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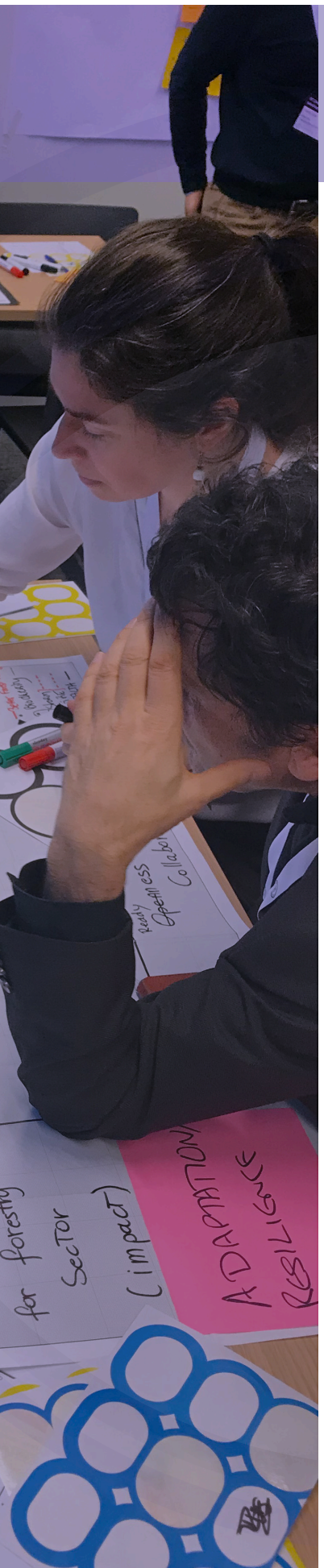

Participatory processes for decision-making in policy learning: a methodological proposal.

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Abstract

Participatory approaches are intended to be a useful tool in understanding complex systems, while at the same time trying to favour the development of processes linked to social problems. For their part, co-creation methods linked to visual thinking tools facilitate the pooling of different perspectives provided by different stakeholders around a common challenge. The different experiences from which this methodological proposal arises have made it possible to verify how the follow-up of a structured procedure provides further indicators and empirical evidence that favour decision-making in the generation of public policies around energy transitions and sustainability problems.

This paper structures the methodology used over five years of application within the Transitions Hub project. Despite the existence of elements that can undergo variations of different types, especially due to differences in the context of application, the aforementioned methodological structure constitutes a standard that can be replicated in different environments that have in common the existence of a problem or challenge that can be faced from different fronts. The participatory processes carried out from 2014 to the present 2019 show a refinement of the process to constitute such a standard. The Visual Thinking techniques that have been applied in the workshops during these five years, given the incipience of the discipline, will be expanded in the future, as well as the modalities of data analysis and information dissemination. Nevertheless, the conformation of a methodological pattern supposes a milestone for the establishment of this approach to complex problem solving.

Keywords

participatory methods, co-creation, stakeholder engagement, visual thinking, circular economy, practitioners, policy, decision-making

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Colophon

Disclaimer: The content of this paper is based on the results of applied research projects by a cross-team of Transitions Hub and RIS programme staff as part of wide interaction with academic and policy community . As such, the results do no necessarily reflect the opinion of EIT Climate-KIC.

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1. Introduction

Participatory action research has an extensive history in many fields of research. It first found expression in the work of the Tavistock Institute of Human Relations in the United Kingdom (Rapaport, 1970). Participatory research is an alternative philosophy of social research (and social life [vivéncia]) often associated with social transformation in the Third World. It has roots in liberation theology and neo-Marxist approaches to community development (e.g., in Latin America) but also has rather liberal origins in human rights activism (e.g., in Asia). Three particular attributes are often used to distinguish participatory research from conventional research: shared ownership of research projects, community-based analysis of social problems, and an orientation toward community action (Kemmis and McTaggart, 2007). Its approach to complex systems conceives systems as a human reconstruction of the complexity upholding learning, providing a new dimension to participation. Besides some conceptions similar to consultation (Burns, 2007), participatory action research has become an ambivalent concept: it is a process in itself, but also a source of knowledge creation (Nevens et al, 2013).

As a social learning process, it can be established that it can arise from monitoring and evaluation or transitions in general (Nevens et al., 2013). As a provider of social outcomes related to policy or social learning (Geurts and Joldersma, 2001), it can improve the quality of decisions, having a long-term impact on a specific action (Salter et al, 2010). But, while who and what we learn matter (Van de Kerkhof & Wieczorek, 2005), we focus on how the learning process is carried out.

Participatory action research processes are, according to the experts, useful to understand system change and sustainability aspects as allow the exploration of paradigm changing within collaborative contexts (Bocken et al., 2018). Bringing 'analysts' and 'actors' together by combining problem solving methods, data analysis and expert advice, co-creation becomes an essential process that is the core of this approach, being this point mainly theorized in the service management field and tailored to the business – costumer relationship (Galvagno & Dalli, 2014). Engaging in practice favours a rapid and effective sharing of information between peers that improves the effectiveness of the learning (Lave & Wenger, 1991) and get enlarged when personal experience and competence are linked to community knowledge within communities of practice.

These communities of practice are formed by a group of people who recognize knowledge as an asset and mutually engage in a process of collective learning that produce a repertoire of common resources in a shared domain of human endeavour (Wenger, 1998, 2000), leading to the generation of distinct routines, conventions and other institutional arrangements. Learning within these communities is based on convergence based on mutual relationships, shared ways of interacting, knowledge about the rest of the agents and their competences, but also a shared language (Wenger, 1998).

