Can sustainability transition methodologies support urban governance? - Case study CDMX Tri-color Coalition

Authors: VALENCIA LEÑERO Eva Marina[1,2], NADER SAYÚN Michel[1,3], REBOLLAR GUAGNELLI Moisés Rodrigo[1]

Reviewer: GOMEZ ZAMUDIO, Ricardo[1]

[1] Tri-Color Coalition

[2] International Maize and Wheat Improvement Center

[3] Aalto University

DOI: 10.3217/978-3-85125-932-2-19

Abstract. System change requires different perspectives to create synergies. Sustainability transitions is a field of research that intends to solve grand societal challenges with large-scale societal changes. Urban governance is related to the processes and relationships between the government and civil society delivered in towns and cities. This research aims to analyse in which degree can two sustainability transition methodologies support complex urban governance challenges. The case study was done as an exercise of the Tricolor Coalition for Mexico City's (CDMX) water and energy sectors. The two methodologies due to their its actionable and contextualizable application were: Doughnut Economics City Portrait Methodology to define "sustainability" for CDMX's water and energy context and the XCurve Framework to analyse the possible "transitions" processes required for a water and energy societal change. The results were that these methodologies were useful for governance in CDMX to create stronger networks between stakeholders with similar visions, and to exchange knowledge, resources, and ideas for change. However, it also found that applying these methodologies was insufficient to create governance change. The design of long-term, resourceful and accessible platforms is required to monitor and follow-up with the changes. More research is required to understand how to design and create these types of platforms.

1 Introduction

Urbanisation is set to increase in the coming decades together with global demographics (World Population Review, 2021). However, this trend entails complex challenges. To face them, multistakeholder urban governance is a recognized need to address these cities' complex contexts (Frantzeskaki et al., 2018). One way urban governance has been put into practice is through the creation of community arenas/ coalitions / urban labs of decision-makers that work together to collaborate toward a system change (Nevens et al., 2013; Raworth, 2021; Wittmayer et al., 2011).

These coalitions can serve as platforms to connect multiple and diverse stakeholders to implement systemic transformative action (Wittmayer et al., 2011), and build capacities (Frantzeskaki et al., 2018; Hölscher et al., 2019b). Systems thinking has been included as part of these platforms to increase the complexity knowledge of the stakeholders (Wittmayer et al., 2011). In comparison, the capacities have been acknowledged to be useful to support the ability of the stakeholders to develop and implement action to face the complexity they face(Frantzeskaki et al., 2018).

Coalitions around the world have been created to tackle global challenges such as sustainability or social inequalities. However, few of them have been put into practice in Global South urban contexts (Hölscher et al., 2019a). From these Coalitions, one that has been downscaled not only in the Global North has been the Doughnut Economic Coalitions (Raworth, 2021). They propose joint action towards a global socio-ecological transformation into a “safe and just space” based on Kate Raworth’s Doughnut Economics (2015). However, there are not yet Doughnut Economic Coalitions all around the world.

Mexico City (CDMX) is one of the fifth most populated cities around the world, with over 9 million inhabitants in its political boundary and 22 million in its urbanised area (INEGI, 2021; World Bank, 2020). It has water and energy (W&E) security challenges to guarantee the access of these resources to its growing population without compromising the environmental capacity of its resources.

The energy challenges include decreasing CO2 emissions (mainly caused by transport), energy consumption habits in the population, renewable energy development and funding, and energy poverty (Gobierno de la CDMX, 2019). The water challenges include unequal water distribution, floods, water pollution, missing infrastructure maintenance, professional capacity development, long-term transparency of information, dependency on water imports, lack of water infiltration, and coordination between different institutions at different levels (Gobierno de la CDMX, 2021; Mexico City’s Water System - SACMEX, 2020; Ministry of Natural Resources SEDEMA, 2019).

These challenges require multiple public-private and social stakeholders. However, there are few groups in the city that promote multi-stakeholder urban governance processes that can face these sustainability challenges.

The Tri-Color Coalition (Tricolor Coalition for Sustainability Transitions, 2022), as part of a group of agents in CDMX, decided to create a Doughnut Economic City Coalition using this idea for a coalition because of its adaptability for the local context in 2021. Furthermore, it aimed to support change in W&E governance challenges using sustainability transition methodologies. In this paper, we present and analyse the application of the Doughnut Economics City Portrait Methodology (City Portrait) and XCurve Toolkit (XCurve) sustainability transition methodologies in Mexico City’s Doughnut Economic coalition to support urban governance processes to respond to these W&E security challenges of the city.

2 Background

2.1 Systemic Change

The international challenges are complex and are in constant evolution. Thus, systems thinking perspectives have been used to comprehend these challenges' complexity (Voulvoulis et al., 2022). A system is "an interconnected set of elements that is coherently organised in a way that achieves something" (Wright and Meadows, 2008). Systems include: "elements, interconnections, and a function or purpose" (Wright and Meadows, 2008). Furthermore, there are different types of systems which have been analysed for sustainability (Loorbach et al., 2017): socio-technical, techno-economic, political, and socio-ecological. Each system has been created to analyse the sustainability complexity challenges that come with the links between societal actors and other elements they interact with.

2.2 Links between Sustainability Transitions and Urban Governance

Sustainability transitions and urban governance are fields where innovation looks for systemic change through local agents. They have different but complementary approaches to systemic change. Sustainability transition studies pathways and visions for systemic change (Loorbach et al., 2017; Markard et al., 2012). In comparison, urban governance provides information about the complexity of agents who promote these pathways (Abdel-Razek, 2021). Sustainability transitions could be a way where complex networks of governance agents find common pathways and visions for system change.

The link between sustainability and governance has been promoted in practice at an international level. The 2030 UN Agenda (the political treaty for sustainability transitions) recognizes the principle of common but differentiated responsibilities (principle based on a governance approach). This principle entails that states are the main agents responsible for guaranteeing basic needs and human rights, but the responsibility is shared between other agents (General Assembly, 2015). According to this principle, guaranteeing basic needs and human rights requires collaboration with non-governmental stakeholders. Even when this principle exists, one challenge is to include agents from different scales, sectors, and groups. This is required to create synergies and increase resources to tackle global problems. Sustainability transitions research proposes alternative methodologies to address this challenge, some of which are described below.

