Co-creating science: from participatory design to Agile management of research projects, integrating diversity in transdisciplinarity

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INTRODUCTION

Research collaboration and transdisciplinarity are two interlinked and emergent paradigms in the scientific domain. On the one hand, research collaboration has grown in popularity among scientific teams in different areas, being actively supported by research institutions, governments and other type of organisations. On the other hand, transdisciplinarity represents new types of scientific activity that go beyond the collaboration of experts from different disciplines, and can also involve non-scientific stakeholder communities for holistically addressing different problems and issues, like in the case of citizen science or action research approaches. In this sense, challenges on how to deal with diversity from participants for planning and managing such complex research processes, characterised by collaboration and transdisciplinarity, requires among other things to focus on co-creation methods. In this sense, among the different practices of co-creation, participatory design (or co-design) and Agile management are two relevant methodological frameworks, originated outside academia but progressively adopted in a wide diversity of new domains. This study explores the adoption of these two co-creation practices for the planning and management of transdisciplinary research processes, based on three case studies.

CHALLENGES IN TRANSDISCIPLINARY RESEARCH

Transdisciplinarity, from the perspective of team science, can be described as an integrative process in which researchers work jointly to create new models and languages to address a common research problem (Rosenfield, 1992). In relation to public participation in research, transdisciplinarity is also described by other authors as a form of research that can enable inputs and scoping across scientific and non-scientific stakeholder communities, driven by the need to solve real-life problems designing the phases or the research process in a recurrent order (Hadorn et al., 2008).

Other current perspectives in the scientific domain in relation to a change of paradigm in transdisciplinary collaboration are Responsible Research and Innovation (RRI), promoting the involvement of stakeholders and civil society in scientific activities for developing more inclusive innovation processes (Owen et al, 2012), or Open Science, a series of principles and digital practices fostering a more transparent scientific culture and its connection with citizens (Fecher & Friesike, 2014).
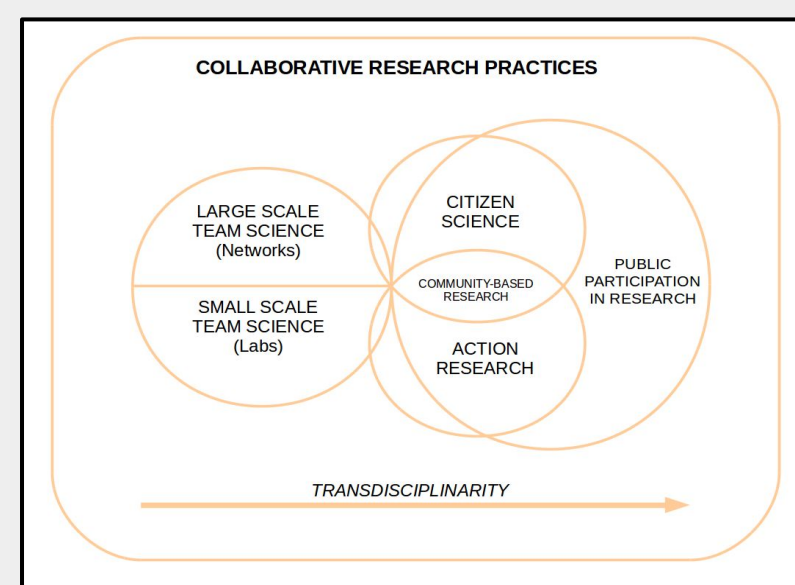

