannot be freely moved from one domain/place to another, but need adaptation

Cultural and organizational factors may frequently hamper the implementation of policies. Structural questions bound to established cultures, mindsets and practices of diverse sectors, places, systems and typologies of organizations must be considered, while policy implementation may require sectorial, systemic and organizational transformation, which must be carefully handled. Context-dependency must be carefully considered when evaluating the transferability of approaches, practices and tools (Deserti & Rizzo 2019a).

Our experimentation is showing that in countries such as Poland, Serbia and Greece, there is a clear indication that the novelty of the co-design approach for policy makers and civil servants demands an in-depth understanding of what capacity building and cultural change is needed. In Cracow, the KTP team, working on co-designing the air protection policy of the region, reports among the main difficulties the lack of experience of policy makers with participatory processes, and the challenge of managing the division of responsibilities among different institutions at different levels (national, regional, local), as well as their divergent needs and interests. In Novi Sad, in Serbia the local team reports that one of the main obstacles they are facing in engaging policy makers with the experimentation is the long tradition of top down policy making of the country. In Thessaloniki, the Thess-AHALL team reports that one of the biggest obstacles in getting policy makers' attention is the disconnection between the policy of the central governments that have invested in democratizing science and the local policies that, also due to the limited knowledge of co-creation, do not promote the involvement of citizens in research and innovation. On the contrary, Fab Lab Barcelona and Underbroen fab lab report that both in Barcelona and Copenhagen complex processes of engagement to codesign solutions have been conducted with large stakeholder networks and that prototypes are under development. For both teams, the difficulty is more bound to the envisioning of sustainable trajectories for the solutions under development, as local policy

makers are already engaged with numerous experiments of codesign and citizen engagement and it is difficult to fit in their agenda.

Our experimentation confirms that a standard approach to co-creation in policy is likely to be difficult as the way decisions are made, evidence used and the extent to which public participation exercises are embraced by policymakers (and citizens) appears to be context specific. In particular, some studies have found how important the democratic context is. Participation and co-creation are considered to better suit to more open and less "paternalistic" political systems (Beigelbauer and Hansen 2011). This presents particular challenges for scaling and transferring participatory design approaches: one of the difficulties emerging in our transnational experimentation is in fact that of adopting the same approach to diverse contexts and even to the different organizations involved. The guidelines produced by Sciencewise, the UK body set up to encourage co-creation in policy, highlight the importance of institutional context, arguing that "the means by which dialogue can impact upon policy and decision-making will be specific to each organisation involved in the dialogue process and each issue under consideration." (Sciencewise 2018).

Moreover, co-creation can change knowledge and assumptions about who is responsible for the definition of solutions and policies, challenging established practices and calling for a shift in power. In this perspective, cultural and organizational factors play a fundamental role in driving or hindering co-creation (Deserti, A., and F. Rizzo. 2019b). Financial incentives do not seem to be effective in boosting citizen and stakeholder engagement, while social motivations on one hand, and the capacity to manage change on the other hand are often at the core of successful co-creation practices. Co-creation and co-design are political acts, because they introduce a set of practices and tools which directly challenge the established order. In this perspective, particular caution must be placed in managing this natural tension toward transformation in situations that are most often characterized by resistance to change.

The conduction of our experimentation is actually demanding for cultural and organizational transformation, leading to contradictory insights. On one hand, co-creation acts as a trigger to change the culture of organizations. This is the case with the Science Gallery team in Dublin: through the experimentation they have learned how to manage co-creation and they are diffusing its practice in the organization and using it in other initiatives. On the other hand, co-creation may remain isolated in single initiatives and find difficulty in spreading throughout the organization. This is the case with Ciência Viva in Lisbon, where the experimentation is successfully engaging citizens and other stakeholders but does not seem to be producing a relevant change in a fairly large organization.