2.3 Sustainability Transitions Research

If collaborative work is required for sustainability transitions to promote governance processes, it is important to define the following two elements:

A collaborative definition of sustainability - which can serve as the normative framework for collaboration in governance

Collaborative Transition processes - an analysis of multiple possible transition pathways where collaboration can develop to promote governance

About Sustainability

From the Brundtland Report, sustainable development is the "development that guarantees the needs of the present without compromising the ability of the future generations to meet their own needs" (World Commission on Environment and Development, 1987). This definition highlights the focus of development of the current and future generation's needs. However, it does not explain nor clarifies which are these needs. A way in which sustainability transition research has proposed to formulate these needs has been by contextualising the needs to a particular place and time. For this, it has used systems thinking approaches to define the scope and parts of the system that is being analysed. From these systems, the socio-ecological system approach has been recognized to have a closer framework to sustainability (Fischer et al., 2015).

If the socio-ecological system is used as the framework for sustainability, we still require the normative elements of this framework contextualised to different times and places. Kate Raworth proposed a framework for an international normative perspective of a socio-ecological system called Doughnut Economics. In her framework, Raworth defines that the normative socio-ecological system our societies should work for is one that transits towards "a safe and just space" (Raworth, 2017).

She envisions a "just space" as the social and political values of the Sustainable Development Goals (SDGs) (Department of Economic and Social Affairs, n.d.; General Assembly, 2015). She describes the "safe space" as being within the limits of the science-based proposal of the Planetary Boundaries (Steffen et al., 2015). She has tested this approach at an international level, but has proposed further downscale analysis at national, regional and local level. (Raworth and Benyus, 2021). Sustainability, as envisioned by Raworth, means reaching the SDGs while respecting planetary boundaries. However, it does not include proposals for transitional pathways. Even when Raworth's definition gives a normative framework for sustainability, it misses the procedural requirements to achieve the proposed vision.

About Transitions

To respond to the procedural aspect of the transitions, several socio-technical frameworks have been created (Loorbach et al., 2017). From these approaches, one which has been developed into an actionable methodology is the XCurve (Hebinck et al., 2022; Loorbach et al., 2017). For this approach, transitions include two processes: innovation and disruption. These represent positive and negative feedback loops according to the principle of self-organisation of system's dynamics(Rambidi, 2014).

Doughnut Economics and the XCurve Framework have actionable guidelines for participatory action (Hebinck et al., 2022; Raworth and Benyus, 2021). Due to the

usefulness of these methodologies to create transitional pathways for governance processes, as well as its actionable characteristics, they were applied in the context of CDMX by the Tri-Color Coalition during 2021 and 2022.

3 Aim and Research Questions

Aim and Research Questions

The aim of this paper is to analyse in which degree can the sustainability transition methodologies support complex urban governance challenges. Due to their socio-ecological relevance, the scope of the analysis is limited to the W&E sectors in CDMX. Moreover, the analysis of the activities was delimited to those done by the Tricolor Coalition, with its members and interested participants. Therefore, the audience for this paper are stakeholders interested in promoting governance processes and academia interested in the application of sustainability transformation methodologies.

The research questions that guide this research are the following:

RQ1: How to apply sustainability research methodologies in the Tri-Color Coalition to support CDMX's water and energy governance processes?

RQ2: To what extent are these methodologies adequate to support change in Mexico City's water and energy sector governance processes?

4 Methods

We (the Tri-Color Coalition) used an action-research approach. We followed the definition of action-research by Brydon-Miller et al., as "a participatory, democratic process concerned with developing practical knowing in the pursuit of worthwhile human purposes, grounded in a participatory worldview which we believe is emerging at this historical moment. It seeks to bring together action and reflection, theory and practice, in participation with others" (Brydon-Miller et al., 2003). For this, we conducted five (5) participatory workshops in 2021 and 2022 and applied two methodologies: City-Portrait Methodology and the XCurve Framework. We triangled the information obtained from these workshops with the information done after a literature review of the water and energy challenges of Mexico City and interviews with relevant stakeholders. For the participatory workshops, we invited participants from the following groups procuring a balanced amount of participants per group: local government, enterprises, academia, NGOs, and citizens. All the participants were involved with W&E, because of their personal motivations, projects they are a part of or their main job.

4.1 Data Processing by Research Question

The data obtained in this year-long project comes from the events and interactions we had with our members and other stakeholders. Our dynamic objectives were methodically reviewed and iterated according to feedback and best practices from past events. Our timeline was the following:

Figure 1 – Action Research Timeline

Data Processing for RQ1 - How to apply sustainability research methodologies to support Mexico City's water and energy governance processes?

a) Data Collection - We used three methods: literature review, interviews and a stakeholder workshop. A literature review and interviews were done to understand the process of the creation of other Doughnut Coalitions around the world (Amsterdam, Berlin, Brazil, Barbados, California) as Tri-Color Coalition was based on these. Moreover, we developed a stakeholder workshop to collect data on their answers to this research question. We were involved and engaged first with CDMX's Doughnut Economics stakeholders and later with W&E decision-makers.

b) Data Reduction - To reduce the data, we made an inductive coding of the information collected from the literature reviews and the interviews and translated them into actionable working steps:

- Step 1 - Stakeholder Mapping
- Step 2 – Analysing the challenge
- Step 3 - Ideal Future Scenario
- Step 4 - Actionable project proposals.

c) Data Analysis - Finally, we made a literature review to find actionable sustainability transition methodologies we could use to address CDMX's W&E governance challenges.

Data Processing for RQ2 - To what extent these methodologies are adequate to support change in Mexico City's water and energy governance processes?

a) Data Collection: We collected data from the research for a stakeholder map from 4 codesign events with the members of the Tri-Color Coalition, an in depth literature review of W&E challenges in CDMX, indicators following the advice from experts, and a survey with the members of the Tri-Color Coalition and other agents of change. We obtained four types of data: a) challenges of CDMX's W&E challenges, b) stakeholders

that could support the response to those challenges and, c) future scenarios of those stakeholders of what change would mean, d) possible actions where these stakeholders could jointly collaborate.

b) Data Reduction: As we collected a substantial amount of data, we summarised and condensed the data using two criteria: a) relevance for representative decision-makers and academic stakeholders, and b) valid data comparison.

c) Data Analysis: The data were analysed following the City-Portrait Methodology and the X-Curve Framework sustainability transition research methodologies. In each of the workshops and events, we allowed some space to iterate the analysis through codesign. Also, we did this iteration to ensure that the data translated accurately from our participants to our records. Furthermore, the results were reviewed with experts who are members of the Tricolor Coalition. The results of the survey were analysed statistically.