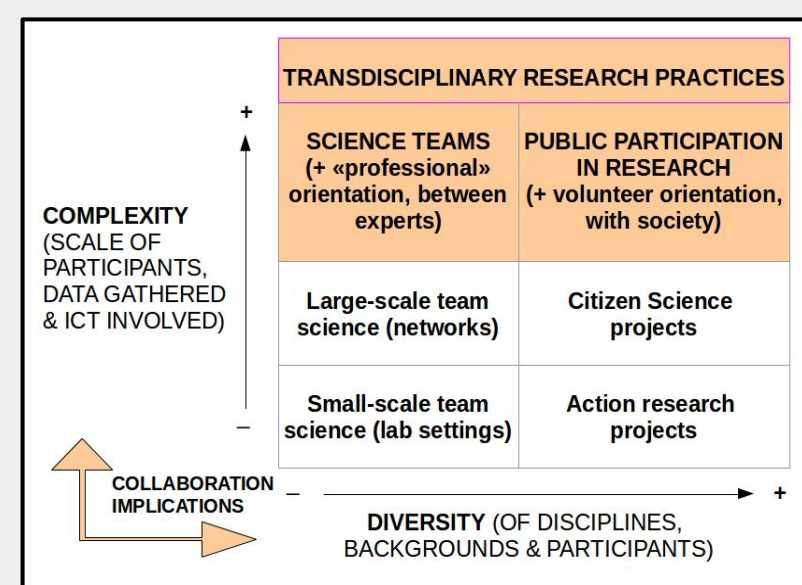Figure 1: transdisciplinarity and collaborative research practices.

Figure 2: Balance of complexity and diversity in transdisciplinary research.

Although collaborative practices in transdisciplinary research domains (as reflected in Figure 1) represent a wide corpus of academic literature and references, with specific methods for data gathering and analysis, there's a general lack of clear methodology and clarity on practical details about how to co-develop collaborative inquiry processes in participatory research (Frideres, 1992) or in interdisciplinary contexts (Rosenblum, 1995).

Transdisciplinary research practices face other critical questions related to how they collectively produce relevant knowledge, usually in relation to diversity and complexity issues (as reflected in Figure 2) or to organisational learning (König et al., 2013). Something that currently represents a wide and challenging field in continuous evolution at the methodological level, requiring analysis about how and when collaborative research is implemented (Katz & Martin, 1997).

If we focus on the specific field of collaboration in transdisciplinary research, the same challenges arise when it comes to cooperatively develop effective project management (Hollaender et al., 2002), to co-design the research plans and approaches (Pohl & Hadorn, 2007) or in general terms to develop a culture of cooperation between disciplinary experts and other stakeholders (Klein et al., 2012).

CO-DESIGN AND AGILE METHODS

The field of participatory design emerged in Scandinavia in the 70s and 80s, aiming to empower the users of computer systems to play an active and creative role in designing them (Bødker, 1994). During the following decades this resulted in the emerging field of interaction design (Di Russo, 2016), which started to generate different methods like prototyping, mock-ups or scenarios (Kensing & Blomberg, 1998). In this sense design thinking, and co-design as it's more participative dimension (Manzini & Coad, 2015), represents a set of practical approaches for the creative definition and solving of problems (Cross, 2011). It offers a great variety of visual methods and techniques for cooperatively designing new projects in complex circumstances (Sanders & Stappers, 2008), as well as the simultaneous exploration of scenarios and the integration of many possible points of view (Blizzard & Klotz, 2012).