In this environment of participatory action research within communities of practice, knowledge becomes in many ways the main resource to extract progress and innovative practices (van Oort and Lambooy, 2014), going through a complex process of meaning making, in which agents argue, contest and compete for the dominance of their interpretations (Boschma, 2005). Knowledge flows that merge from these practices are open to interpretive flexibility (Feola and Nunes, 2014; Feola, 2015), and the result is a new degree of interaction impacted by the degree of trust generated between the actors and agents taking part into the participatory processes (Bathalt et al, 2004).

The main result of these kinds of interactions driven by participatory methods is the actor learning (Brown et al., 2003; Raven, 2005), which become essential to embed new collaborative approaches between them (Leising et

al, 2018). This actor learning is the result of a process of multimodal communication that overcome the purely written and spoken forms of data collection to provide alternative ways of approaching to a common topic (Hartel, 2014). This communicative event must be understood within a Triple-Helix Space's logic (Leydesdorff and Etzkowitz, 1996, 1998), where industries, government and universities share knowledge in order to solve common problems and provide a high degree of generative synergies within complex systems (Leydesdorff, 2008). These activities between Triple Helix actors, such as participatory processes, can be measured in many ways (Leydesdorff, 2003; Leydesdorff et al., 2006) and, as we will see in the following points of this paper, codified knowledge is one of the valuable measurable outputs that we can extract, where inputs are transformed into potential insights to be embedded in a local environment in tacit forms (Maskell et al., 1998; Asheim, 1999). This process of knowledge codification in participatory processes allows aligning closely common and different cognitive frameworks to enable innovation diffusion (Longhurst, 2015), or even policy transfer (Dolowitz and Marsh, 2000) and technological evolution (Garud and Rappa, 1994).

By means of this research process and the subsequent knowledge transfer within participatory approach, some alliances between researches and participants are built around the development of skills and capacities. This construction of bonds between participant agents is considered to be as important as the results (Kindon et al, 2010; McIntyre, 2008) as it is stated that the engagement in participatory practices favours a rapid and effective sharing of information between peers that improves the effectiveness of the learning (Lave and Wenger, 1991). As a process outcome, social learning and/or policy learning (Geurts & Joldersma, 2001) can improve the quality of decisions and have a long-term impact on a certain action (Salter et al., 2010).

The participatory processes as these that we are going to use as an example for this methodological paper use to include the application of semantic and visual tools to foster system analysis (Matti, Bauer, Granell Ruiz, & Fernandez, 2017; Matti, Juan Agulló, Hubmann, & Morigi, 2017). As we shall now see, the role of the participants is redefined through the application of a challenge-led approach. The main goal of this perspective is to increase the horizontality of the team performance. This fact enables a collaborative construction –and subsequent codification and diffusion- of knowledge through the active participation of researchers and participants, promoting critical and self-awareness that make able collective and social change (McIntyre, 2008). After this challenge-led approach and the use of visual tools, a key aspect of co-creation is the codification of knowledge that we have previously mentioned. In the experiences of the application of our approach, the codification of tacit knowledge allows the creation of practice-based and usable knowledge for policy makers, business managers and/or innovation leaders. A critical aspect to enable this step is the science-based design of the exercises that are based in visual tools in the overall logic of System Innovation and multi-level perspective introduced by transitions literature (Elzen et al, 2004; Geels, 2002, 2004).

In practice, the approach has been used as part of training and capacity building process in several countries and context. Below is the list of most relevant cases:

1. Climate-KIC Pioneers into practice program, 12 European locations (2016-current)

2. Climate-KIC Innovator Catalyst (Professional education training): a) Water management - Valencia (2014), Sustainable Agriculture - Budapest (2015) and Circular Economy – Valencia (2016).

3. Climate-KIC Transition cities project, multiple locations (2015-2017)

4. City of Apeldoorn – Saxion University – Climate KIC collaboration. Cleantech strategy for Apeldoorn, Netherlands (2016)

5. JRC EU Policy Lab- Climate KIC. Collaboration as part of Climate Mitigation Fund project, Frankfurt and Bologna, Italy (2016-2017)

6. EIT Raw Materials – Climate –KIC collaboration. Socio-technical analysis of mining sector, Austria (2016)

7. EIT Cross-KIC project. Green Innovation at Schools. Adaptation of participatory methods and visual tools to secondary schools context. (2017-current)

2. Participatory approach methodology

The proposed methodology follows this scheme:

1. Problem definition
2. Co-creation process
   a. Creation of delivery team
   b. Process design
   c. Tools and adaptation
3. Workshop design
   a. Selection of participants
   b. Materials provided and estimated timing
4. Workshop management
5. Workshop reporting
   a. Knowledge codification & analysis
   b. Communication & dissemination

2.1. Problem definition

Before starting any participatory process, it is essential to take some decisions about the challenge and its context. For doing so, an initial meeting between the problem owner and the technical assistant, and ideally a thematic expert, should be held to discuss the challenge and expectations of the process.

In this sense, it is paramount to define the problem to address and be flexible to fine-tune it as the process advances. In some cases the problem-owner may have already identified clearly a particular issue to solve, in which case the participatory process will be more focused on analysing and deeply understanding the question and try to come across potential solutions. In other cases the challenge may be to analyse the suitability of a potential solution that has already been identified.