4.2 Actionable Sustainability Transition Methodologies

Sustainability transitions literature has been criticised for its small impact outside academia (Kirchherr, 2022). For the past decade, this criticism has motivated researchers to create manuals and guidelines to translate sustainability transitions academic knowledge into practical actions and make information accessible and context-sensitive (Raworth and Benyus, 2021; Silvestri et al., 2020; Wittmayer et al., 2011).

The reach of sustainability tools outside academia, high-income contexts (Doughnut Economic Coalitions in European cities, for example), and the third sector (such as Design Your Action in Southern Mexico) have been limited. Moreover, from our experience, the mentioned manuals and tools are not available in all the necessary languages, they often use difficult theoretical concepts which require advanced training from facilitators and participants. Also, they do not always needs or culture sensitive (Bartunek, 2007; Kaufman, 2022).

Moreover, from previous Coalition Founders' experiences learned from two (2) interviews and two (2) conferences, we learned that an individual methodology was insufficient to promote governance processes. Thus, based on this, we choose to follow two sustainability transition research methodologies in a complementary way.

4.2.1 About City Portrait and XCurve methodologies

City Portrait and XCurve have both theoretical explanations as well as actionable guidelines. City Portrait Methodology aims to address the analysis of the Doughnut Economics proposal in context, giving a vision for sustainability goals. In comparison, XCurve analyses of available interventions to reach said vision. In practice, we tested

these two theories by adapting them to CDMX's W&E governance process while finding a way, so they complement each other's actionable gaps.

City Portrait Methodology

The City Portrait Methodology serves as a workshop to analyse the sustainability ideal scenario of a group of stakeholders in a city. This methodology requires to choose the stakeholders that will participate in the workshop, the development of the workshop, and the analysis of the current state of the city and the stakeholders' future vision of it (Raworth and Benyus, 2021).
Due to the priority of this research to support governance processes, we adapted of this approach by dividing this methodologies' requirements into three (3) steps. The steps done to develop this methodology were the following:

- Step 1 – Stakeholder Mapping.

Using a Social Network Analysis, we made a stakeholder map (Yang et al., 2017). We identified and analysed CDMX's agents of change in the W&E to create a network. The identification of diverse agents was based on research of social media, publications, and governmental videos using a snowball methodology. To ensure inclusive participation, we had continuous feedback from new agents during the process.

- Step 2 – Analysing the challenge using the Doughnut City Portrait questions
We facilitated four focus groups with experts and reviewed the literature to analyse the most relevant water-energy challenges in CDMX. The first two focus groups aimed to ask the participants about their needs as sustainability decisionmakers. These focus groups had balanced participation of between 20-40 agents from government, enterprises, academia, non-governmental stakeholders, and citizens. Two other focus groups were done with academic experts, one for water and one for energy, and they aimed to respond to four questions: 1) What are the social and environmental requirements in CDMX? 2) What is the scale of these requirements? 3) What indicators can be used to measure these requirements? 4) What are the ideal values of these requirements for CDMX?

The City Portrait Methodology consists of the analysis of a "safe and just space" in a geographical context. This method has been used at different scales and in different regions (Raworth, 2021). For inclusive purposes, it is done qualitatively, asking the four questions from Figure 2 below:

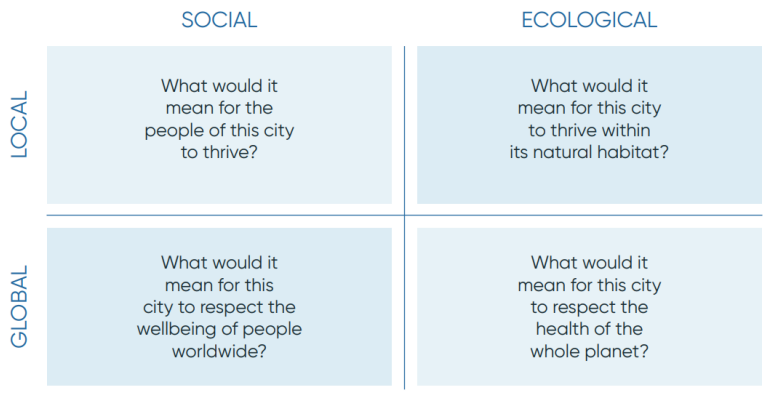

Figure 2 City Portrait Methodology canvas (Raworth and Benyus, 2021)

- Step 3 – Future Scenarios.

We created a survey based on Causal Layered Analysis for current and future scenarios of W&E in CDMX (Inayatullah, 1998). We aimed to identify how agents perceive the challenges today and what their expectations are for the future. We will use this material to create scenarios that can be used to define transitional paths. In the design of the survey, we aim to identify values, priorities, and expectations of agents of change in CDMX.

As used in design, future scenarios are useful tools to gather interests and values of the agents of change we are working with. Also, they spark creative thinking and promote action towards the co-created vision for the system.

XCurve Framework + Toolkit

The XCurve Framework, compared to other sustainability transition methodologies that analyse the dynamics of systems change, includes both the build-up and the breakdown patterns required for change. This framework resulted from a literature review and was then developed into an actionable framework paper (Hebinck et al., 2022) and a toolkit with different examples of workshops for its use(Giorgia Silvestri et al., 2022). The toolkit's main purpose is the analysis of the interventions in a context. Based on this toolkit, we applied this methodology in one step:

Analysis of CDMX water and energy projects

We made a focus group to analyse available interventions for sustainability transitions. We designed and facilitated a participatory online workshop adapting the guidelines proposed for this framework to our context and following the analysed results from our previous work. (Silvestri G., et. al, 2020). In this workshop, we invited the stakeholders who participated in the focus groups, and the ones who participated in the survey. We

began the process by summarising the results of the previous research to the group. We presented the preliminary analysis of the challenges and some data from the survey to guide the conversation. In Figure 3, this image from the XCurve toolkit shows four moments that have to be asked during the workshops. Thus, during our focus group, we made four breakout rooms which rotated every 7 minutes, in a World Cafe Format.