4.4. Work needs to be done to establish the credibility and value of public perspectives and inputs

Co-creation requires the interaction of people with different cultures, beliefs and forms of knowledge within a frame of collaboration, which enacts policy making as a nonlinear, open-ended and iterative process. In performing such an interaction, co-creation enables a learning process in which knowledge is shared in a peer-to-peer way. In this

framework, citizen "lay knowledge" must be considered a complementary experiential source of critical insights to be rendered actionable in (re)designing solutions and policy measures. Nevertheless, if we examine co-creation experiences to date, there have also been indications that policymakers do not consider social knowledge as equal to "expert" technical knowledge such that the role of the public is limited to discussion questions of values and ethical issues, rather than exposing "expertise" to scrutiny (Smallman 2019b).

The need to convince policy makers of the value of co-creation activities that involve lay people is confirmed by our experimentation. Different labs are facing the issue of how to improve the credibility of co-creation among policy makers, dealing with the problem of how to keep them involved in the process and how to produce concrete results for them to be used to inform policy. On the other hand, sometimes they are also facing the challenge of convincing citizens that participatory processes are not instrumental to predefined political goals and gaining consensus. The Traces team in Paris reports that the interaction with policy makers at the regional level has been positive but policy makers are not attending the co-design activities as they expect relevant outcomes before engaging with the initiative. Similar situations are reported from the labs in Greece, Portugal and Serbia.

Participatory processes, especially those dominated by lay people, have also been criticized for producing very unspecific and broad results that are hard to integrate into policy-making (Kurath 2009). Reviews of recent RRI projects have echoed these points, with the need to provide support for participants from all stakeholder groups to participate in co-creation being a common learning point as projects reported that citizens and third sector actors often fear they do not have the necessary knowledge and skills to engage in participatory activities around science, technology and innovation, scientific methods and policy (Dreyer, Koskow, and Dratsdrummer 2018). One of the key ways of addressing this power imbalance is to frame co-creation exercises around issues identified and experienced by citizens in everyday life, often in the form of challenge-based forms of public engagement (Dreyer, Koskow, and Dratsdrummer 2018). This last observation is coherent with the results of our experimentation. In particular, the labs report positive interactions with the policy makers at the level of the municipalities that quite often show interest in the experimentation because the challenges faced are strongly linked with the local context and with issues that they cannot solve alone.

5. Conclusions and future work

There is a paradox within the move toward co-creation of policy making: on one hand, for co-creation to offer genuine alternatives to politics 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 (Smallman 2019b).

Public participation tends to generate a variety of views that are difficult to synthetize into clear outcomes or conclusions that would be policy relevant and a basis for collective decision making. The relevant issue here 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 experiments of the labs described in this article to establish an intermediate layer between grassroots initiatives and high-level political visions and goals are producing knowledge about how difficult it is to build a long-lasting interaction with policy makers. The strategy that some of the labs are trying to apply is to better align their experimentation with the policy making priorities and agenda. The risk here is that grassroots initiatives can be partially reformulated and drift from their original objectives: the bottom up agenda setting for RRI and STI policy making triggered by context-based local challenges would be hampered by a reorientation to meet the interests of policy makers. The functioning of the above described intermediate layer seems to call for a mediation, in which all the involved actors must find their own convenience but at the same time the processes in place must ensure that value for society as a whole is achieved. Being the experimentation of co-creation in policy making in its initial steps, how to manage the interaction among policy makers, citizens and diverse actors and stakeholders to create greater societal value surely needs further studies. The debate is the field of RRI is still open: while the EU Commission is pushing for a transversal role of RRI in research programs, researchers in the field push for specific instruments to support the field as it still has many challenges to deal with. In particular, turning the results of RRI research into practice, expanding the notion of innovation beyond the research-led one, better including co-creation processes and tools, and proving their effectiveness and building legitimation in the eyes of policy makers. As the experimentation analyzed in this article is largely based on the adoption of design processes and tools, it is important to notice that its results showed that while they work well in dealing with services as proxies for policies, their direct application to policies calls for creating the conditions for involving policy makers as co-designers from ideation to implementation, which emerged as far more difficult.

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Funding

ORCID

Alessandro Deserti http://orcid.org/0000-0002-1049-7650
Francesca Rizzo http://orcid.org/0000-0001-5809-0684
Melanie Smallman http://orcid.org/0000-0002-1248-196X

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