Finally, it can be a case study compiled ad hoc for using it on a capacity building process to help practitioners to improve performances in their day to day activity by horizontally working and interacting among them.

Whatever the challenge may be it should be clearly set and agreed upon at the beginning of the process along with the outcomes expected to achieve.

2.2. Co-creation process

The particiatory process can crystallise on a variety of options, from one-day tailored workshops to a full roadmap process. Bottom up exercises combined with a top down approach that nurtures a co-creation process that benefits from each participant knowledge and expertise.

Therefore, the design of the process requires to consider several aspects on an correlative way since the decisions adopted regarding one of the parts will influence the needs to be met by the others, thus making each co-creation process unique and bringing the value of the knowledge and perceptions of the diverse groups of actors participating. However, the overall logic of the process is common to all experiences.

In practical terms, this process follows an experimental format to work on existent and new skills as well as applied knowledge and tools where activities are mapped out according to providing a broad set of alternatives (see figure 1) rather than a fixed list of tools, methods, and activities and following a bottom-up approach to match participants´ needs and a horizontal performance.

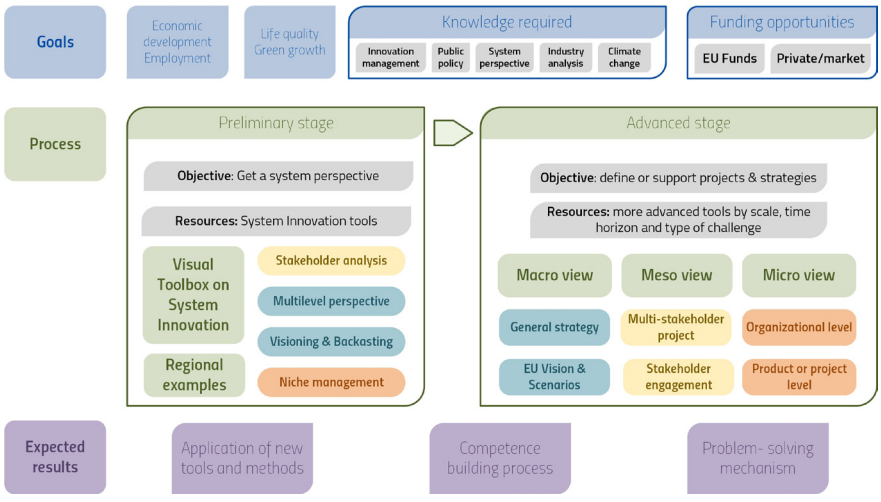

Figure 1. Transitions Hub approach for a participatory capacity building process.

2.2.1. Creation of delivery team

The technical assistance from the expert team can be defined by the combination tailored design, the continue presence of thematic experts and the horizontal practices for analysis and strategic planning.

A knowledge-base assistance is provided by local or international specialists. A combination of local and international experts it is strongly recommended to ensure a broader scope of problems and approaches addressed during the roadmap process.

It can include exchange of information or application or special data or policy knowledge

Expertise in specific topics and areas can be also applied for problem-solving mechanisms based in specific tool and methods

To be able to provide this, a multidisciplinary team needs to be assembled that is able to cover the diverse skills needed to carry out the process (e.g. academics, policy advisors or senior project managers, data analysts, facilitators, thematic experts, coaches...). In order to achieve this on the most satisfactory way, it is crucial to balance the responsibilities among the people involved on the project and to assign the general roles and responsibilities in the preparation and implementation of the co-creation process. This does not mean that each role must be played by an individual, but that these roles must be covered (even more than one by the same person) for the correct development of the process. Roles and responsibilities can be combined and interchangeable along the roadmap process by considering content and logistics elements as well as the specific set up of the team, practitioner challenges and local available resources.

Once the problem has been defined, the team will design a process tailored to achieved the desiderated results and lay down solid geographical and temporal boundaries to the process, as well as clear rules for the decision-making procedures.

2.2.2. Process design

As mentioned before, the practitioner challenge and priorities as well as the available resources and the status of the identified problems are main elements to define the extension and the components of the participatory process.

The process follows a building block logic formed by stand-alone modules that can be incrementally added up to get the full learning pathway: the Roadmap.

- Short version (teaser): a single workshop and follow-up activities. The workshop content is tailored to the practitioner context and problem and the outcome is usually a dashboard of bottom-up indicators created during the workshop.

- Pilot: two workshops and follow-up activities. In this case the second workshop builds upon the results from the first one to advance on the process. For example, workshop 1 can be focused on analysing the current situation and identify main actors and opportunities. The results of this exercise can provide valuable inputs on the workshop 2 that may be focused on visioning and back casting.

- Roadmap: a longer process tailored around workshops and meetings in combination with other communication activities for problem solving.

The basic structure of a roadmap consists of three stages that begin with a preparatory step aimed to identify the challenge and to elaborate the overall planning of the two further stages. Taking the roadmap showed on figure 2 as an example, we can see that the first phase includes the initial two workshops and is focused on gathering information that will allow the participants to get a system innovation perspective of the challenge to work on regional examples. Data is also gathered for network maps. The first workshop intends to help participants to do the initial system analysis and stakeholders mapping. The information produced at the workshops is processed with visual tools and shared via follow-up webinars and the report of the results of one workshop can be use as input for the next one through all the process. The second workshop consists on a visioning exercise aimed to provide a long-term perspective. An initial stakeholder analysis is also run based on the results of the first workshop. The information is again codified and shared.