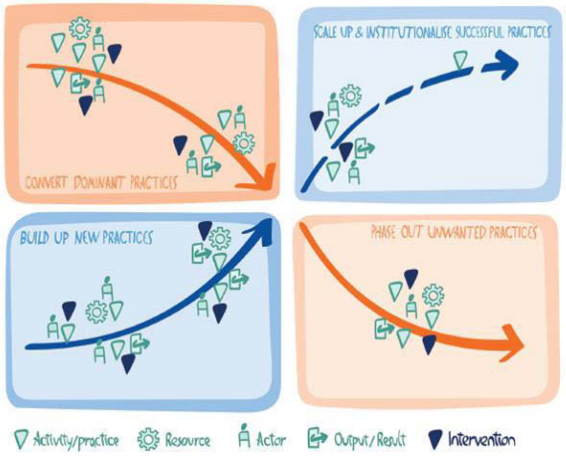

Figure 3 X-Curve framework Proposed Workshop Visualization (Silvestri, G, et. al, 2020)

We made some changes to the original guidelines of the XCurve Toolkit. To adapt this workshop to support governance processes, we extended the research from asking merely about which interventions the participants considered useful to inquire more about the feasibility of agents jointly implementing these interventions. For this, we asked three questions for each XCurve quadrant: 1) Which are concrete interventions for this quadrant? 2) Who can implement these interventions? 3) What are these agents' existent and missing capacities to implement these interventions? We did this adaptation after concluding that governance processes require understanding agency and capacities (Hölscher, 2019).

5 Results and Discussion

RQ1 - How to apply sustainability research methodologies to support CDMX's W&E governance processes?

We organised an initial event to co-create how to adapt sustainability research methodologies to CDMX's W&E sectors. From this event, we learned that stakeholders are interested in using these methodologies to support governance processes in the following ways(Tricolor Coalition and First Meeting Stakeholders, 2021):

- Develop communication tools.
- Create reference baselines.

- Create a support structure between the participants.
- Analyze the focus ideas and priority actions of the system.
- Create a platform to fund projects.
- Exchange knowledge.
- Compile existing research
- Evaluate existing development plans with the information obtained.

From these results, we decided to test methodologies that could help us to deliver the previous goals. Moreover, we realized the need of a platform where these services could be provided.

Following this initial event, the Tri-Color Coalition started then as a multistakeholder action-research project to find sustainability transitional pathways using Doughnut Economics and XCurve Framework. However, through the responses and requirements of the stakeholders for this action-research project, it showed the need to develop into a structured platform for collaboration due to the needs of the participants. The coalition at first had 3 members and, as of August 2022, there are 21 members and over 100 interested stakeholders. These members are individuals and institutions interested in sustainability coming from the government of CDMX, enterprises, NGOs, academia and citizens.

RQ2: To what extent are these methodologies adequate to support change in CDMX's W&E governance processes?

We analysed the degree to which these sustainability transition research methodologies were adequate to support CDMX's W&E governance processes. As a result, we obtained the following:

5.1 City Portrait Methodology

For the City Portrait Methodology, three steps were done: stakeholder mapping, identifying priority problems, analysing the future scenarios.

Stakeholder Map

For the stakeholder map 136, agents related to water, energy, and sustainability were identified in CDMX. There are agents from all three sectors, public, private and social, and academia. The agents identified were from the government, the private sector, the third sector, academia, and citizens. The stakeholders are part of either international, national, or urban levels. Agents involved in water (4 public projects and 1 private project) and energy (5 projects) were identified. In addition, another private project was chosen to understand the possibilities of collaboration within the private sector. From

these stakeholders, 37 out of the 136 stakeholders were interested in being part of CDMX's Tri-Color Coalition (Fig 3, in black). As a result of the review of documents and audiovisual analysis, 14 experts from academia and the government sector were identified who played a key role in the implementation of W&E projects in CDMX.

Additionally, stakeholders that are implementing various energy or water projects in CDMX were identified within the stakeholder network analysis. Each of these stakeholders is characterised as node in Figure 4. In the graphic, the thickness of the lines that connecting one project with another depends on the amount of links we found between them. We call "multi-connectors" the nodes (circles) with more than one link. (Figure 4, orange = energy and navy blue = water). Likewise, stakeholders involved in both W&E projects were identified (Figure 4, green). In the following list, institutional names are shown for the super-connector of energy, water, or both:

The water multi-connector was CDMX's Water System Agency (Sistema de Aguas de la Ciudad de México). In comparison, there were several energy multi-connectors: a) Secretary of Energy, b) Federal Electricity Commission, c) Secretary of Economic Development of CDMX, d) Government of CDMX, e) National Polytechnic Institute, f) Trust for Energy Saving Electric, g) "Central de Abastos". Finally, from an energy-water nexus perspective, the energy-water multi-connectors were: a) Secretary of the Environment of CDMX, b) Secretary of Education, Science, Technology and Innovation, c) National Autonomous University of Mexico (UNAM), d) German Cooperation Agency for Sustainable Development (GIZ).