Agile principles and frameworks started to be widely applied by software development teams at the beginning of 2001, with the aim of making workflows more continuous and incremental (Hoda et al., 2013), based on principles of adaptability, personal and group autonomy, modularity and self-organised collaboration, as defined in the Agile manifesto (Beck et al., 2001). Also representing a set of emerging co-creation practises, Agile has recently expanded to other organisational contexts (Rigby et al., 2016), including research activity (Sandberg & Crnkovic, 2017). This is mainly due to its potential for optimising the operative capacity of teamwork in short cycles of implementation, for visualising and sharing tasks progress and for maximizing the success possibilities of projects in uncertain, complex and multidisciplinary environments (Cao et al., 2009).
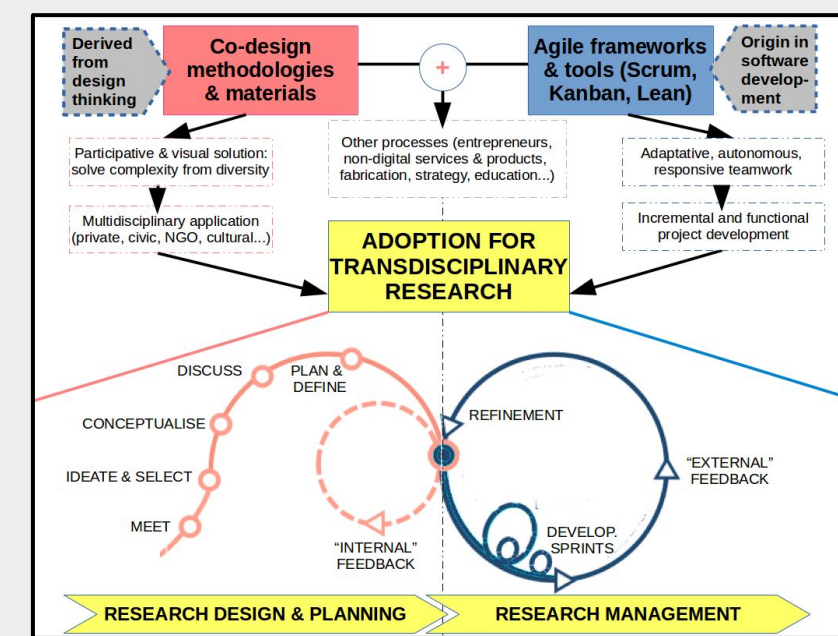

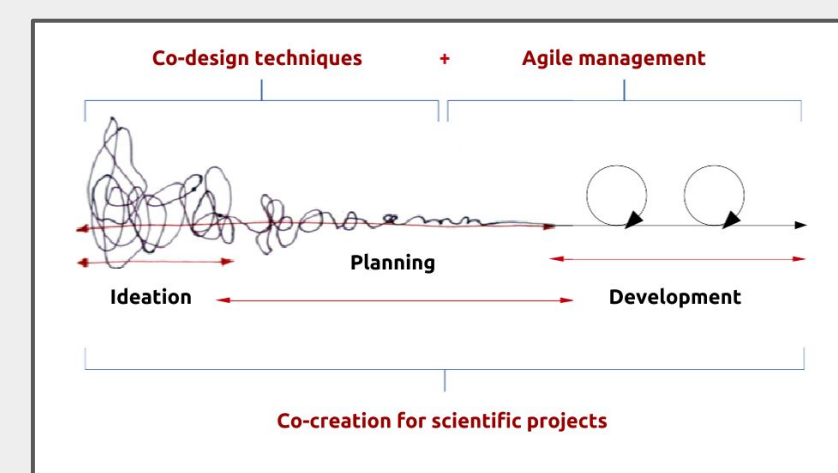Figure 3: Co-design and Agile applied to collaboration in transdisciplinary research

Figure 4: Overview of the participatory design and Agile stages for the ideation, planning and day-to-day management of transdisciplinary research projects (adapted from Sanders & Stappers, 2008)

METHODOLOGY AND CASE STUDIES

This exploratory research project is based on three specific case studies. It combines quantitative analysis via questionnaire surveys with semi-structured interviews and a qualitative approach based on field notes from participant observation during each case, as well as artifact and document analysis. In parallel to this study, the project develops and test a research co-creation toolkit ("ColMeth toolkit", under a Creative Commons license), with facilitation materials and a corpus of adapted co-design and Agile management methods, which can be adopted in other types of transdisciplinary research and knowledge generation environments.

STEM4youth (2016-2017)

The first case study focuses on the adoption of co-design techniques for the planning of several citizen science experiments in the context of the European project Stem4Youth, in collaboration with young students and a team of scientists from OpenSystems (University of Barcelona).

CECAN Center (2017-2018)

The second case study analyses the experimental adoption of Agile tools and Scrum management principles in CECAN, a wide distributed research center with scientists from different disciplines, self-organised for projects about public policy, complexity and environmental issues in the UK.