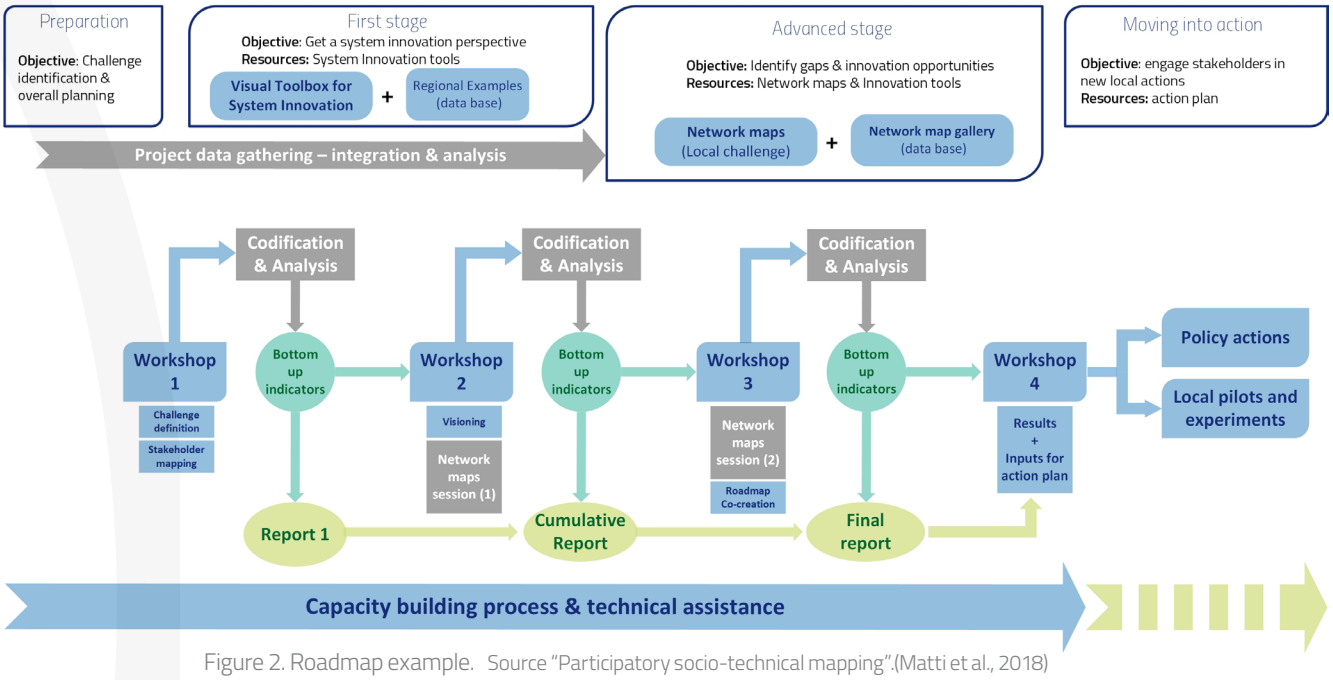

Figure 2. Roadmap example. Source "Participatory socio-technical mapping".(Matti et al., 2018)

The results of this phase will serve as starting point for the third workshop already at the advanced stage in which a broad socio-technical roadmap in co-created by including actors, resources and action within a time frame. This could be included in the design experiments and action plan by applying project and innovation management tools. Between the 3rd and 4th workshop the information for the final report can be drafted.

The fourth and final workshop, presents specific inputs for action plans. This can result in policy actions involvement and proposals for local pilots and experiments.

2.2.3. Selection and adaptation of tools and methods.

A key aspect to consider when designing the process is which tools will be used during the workshops from the available repository.

To do so it is important to consider the overall objectives of the process but also the particular results we want to achieve from the exercise.

It is also important to take into account the backgrounds, knowledge and level of competences of the potential participants and reflect on which approach will allow to make the best of the interaction between them.

The tools and the methodology can be adapted at two levels, the canvas itself and the stickers that participants will use to provide their inputs.

Ocean of opportunities — The Canvas

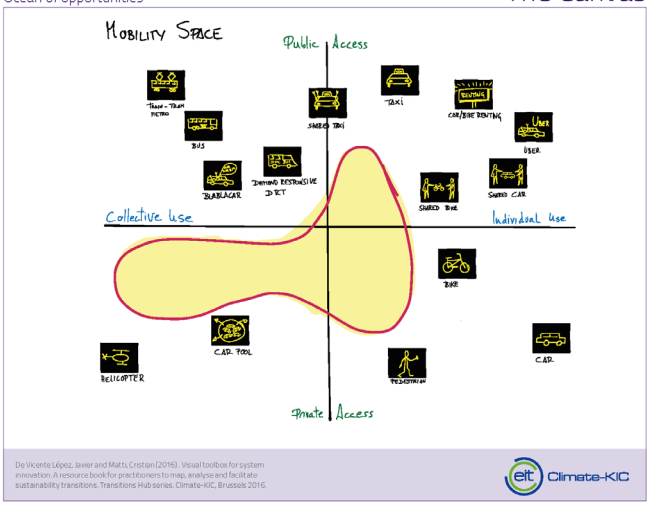

Figure 3. Original Canvas
Source, Visual Toolbox for System Innovation

Taking as example the Ocean of opportunities - an ideation tool aimed at identifying gaps in the market that might become windows of opportunity. (Matti and de Vicente, 2016) - we can explore some adaptations that had been made for using it in different workshops.