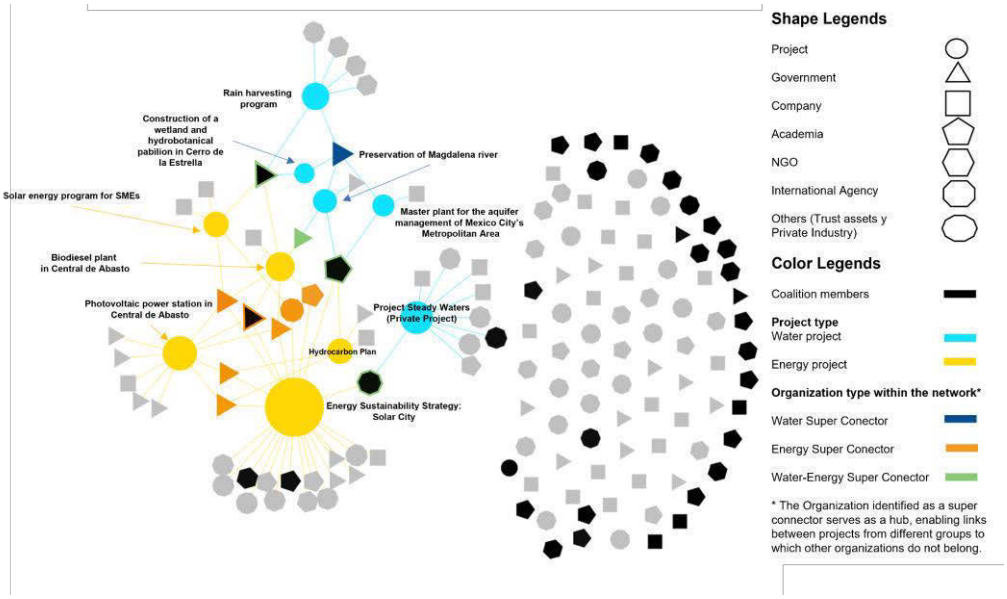

Figure 4 - Map of agents of change related to energy and water projects in CDMX. The geometric figures represent nodes (W&E projects in circles. stakeholders in other geometric figures). Meanwhile, the lines represent the interactions between nodes. This social network analysis is known as a "two-node network" since it connects the stakeholders with the projects that collaborated. Image credits: Ricardo Gomez Zamudio.

Finally, of the 136 stakeholders identified, 50 participated directly in W&E projects implemented in CDMX (Fig. 4 and 5). From these 50 stakeholders, 34% were part of the government, 20% companies, 14% international agencies, 12% academia, 10% NGOs, and 10% others (trust asset and private industry). From these results, we visualise the importance of collaboration between the business sector, government, academia, and international agencies for an effective governance implementation of W&E projects.

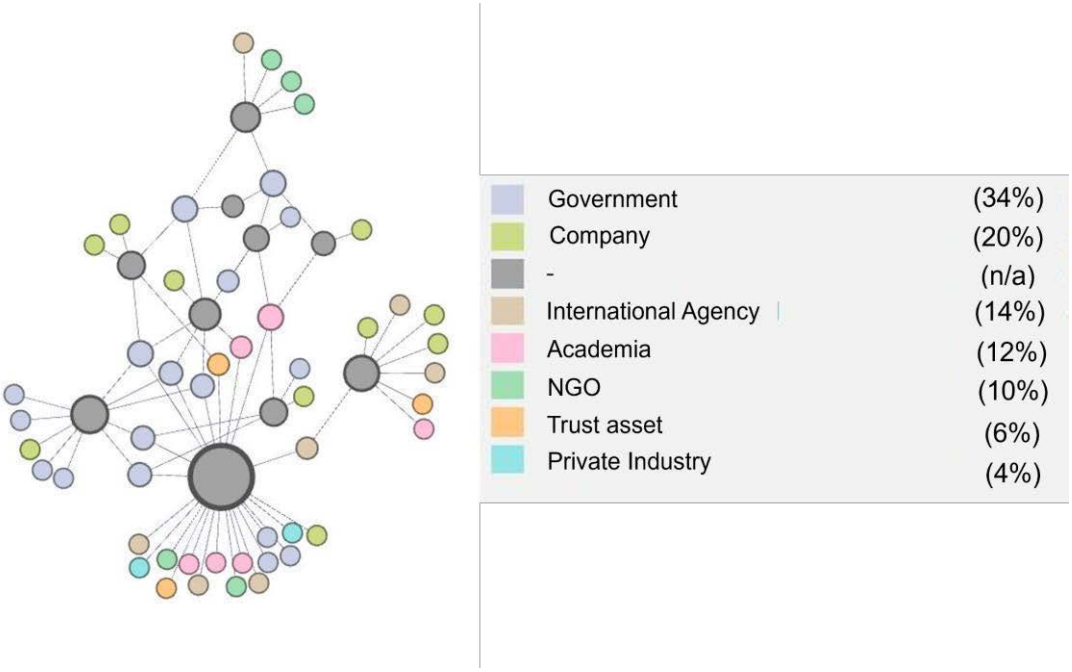

Fig. 5 Map of agents of change related to energy and water projects in CDMX divided by sector. Grey circles represent the analysed projects. Image credits: Ricardo Gómez Zamudio

Based on these results, we aim to show the governance agents of CDMX's W&E and their interconnections. The results show only a few agents serve as supper connectors in W&E. Moreover, the network is divided into branches, each directed by a multi-connector.

One possibility to support governance processes could be then to increase the quantity and quality of the multi-connectors relationships with other public-private-people partnerships. Also, it seems to be useful to support these multi-connectors to continue their collaborative work. Moreover, new agents could be supported as multi-connectors to increase the amount of local nodes and the resilience of the connections. It is worth mentioning that the GIZ collaborated on both public and private projects. Therefore, this analysis suggests that the work GIZ is doing could serve as a good practice example of what is required to strengthen public-private collaborations in CDMX.

We want to highlight that opportunities for improvement of actor network analysis exist as this map is not yet exhaustive of all the W/E relevant stakeholders in Mexico City.

A methodological update and a more extensive analysis of the Mexico City's stakeholders must be done. This analysis should include more extensive information about projects, agents of change, and levels of influence of the agents to be representative of the stakeholders in Mexico. Also, this map could include their levels of influence for the effective implementation of individual or joint projects in the future. Furthermore, participatory workshops with various agents of change in CDMX can be done, to enrich and expand the stakeholder map in the future.

Analysing the challenge

We facilitated two focus groups with academics specialised in W&E, which served to analyse the water and energy priority challenges in Mexico City. We included two experts from CDMX's water sector and three from the energy sector. From the water sector focus group, 45 topics were identified as priorities. These were found during research. From these, a coding exercise was done, and the following 13 priority topics resulted:

CDMX's Water Sustainability Priorities

1	Water reuse
2	Regeneration and conservation of ecosystems
3	Water consumption
4	Citizen and Community Participation in Hydrological Planning
5	Regulation
6	Hydrological Risks
7	Hydraulic Infrastructure
8	Monitoring
9	Urban expansion
10	Inter-scale coordination
11	Shared investment
12	Basic Needs
13	Territorial Planning

Table 1. Priority Topics for CDMX's water sustainability challenges according to a group of experts on the field. Source: Own Creation.