Dimmons.net (2016-2018)

The third group of embedded case studies focuses on the day-to-day activities of the Dimmons research group at IN3 (UOC) for several of its action-research processes and for the co-creation of its strategic planning, where both co-design techniques and Agile principles are applied since 2016.

Figure 5: Co-design discussions and outputs, followed by experiments in public space.

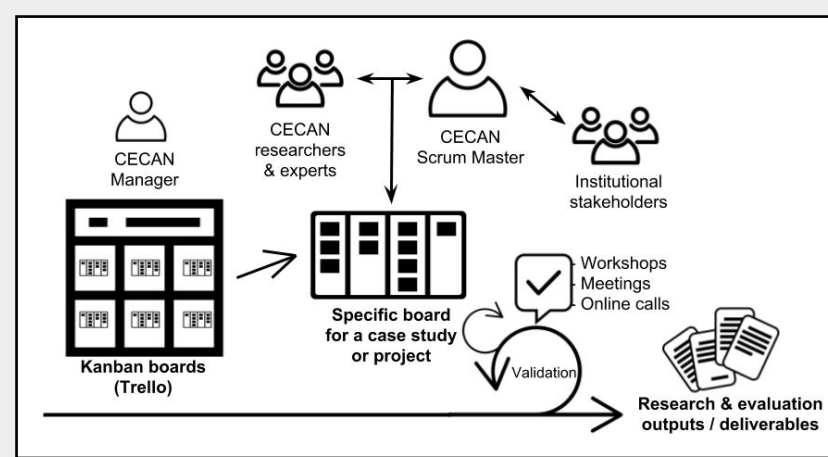Figure 6: Sample of the research co-design toolkit developed and tested during the cases.

Figure 7: Diagram reflecting the adoption of kanban boards on Trello and the Scrum Master role for different research and evaluation projects at CECAN.
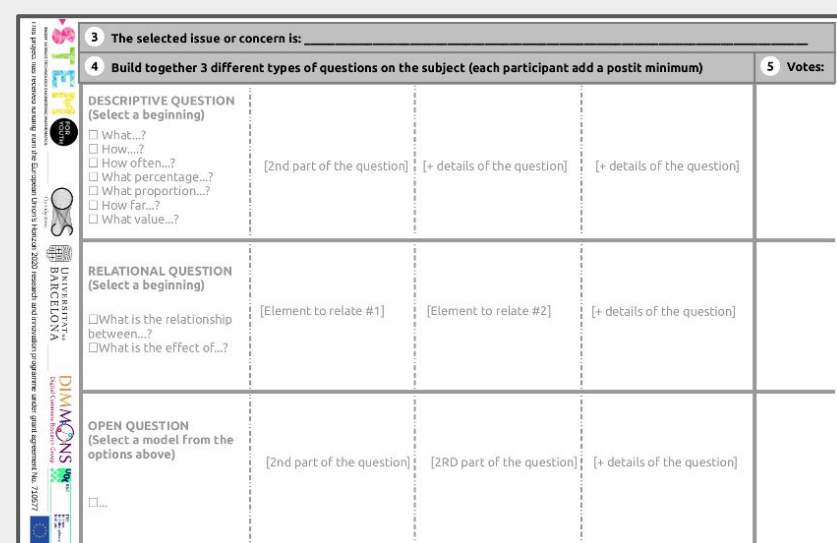