This technique helps mapping out the range of current solutions by framing them within four variables in two main dimensions. The original canvas (Figure 3) shows an example of mobility system bound by use (individual/collective) and access (private/public). These dimensions are placed on opposite ends of two axes. Participants have then to think about possible solutions and scattered through the canvas according where they fit in relation to both dimensions.

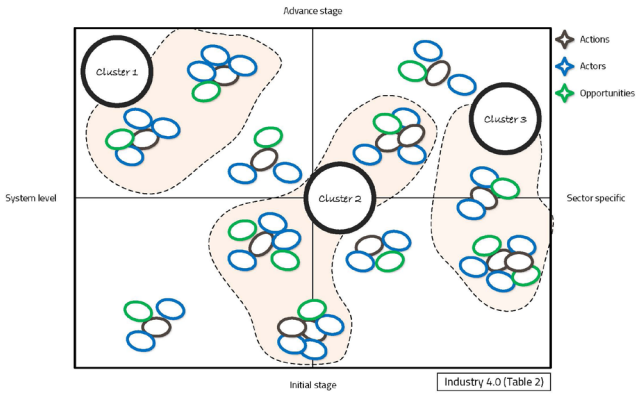

Figure 4. Simulation of final result on an adapted canvas

In the case of the canvas in Figure 4, the exercise aimed to identify projects, ideas or initiatives related to regional priorities and the barriers that they faced as well as the key stakeholders involved. The variables considered on this case were the stage in which this projects were (from initial to advance) and if they were focused on a specific sector or have influence on a more systemic level.

On a first round, participants tried to find out actions, projects or proposals related to the topic discussed. Then they write them down on the black stickers and place them on the canvas in relation to both dimensions. On a second round, the objective was to identify actors participating on the projects or that have influence on them using the blue stickers and putting them near the matching action. Then, they were asked to write on the green stickers opportunities to develop those projects. Finally they try to identify the initiatives that may be related and cluster them.

The exercise where Figure 5 was used was more complex, as can be deduced from the use of more colours of the stickers, taking to consecutive sessions to be complete.

As before, the black stickers were used to indicate projects,

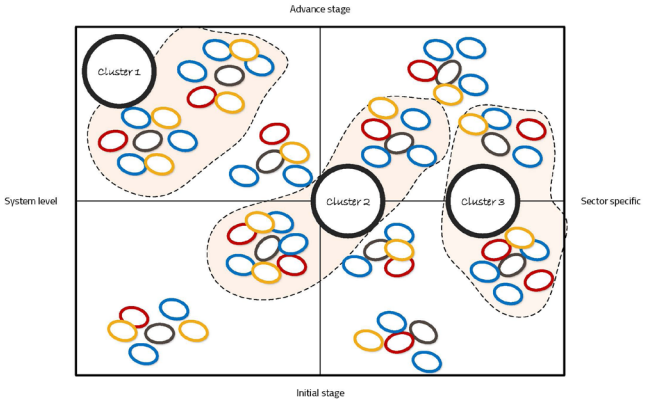

Figure 5 Simulation of final result on an adapted canvas.

ideas or initiatives related to regional priorities and the blue ones to identify the stakeholders involved in them. But a step was added in between to think about barriers and gaps that were slowing down the project. The final step on the first session was to cluster the actions.

On the second session, participants were asked to identify EU funding schemes or instruments that could have an influence on the project (yellow stickers) , and finally which role they envision the problem owner could play on these initiatives.

Therefore, by adapting the canvas and the combination of different stickers a wide range of variations can be achieve on the level of complexity and the amount of information expected to be provided by the participants. This way, tools can be tailored to the needs of each particular workshop.

2.3. Workshop design

2.3.1. Selection of participans

The design of the workshop is based on the three points mentioned above. Every time the client/applicant problem has been defined, and the conformed team has established the tools to be used and the type of feedback to be provided, we enter the workshop design phase itself. In this case, it is important to consider which participants are suitable for it, in quantitative but also qualitative terms. It is desirable that the total number allows for a division into groups of eight to twelve participants, so that each practitioner can manage the group correctly and so that the information

extracted from each practitioner is easily manageable in subsequent coding processes: few participants per group would produce irrelevant amounts of information, while excessively large groups would, in theory, generate too much data and therefore it would be easier to incur contradictions or inconclusive information. In addition, the quantitative composition of the groups can influence the agility of each dynamic, and experiences show that agility is an important factor in unleashing creativity in this type of workshop. In qualitative terms, while seeking to generate knowledge that has a high degree of transformative potential, it is advisable to have the most varied stakeholder groups possible, in order to obtain the greatest possible variety of approaches. For example, if a participatory workshop is to be designed around a problem related to access to energy, it is more appropriate to have participants on all possible margins of the problem: representatives of supply companies, public employees, representatives of consumer organisations, manufacturers of energy supply materials, etc. In the case of having balanced groups in this respect, it is much more likely that the set of ideas collected will offer a greater degree of wealth and, therefore, be potentially more useful for the transforming objective with which the dynamic has been devised.