From the energy sector, 28 topics were identified. From these topics, a coding exercise was done and the following 11 priorities resulted:

CDMX's Energy Sustainability Priorities

1	Air Quality
2	Energy Reduction
3	Energy for those who need it
4	Political support
5	Innovation
6	Urban Planning
7	Renewable Energy
8	Energy Efficiency
9	Circular Economy
10	Social Acceptance
11	Subsidies

Table 2. Priority Topics for CDMX's energy sustainability challenges according to a group of experts on the field. Source: Own Creation.

From this data, we can see five relevant topics for both W&E: resource consumption, resource value chain, territorial planning, community and government engagement, and finance. In comparison, other topic priorities were different between W&E. For the energy sector, innovation and efficiency were considered a priority and, for the water sector, the regeneration of ecosystems and infrastructure.

The similar priorities that exist between the W&E sectors supports the existence of a water-energy nexus, as we have found in the literature (Ahuja,2015). This study is an initial discussion of the priority topics of W&E in CDMX and can be expanded in the future.

Future Scenarios

We have applied a survey (January - July 2022) to understand their values and priorities regarding sustainability transitions in CDMX. This survey is based on Causal Layered Analysis, a technique coined by Sohail (Inayatullah, 1998) and used foresight to define possible futures. We utilised the defined topics and indicators from the previous research (Stakeholder Mapping, p. 11) as starting points to create this survey.

This survey has been answered by 27 agents of change (People currently involved in water or energy projects in CDMX) within the Tri-Color Coalition. We have had a balanced response from different groups of the population, with the private sector (47.8%) being the most present, followed by academia (26.1%) and third sector (13%). We also had responses from residents of 8 different boroughs from the 16 in CDMX. Even though we have strived throughout this project to maintain gender representation,

unlike the Tri-Color Coalition's participants, where 46% identify as male, a majority of the survey respondents identified as male (62.5%). These numbers in participation suggest that agents of change in CDMX are well distributed between different groups of the population, and the work of the Tri-Color Coalition has attracted balanced participation. Future efforts can be made to increase the participation of youth and the elderly, as well as lower-income groups and informal workers.

Although we will continue the analysis and share publicly detailed results and future scenarios from this survey, we are already identifying interesting patterns and pathways for future research within the preliminary analysis of the results. In addition, we obtained several qualitative responses to the W&E futures of CDMX that we will be analysing further:

According to the participants, the future for the water provision in CDMX appears to be very negative (59.2% of our respondents currently receive clean water daily (tap water), and 81.5% of the respondents fully agree with the statement "If current consumption continues, water in CDMX will be depleted". In contradiction, respondents believe their water consumption is sustainable (average 2.93 out of 5) and generally agree that their current consumption is enough for a dignified life (averaging 3.89 out of 5 (no-yes)). We gathered a substantial number of concrete suggestions for change ranging from improvement in water treatment facilities to changes in the subsidy policy for water in CDMX from participants. Water provision in CDMX is a top priority for the population and people. The results suggest that the outlook for water provision looks different between boroughs and incomes. In the future, the Tri-Color Coalition can focus on localised and specific water projects to provide context sensitive interventions.

On a different example from the energy sector, the future scenario, according to our respondents, is not as negative. Respondents are on average neutral towards current energy prices in CDMX (3 points (1 to 5) where in the question "energy is expensive in CDMX") with the clear exception of gasoline (gasoline has a strong division by sector; public sector respondents perceive gasoline as more expensive than the others (100% of public sector respondents answered they fully agree to "gasoline in CDMX is expensive" versus only 27% of all other sectors together). Respondents agree that consumption of electricity and gasoline will increase above inflation and believe energy will become more expensive. There is an important division in purchasing power by gender where people who identify as female struggle more to cover their daily energy costs (men answered on average 4.81 and women answered 4.45 to "I can afford my daily energy costs" (1=no, 5=yes). This suggests that sustainability transition pathways for energy will require intersectional interventions focused on differences between income and energy consumption by gender.

We can interpret the results of these surveys as interests and priorities on specific topics of agents of change. The exercise of finding interventions to achieve the desired futures are pathways for our common vision. These pathways allow us to identify and suggest, concrete points for intervention towards a more sustainable future for future research and projects. The scenarios that will result from the complete data analysis will provide us with a tool, based on social priorities, to advocate and communicate the need for sustainability transitions and their effect on people's quality of life; this is in line with the reflections from the first event.

5.3 Analysis of Current Projects Happening in CDMX

We adapted and applied XCurve Framework to analyse governance processes. We invited all engaging agents in the Tri-Color Coalition and made an open call for new participants. The participants included people from the government, the private sector, the third sector and international stakeholders. Due to privacy concerns, we will not publish the name of the stakeholders involved.

The results from this workshop are divided into two, disruptions and innovations, according to the XCurve Methodology. Moreover, each of these themes will be subdivided into three types of results:

- Interventions (required for a transformative change)
- Stakeholder roles (stakeholders that can implement these interventions)
- Capacities (existent and missing capacities of the stakeholders to implement these interventions).

5.4 Disruptive interventions

- Interventions:

The disruptive interventions that were stated in the workshop include: 1) over-consumption (and lack of sanctions to it), 2) inequality of resources, 3) pollution by citizens (as a normal citizen practice), 4) environmental degradation, 5) short-term vision (instead of long-term), 6) lack of trust in the system, 7) lack of investment in sustainable projects, 8) legal obstacles for production of renewable energy sources, 9) lack of monitoring of carbon emissions in energy production, 10) lack of an adequate value for energy and water, 11) lack of knowledge of the technical and economic feasibility of reducing CO2 emissions. The results show that the stakeholders chose which were the patterns and obstacles they saw were required for a sustainability transformation. These shows that governance processes for disruption require interdisciplinary efforts that come from political science, finance, education, economics and legal perspectives.

- Stakeholder Roles:

The agents recognized to be capable and responsible stakeholders for the interventions included public, private, NGOs and citizens. From the public sector, the federal and local level were recognized, and the executive and the legislative civil servants. From the private sector the list included: investors, industries and expert consultants. From the social sector three groups were mentioned: academia (including observatories), NGOs and city residents at a household level. These results showed that disruption mainly required agents with structural power.

- Capacities:

The participants described what actions agents of change could do to tackle the identified challenges: 1) legal defence, 2) lobbying in communities, 3) unity between stakeholders with same vision, 4) public writing manifestations, 5) social participation, 6) promotion of transparency, 7) registry of service providers, 8) circular economy and inclusive political will, 9) monitor/oversight by citizens.