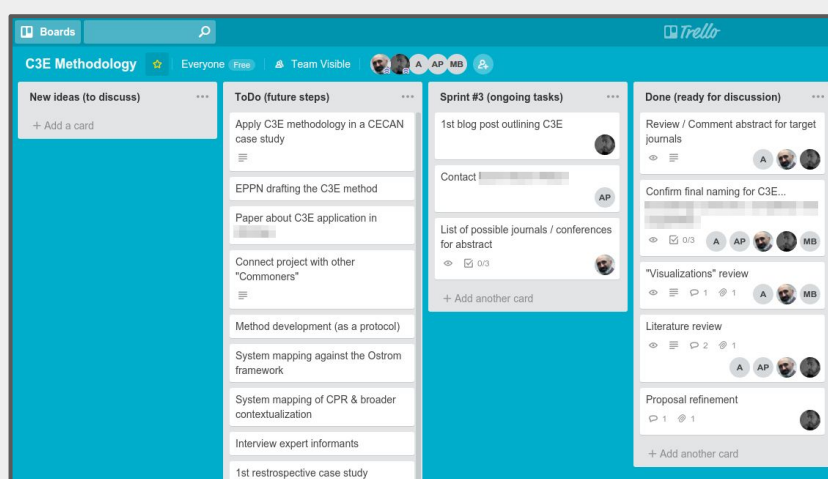Figure 8: Screenshot of one of the kanban boards (Trello) used for visualizing the workflow of a specific research project at CECAN.

Figure 9: Co-design session about expertise with research methodologies and approaches, during the first stage of the Dimmons strategic planning process.
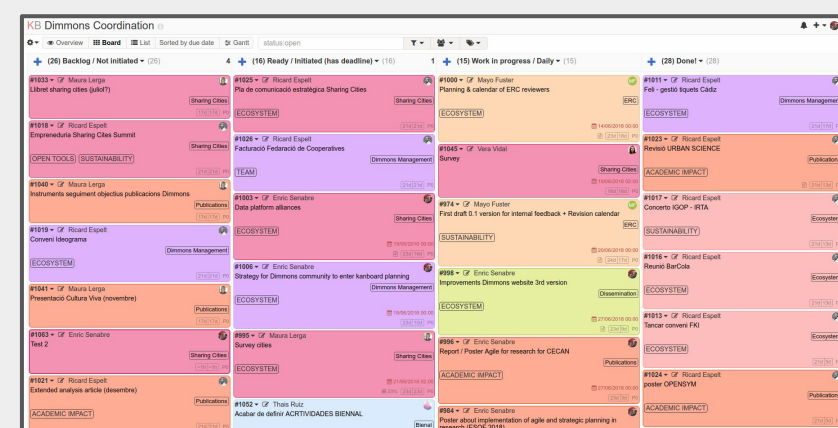

Figure 10: Screenshot of one of the open source kanban board (Kanboard) used for the daily management of the Dimmons research group, reflecting tasks, projects and key goals derived from the strategic plan.

RESULTS AND DISCUSSION

Although some of the data from this project is still being processed, depending on the case study, from the current contribution to literature and academic discussion (Senabre, 2017; Senabre et al., 2018; Senabre, 2018) some results and observations point to:

- Co-creation, adopting visual material and participatory design techniques that allow the generation and selection of ideas can provide quality results for a science that is more open to citizens, and which is more diverse and collaborative. Co-creation is perceived as a fundamental factor in participants' commitment, a key aspect in transdisciplinary projects.
- Science can integrate social needs and concerns into its design and management dynamics if, at the start of the co-creation process, it can generate the actors' trust in the process. Initiating the mechanisms for decision taking preliminary to any investigation is valued by different participants as an important aspect of successful integration.
- Good coordination of transdisciplinary work requires coherent sequencing of the various co-design and Agile phases, in which scientific experts fully integrate their expertise with roles of facilitation and group dynamics.
- A key question is a good balance relations of power during the entire process, ceding the initiative to participants in a structured way while retaining key roles, like coordination manager or discipline expert.
- Online tools and offline toolkits developed or adopted during the process usually served as guide and reference point at key moments, as support mechanisms that generated reflection and debate, making more explicit the knowledge and expertise of participants. It functioned well as a support of design techniques to integrate the diversity of viewpoints and opinions in visual form.
- As far as suggestions for research teams interested in adopting co-design and agile for transdisciplinary projects is concerned, results from this experience point to the need to adopt a high degree of flexibility for progressive self-discovery, in order to become familiar with both frameworks after understanding its basic principles.
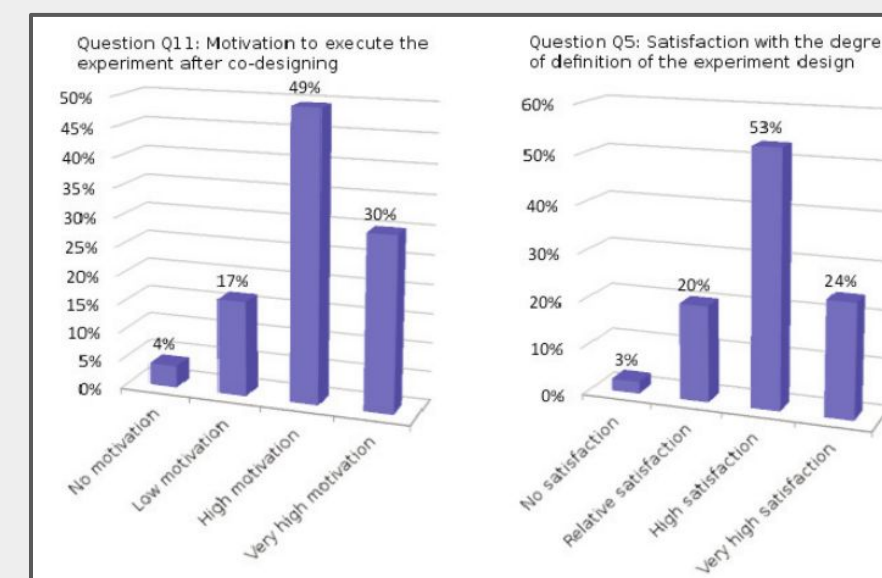

Figure 11: Some results from a survey to 79 participants during the co-design of citizen science experiments for the Stem4youth project (Senabre et al., 2018).
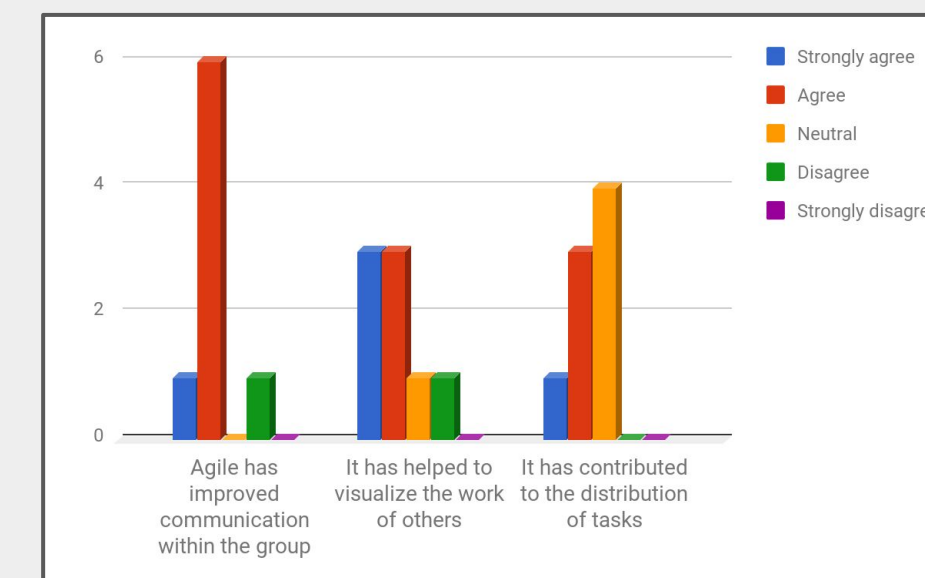

Figure 12: Some results from a survey to a Dimmons research team which used agile management for a project integrating different states of the art about the collaborative economy (DECODE project).

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