Based on the above, the institution contracting the participatory action service should make a selection of relevant actors. The first step will be the identification, trying to answer who should take part into the workshop. This should be done attending to their closeness to the project, interests or relevance. This step has to be as broad as possible. The second step should be the understanding of the actors: expectations, their assumptions, their worries, drivers, knowledge, resources, etc. The third step is the analysis of the stakeholder networks: in order to properly administrate them within the workshop, it is essential to detect the influence of each stakeholder group for the good of the session, due to the different roles that some actors can play among other groups.

Practice has taught us that the recruitment phase can be carried out in different ways - using as many advertising media as possible - but that the common note must always be clarity. The presentation of the type of workshop and, above all, the explanation of the problem/challenge to be faced is key to bringing the different contact networks closer to the participatory sessions. In not a few cases there will be an asymmetry with respect to the number of participants from different interest groups. Therefore, an effective screening must be carried out to try to compensate for this imbalance.

2.3.2. Materials provided and estimated timing

From the confirmation of the attendees based on the above criteria, the material needs are revealed: usually a room large enough for the groups to work independently, i.e. without interference from the rest of the participants. In addition, walls are needed in which to place the canvases since one of the essential points for the teams to share their thoughts in visual thinking techniques or design thinking is visibility. You will need one canvas per group and technique and also a sufficient number of stickers or post its and writing materials such as markers and pens. It is also advisable to avoid the presence of additional papers in which participants can ruminate or reconsider their ideas, as this could cause them to incur in a loss of potentially relevant information. In addition, you will have to set up different visual rules or codes according to the available materials: stickers can have different colours that can mean different things (like elements such as actions, actors, opportunities or gaps) and also different sizes to express different ideas (small stickers can express individual ideas, while bigger stickers can cluster them thematically).

The timing of the phases belonging to each of the exercises may fluctuate, but it is always advisable to pay attention to the existing indications in the reference manuals (Matti and de Vicente, 2016). Trying to carry out each of the exercises more quickly in order to obtain a greater amount of information may have the opposite effect to that desired, since the participants may be saturated by the multiple jumps in the dynamics. Therefore, it is preferable to make a generous approach in terms of materials and conservative in terms of time.

2.4. Workshop management

Facing a participatory workshop is an exercise for which certain measures must be adopted a priori. Facilitating the use and application of visual tools for this type of session requires in the first place a different positioning to that of a coach or a

traditional teacher. There are two fundamental needs that must be addressed:

- Maintain a clear perspective on the process during the session (taking into account the previous planning we have described, as well as time management and a clear explanation of the guidelines of the technique in question).

- Acquire a clearly impartial position towards the ideas, solutions and issues that will emerge during the activities on the part of the participants.

From the assumption of these needs, a series of previous considerations arise regarding the management of the participants in each group. We can synthesize them in the following points:

- Establishment of a set of 'de facto rules' for group dynamics, to ensure respect within the collective and a dynamic of interaction as constructive and equitable as possible.

- Correct distribution of participants per group to ensure proper functioning.

- Understanding of the situation and knowledge of the participants' profiles in order to know if it is convenient to create the groups or to let the participants self-manage in this respect.

- Taking into account the communicative nature of the sessions, consider the correct distribution of those people with a more participative profile in order to promote an adequate dynamic.

From the conformation of the groups, it is appropriate to bear in mind that the main task of the facilitator in this specific point is the promotion of certain situations. We can summarize it in these advices:

- Encourage participants to write all their ideas on stickers, not on additional papers. They can always be discarded later, but generally information that is not written is lost, and any input can be valuable.

- Be accessible to the answer of any doubt regarding the canvas or the methodology, no matter how irrelevant it may seem. It is desirable that all participants understand - and feel they understand - the techniques, the dynamics and their role in them.

- Contribute to eliminate and avoid any kind of dependence on the approval of others. Prejudices or biases are limiting when it comes to promoting the inclusion of ideas in participatory techniques.

- Observe the dynamics and behaviour of all participants from a distance that allows for rapid intervention that encourages the inclusion of the most passive elements in the exercise.

- Try to sustain energy levels so that participants remain focused and interested. If the group's energy begins to decline, we may have a good time to take a breath.

- Carry out good time management, bearing in mind that flexibility is a necessary virtue for participatory sessions to be successful.

- Intervene only when necessary, assuming that an unnecessary intervention can interrupt a generating dynamic and therefore lose the information and knowledge derived from it.

If there are certain behaviours or issues to encourage, there are also certain points to avoid in participatory dynamics:

- The objective of participatory methodologies is to build knowledge, not to reach consensus. Therefore, there is a need to minimize the importance of debates by generating individual ideas.

- The passage of time should not cause anxiety for the participants, but rather challenge their ability to generate ideas.

- It is necessary to avoid conceptions of "good or bad" ideas. All ideas are welcome.

- In the case of a group of a more passive nature, the facilitator can use two types of strategy:

- Use questions - usually open-ended - to help them generate ideas.

- Use metaphors and not examples to fill certain conceptual gaps that can generate passivity on their own.

The direction and management of a participative dynamic can seem a difficult task, because it does not cease to consist in the management of a highly heterogeneous group. However, although there is a high degree of complexity in this task, correct preparation and taking into account the advice presented at this point in the methodology can turn this conduct into a relatively simple experience.

2.5. Knowledge codification and analysis

2.5.1. The codification process

Once the workshop has concluded and the elements have been clustered, we can conclude that the main function of the canvas –to capture data- has successfully concluded. Participants, according to the colour code previously established, will have reflected on-going actions, related actors and potential opportunities that could arise from the existing scenario they will have been working on. After that, bigger stickers will have been used to establish clusters of ideas according to thematic concomitances.