The missing capacities mentioned were: 1) a fragmented society (they referred to "class" divisions), 2) political will, 3) citizen commitment, 4) dialogue between public and private stakeholders, 5) regulatory capacities in law and 6) enforcement of the law, 7) involvement of the affected agents, 8) communication about the transition, 9) decreasing bureaucracy obstacles, 10) involvement of different agents in the decision-making process and 11) transition of the staff into their new roles.

These results show political existent capacities. However, they show lack of communication, legal and cultural capacities.

5.5 Innovative interventions

- Interventions:

The participants stated innovative interventions through concrete projects that could be developed to reach the system's transformative goals. These included: 1) rain catchment, 2) water leakage analysis, 3) water crisis education, 4) enforcement of W&E payments, 5) advice for water basin councils, 6) incentives for renewable energy and water recycling, 7) strengthening the strategy of solar heating and water recycling in buildings, 8) increasing sustainability education, involving experts on the field, 9) citizens non-conformation with the problems 10) coherence between politicians and citizens actions, 11) taxes to negative externalities, 12) promotion of technological developments in W&E, 13)thermal efficiency regulation for building constructions, 14) economic incentives in taxes, 15) enterprise donations, 16) compilation of success

practices for policy creation, 17) education Campaigns, 18) citizen council followup to interventions and 19) collaboration between government agencies.

- Stakeholder Roles:

We recognised four agents that can implement these interventions: 1) Public servants (different sectors, but not all of the government); 2) civil society (organised communities, citizen representatives and the citizens themselves), 3) developers for sustainability projects (private sustainability investors and small businesses for funding the sustainability projects and policy lobbying) and 4) academia (experts in sustainability and climate change from public and private institutions to spread the information of the current state and of new action proposals). They stated that their roles were divided, but that there was the need for collaboration amongst them.

- Capacities:

The capacities that we found through the workshop for these innovations included: 1) government reports 2) market prices for W&E and 3) long-term planning for governments (20 years).

The capacities the participants identified as missing included: 1) reception of projects, 2) Increased communication of expert institutions, 3) citizen or entrepreneurial counsel to monitor governmental action, 4) pressure from civil society, 5) legal modifications, 6) multi-stakeholder dialogue events, 7) understanding of the W&E agents, 8) reaching agreements between different stakeholders, 9) understanding of the current challenges, 10) information on how agents can support change, 11) taxation that show the real value of W&E, 12) creating a common vision, 13) creating a private funding commitment, 14) creating relevant legal sanctions, 15) increasing water measurements , 16) perfecting information and dissemination channels.

Figure 5 shows the results of the participatory workshop:

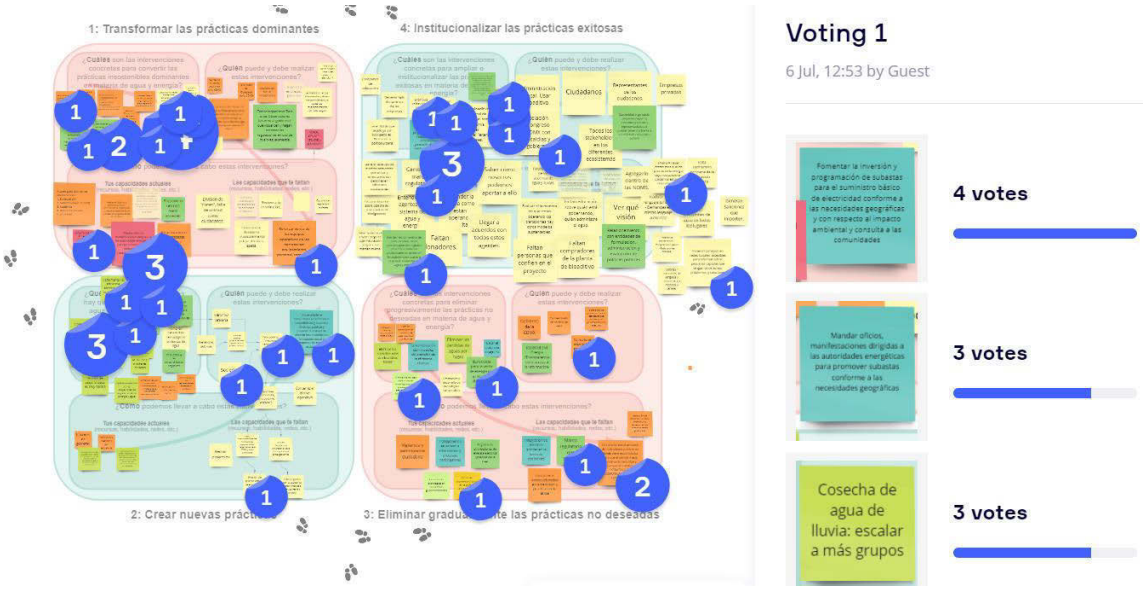

Figure 5 - Multi Stakeholder Intervention Analysis Workshop. Source: Own Creation Results from Intervention Analysis Workshop

In Figure 5, the quadrants in red show the disruptive interventions analysis and the ones in blue show the innovative interventions analysis. Moreover, on the right side of Figure 5, there is a list with the five interventions that had the highest number of votes from the participants. These were chosen as priority interventions for a sustainability transition in Mexico City taken into consideration feasibility and impact. These interventions show possible governance collaborations in the near future.

After finishing this workshop, the stakeholders finally answered a survey to understand the usefulness of this workshop. They stated that the most useful part of this workshop was the dialogue with other agents of change.

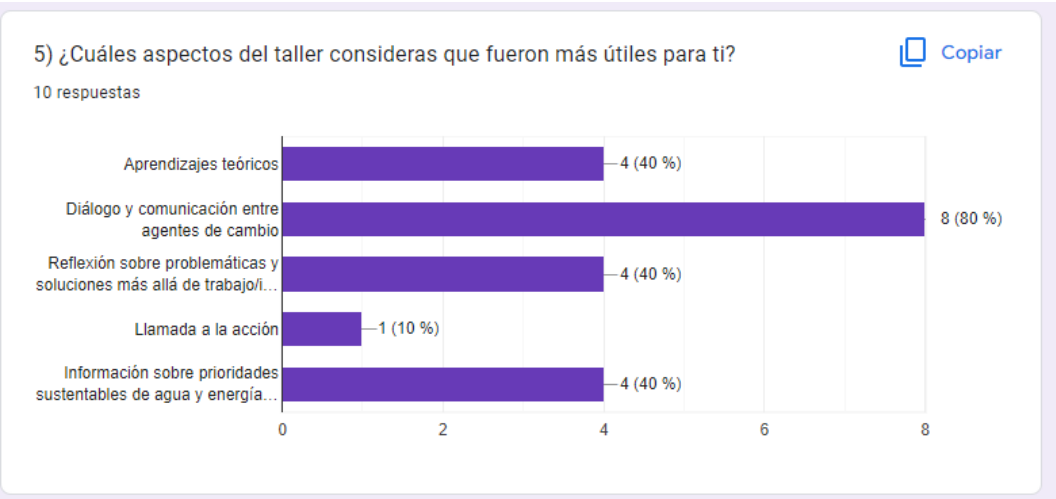

Figure 6 - Survey of the Intervention Analysis Workshop Source: Own Creation based on Survey.

Moreover, even when the participants of the workshop stated that the call to action was not as useful for them for this workshop, all of the participants said they would be open for future collaboration (20% of the participants answering “maybe” to these questions). This shows that there was a clear positive potential to continue developing governance processes.

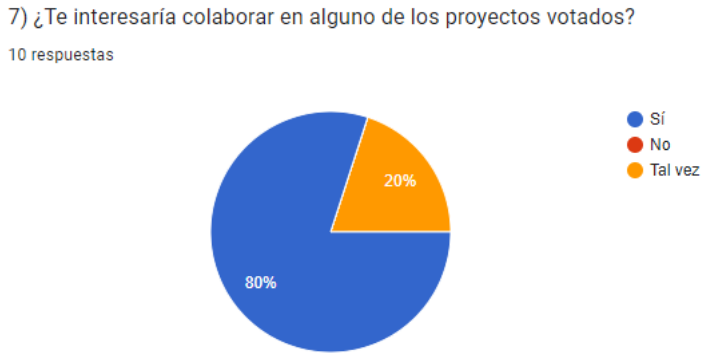

Figure 7 - Seventh Question in the Survey (Translation: 7) Would you be interested in collaborating on one of the voted projects? 10 answers: Yes, No, Maybe)
Source: Own Creation.

These results show how the adapted X-Curve toolkit served to analyse the interventions, roles, bottlenecks and opportunities for a sustainability transition CDMX’s W&E sector. The workshop provided participants with a space for dialogue, holistic learning of the W&E priorities and a space to reflect and be informed on current issues and strategic opportunities. It also catalysed ideation of specific actions for sustainability transitions. Our results reflect the opinion of those who participated in the workshop and cannot be considered exhaustive. However, it does give an initial approach and guides us to future action research opportunities. Moreover, it shows that a longer-term project is required to not only analyse the governance vision of the stakeholders, but also to put it into action.

6 Conclusion

To respond to the first research question, and through a year of work with agents of change in the W&E sector in CDMX, we learned that the methodologies we decided to apply, with proper adaptations, are useful for creating a platform with multiple stakeholders. Continuous and long-term collaboration in various projects and events was useful as an action-research approach. We identified three ways in which these methodologies could be used to support governance processes: a) creating a network of agents of change, b) delivering updated and holistic information on the challenges and prioritise projects to address a sustainability transition in CDMX, and finally, c) supporting capacity building of agents of change at an individual and group level.

The importance given by stakeholders to networking must be highlighted. Agents of change were mostly interested in exchanging contacts, knowledge, ideas, and resources for reflection and action (Figure 6). With this research, we have acquired substantial data on CDMX agents of change in the W&E sectors. This data has opened opportunities for future projects and research.

Moreover, to respond to our second research question, we observed that these methodologies were adequate but insufficient on their own to support governance processes. These methodologies functioned better together, as neither provided all the elements we required to translate theory into action. Each of these methodologies made an analysis with a different perspective of the systemic challenges for a CDMX 's W&E sustainability transition: the vision of the change, the analysis of the current situation, the future vision of the stakeholders, and the possible interventions available. Each of these methodologies was insufficient for action. Still the complementation of these methodologies was useful to guide and co-create with stakeholders a complex system analysis reflection into possible collaborative action. These complementary methodologies used to support urban governance could also be applied to guide other sustainability transitions with a governance approach at an urban scale. However, they should also be adapted according to the stakeholders needs, for their involvement in the process and their benefit.

In addition, this research paper shows that sustainability transition methodologies are adequate to be applied to concrete cases in urban settings. They show that these systems thinking methodologies promote collaboration between governance actors and develop joint understandings and pathways for action. However, for them to be useful for governance processes, these methodologies must be co-contextualized and co-created according to the stakeholders that participate in them.

Moreover, we recognise that an action-research that brings people together cannot be done in the short term and requires both scientific basis but also social interaction, as they were two interests of the stakeholders when deciding to collaborate. Also, in the Tricolor Coalition, researchers and participants are volunteers interested in sustainability in CDMX. This shows the potential of the proposition. However, due to the scale of the problem, more extensive analysis are needed with more time and resources. Moreover, we saw a lack of participation of some stakeholders due to clarity and legitimacy of this platform. Thus, we believe a coalition building action-research to support governance processes requires an accessible long-term platform with resources, and legitimacy.

In this way, the action-research results can understand the common governance challenges and opportunities for sustainability transitions through time, and can help to facilitate the design and implementation of action between stakeholders. Finally,

further research was also found to be required on the design of multi-stakeholder platforms to achieve dialogue between different agents and promote governance processes. The next objective for the Tri-Color Coalition will be to use the learnings for this design.

Acknowledgements

We would like to thank all the participants in the development of the ideas and objectives to develop these methodologies in the Tri-Color Coalition, including but not limited to: Jill Jäger, Stephen Stec, Katharina Hölscher, Doughnut Economics Action Lab, DRIFT. Moreover, we would like to thank especially our volunteer members that worked with us in the development of our objectives: Jimena Silva Pastrana, Jahir Mojica, Nele Kress, Adriana Elera, Jimena López Montaño, Ariana Célleri, Karla Magali González, as well as the institutions of Pyxera Global, SUEMA and MOJA for their support.

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