From that exercise of clustering –which can be considered, in fact, the first step of the codification process- we can define the scope relationship between the coding elements. It should be done on a chart that has to be sequenced from the bigger elements on the canvas to the smaller ones:

- Canvas > Quadrant/Section > Cluster > Colour > Text > ID

	A	B	C	D	E
1	QUADRANT	CLUSTER	COLOR	TEXT	ID
2	1	Infrastructure	Action	14 standard charging points (municipal car park company)	1
3	1	Infrastructure	Opportunity	Recharging electric motorcycles in municipal car parks	2
4	1	Infrastructure	Opportunity	New public car parks in recharged neighbourhoods	3
5	1	Infrastructure	Opportunity	Promote the use of electric bicycles and motorcycles through suitable recharging points	4
6	1	Infrastructure	Actors	Town Hall	5
7	1	Infrastructure	Actors	Public administration	6
8	1	Infrastructure	Actors	Manufacturers	7
9	1	Infrastructure	Actors	Managers	8
10	1	Infrastructure	Actors	Users	9
11	1	Infrastructure	Actors	Municipal Parking Company	10
12	1	Specific measures	Opportunity	Sharing Bonus	11
13	1	Specific measures	Opportunity	Carsharing of conurbation	12
14	1	Specific measures	Actors	Sharing companies	13
15	1	Specific measures	Actors	Town Hall	14
16	1	Specific measures	Actors	Users	15
17	1	Policy and regulation	Action	H2020: Autodrive	16
18	1	Policy and regulation	Action	H2020: Elviten	17
19	1	Policy and regulation	Opportunity	Standards development	18
				Non-economic incentives for workers using	

Figure 6. Example of codification from bigger to smaller elements

Each element has its own functional usefulness:

- "Canvas" is useful when the group has been subdivided into parallel dynamics, which generally have different thematic lines.

- "Quadrant" or "Section" has given prior information to the participants, sometimes in such a way that the information is distributed if it comes close to certain indicators (feasibility, ability to be controlled, advanced or initial stage) generally graduated by opposition.

- "Cluster" is a fundamental term already explained in the reference manual (Matti et al., 2018), but they have a component of thematic approximation.

- "Colour": in practice, colour is a singular element within a portrait of a situation (a mapping). Therefore, each colour represents a kind of input.

All these parameters are needed to carry on a subsequent analysis. They represent macro categories that will be collectively analysed in addition to the supervision of the inputs (which will be placed under the category "Text"). Finally, the element "ID" –which is nothing but a number code- will allow not only to track specific elements, but also to enable the visual mapping.

2.5.2. Category reduction

As a continuation of the knowledge codification process, a category reduction can make the further analysis an easier task. Based on a search of Key Words into Context (KWIC) methodology using concordance software. The aim of this practice is to reduce a higher-detail corpus of information into a more comprehensive and reduced pack of data to be analysed. Generating a lexicon-based set of categories to group the textual inputs from the workshop comes from the Theory of Conceptual Fields (Verngaud, 2009), which seems a suitable frame from where generate a reduced set of categories (Matti et al., 2017). According to this perspective, the generation of a first category of semantic groups and the latter reduction into less categories is based on the fact that the first pack of categories "contain conceptual components, without which they would be unable to adapt activity to the variety of cases a subject usually meets"(Vergnaud, 2009). Taking the Theory of Conceptual Fields as a basis, and bearing in mind the analytical

need behind the participatory method, we adopt the Cross-Categorical Reduction concept of a "first theory being reduced to the second" (Hooker, 1981) applied to semantics when "an existing theoretical description can be entirely superseded by one of a greater degree of detail and power on a lower level" (Riemer, 2015). This approach leads us to a kind of non-reductionist simplification that can lead to a cognitive effort reduction to maximise meaning comprehension (Sperber and Wilson, 1987).

Therefore, a first analysis should depict the inputs according to their thematic/semantic content (see Table 1, "Original categories") that would be reduced, on a second analysis, into a smaller and simplified pack of comprehensive categories (see Table 1, "Reduced Category").

Reduced Category		Original categories
1	*Materials*	Alternative materials - Bio based materials - Raw materials
2	*Public engagement*	Behavioural change - Public awareness - Public participation – Public engagement
3	*Climate change and derivations*	Climate change - Environmental impact - Health problems - Social affairs
4	*Policies and regulations*	Public policies – Regulation
5	*Stakeholder conflicts*	Conflicts of interests - Stakeholder issues
6	*R&D&I*	Energy innovation - Research and development - Innovation models
7	*Production systems*	Efficient production - Traditional production - Logistics systems
8	*Business models*	Business models - Oriented business
9	*Circularity*	Circular development - Circular economy - Circular innovation - Circular systems - Circular training
10	*Design*	Design creativity - Design planning - Smart design - Urban design
11	*Sustainable processes*	Sustainable packaging - Sustainable production - Sustainable solution – Green food – Sustainable forest - Waste management - Packaging waste - Sustainable transports - Sustainable forest - Water management

Table 1 – Example of reduced categories for content analysis and codifications (Matti et al., 2017)

The process of category reduction is, taking into account that the concept "Cluster" is the very core of the analysis process, just an additional tool to provide a deeper, more comprehensive description of the workshop content.

Visualization and dissemination

All the previous codification, with or without the additional category reduction process, has a fundamental usefulness: the possibility to generate visual material to disseminate the knowledge that has been generated into the workshops. The existence of visual mapping software provides the possibility to spread it from more than one perspective, depending the customer's expectations and the agreements reached before the process.

These are some of the elements that can be visualized after the codification and analysis:

- Existing elements into an scenario (for instance, actions that are already underway)
- Agents conditioning the current scenario (agents generating actions or receiving their outcomes).
- Opportunities that can emerge from real situations, taking into account the agents that condition them.
- Thematic clusters that group together actions and opportunities.
- The relative weight of the elements and their relationship between them (for instance, the number of the actors that each action requires, how many potential opportunities can merge from each action, rakings of actor's influence…).

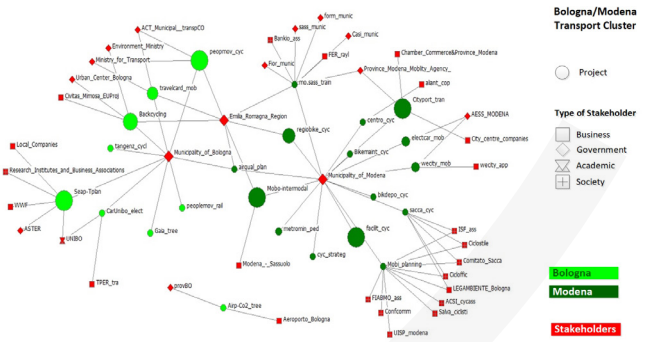

Figure 7. Example of network mapping illustrating existing transport projects and related actors in the city of Modena (Matti et al., 2018).

The network map is a visual tool that can be useful to spread a perspective of existing elements into a specific context (see Figure 7) Mapping programs –such as Gephi or Kumu- are freeware tools that can generate this kind of visualization of relations between elements coming from slight variations of the Excel files that have been generated during the codification process. More simple tools, like Excel, can be also useful in order to provide clear information about the weights of specific

elements of the workshop (see Figure 8).

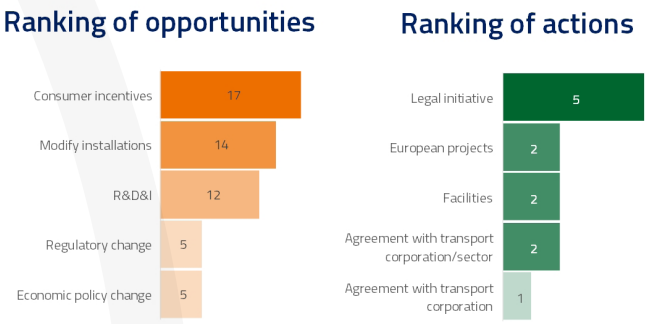

Figure 8 Example of rankings generated with Tableau

Another example of visual tool that is useful to generate visual insights about related categories, elements or facts is the relational table (see Figure 9) as the ones generated with the program Circos

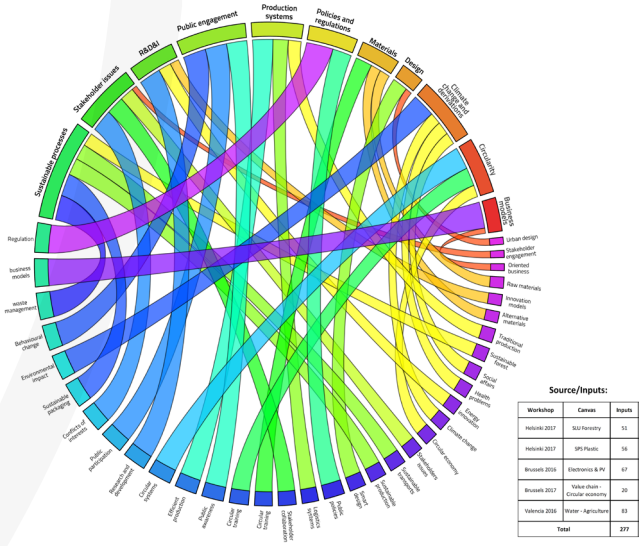

Figure 9. Example of relational table generated with Circos software.

However, the supply of visual dissemination tools is enormous. The purpose of the visualization and dissemination phase, and here lays the importance, is to supplement a report. In this document we will present, in a comprehensive way, the set of findings taken from the participatory workshops in accordance with point 2.2 of this paper.

3. Conclusion

As we have established in the introduction, participatory approaches are intended to be a tool that enables an understanding of complex systems while favouring an evolution subordinated to the collectives or individuals that form part of them. Throughout this paper we have been able to describe and systematize, from the gestation phase to the processing of its results, the methodology used during the last four years by a multidisciplinary team focused on its application and improvement.

We consider that, although there are elements within the process that can suffer variations of different types -especially due to their context of application- the methodological structure can constitute a replicable standard in environments in which a problem or challenge can be tackled by the affected parties. The visual techniques to be used, while Visual Thinking is an incipient discipline, can grow in number and complexity and this will surely be a fact in the immediate future. In addition, the modalities of information dissemination can be multiple, and will always be subject to the needs of those who request mediation services based on a participatory process.

However, the logical framework described above implies a systematization that has been tested, modified and validated over a sufficiently long period of time and with the accompaniment of actors of an entity sufficient to establish its validity.

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