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Mapping perspectives on sustainability transitions towards circular economy models from a practitioner's perspective

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Abstract

The concept of sustainability transitions towards a circular economy can be understood in different ways, and requires interpretation regarding the definition of goals, the timeframe of changes, the question of which actors have agency, and the perception of responsibility. These ambiguities may generate different understandings of what is meant by a circular economy and sustainability transitions. In this paper, we explore a sustainable transition approach to a circular economy with a focus on the practitioners' perspective. Our study seeks to define and integrate conflicting arguments and explanations that practitioners' may express regarding socio-technical elements in the transition process, such as investment flows in new infrastructure, cross-sector collaboration and policy incentives. Our study addresses the lack of alignment between the perspective of practitioners and the key messages of the overall narrative embedded in the current European agenda on Circular Economy.

This paper demonstrates the effect of such inclusive approaches for enabling the transitions to circular economy model. We carried out an empirical research based in a triangulation of different sources (i.e. policy documents, reports, participatory processes). The main empirical material examined is a series of multi stakeholder participatory processes run in 2016-2017 in Brussels, Helsinki and Valencia. The codified results of the participatory process are analysed with methodological techniques for content analysis. As we currently see, blending socio-technical aspects is a pressing requirement in the policy framework to facilitate transformative change. Methodologically, this paper is intended to illustrate the potential of participatory techniques as a method to enable practical action on this matter by facilitating debate on the understanding of large-scale transitions while enabling the consensus on alternative pathways to facilitate transitions towards circular economy models.

Keywords

sustainability transitions, circular economy, practitioners, policy, participatory methods, system mapping

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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

The concept of sustainability transitions towards a circular economy can be understood in different ways, and requires interpretation regarding the definition of goals, the timeframe of changes, the question of which actors have agency, and the perception of responsibility. These ambiguities may generate diverse understandings of what is meant by a circular economy and sustainability transitions. While a circular economy can be defined as a closed-loop process with specific practical limits for optimisation and implementation, which generally have clear economic and regulatory drivers, transition management literature indicates that no transition is ever planned and coordinated from the outset. More specifically, transformative processes could be enabled through the alignment of different factors rather than be "managed" per se; rather than being directed from above, they come about through the aligning of key enabling factors. The presence of a shared vision or common understanding of what transition consists of is critical. In this respect, the generation of shared visions of what transition consists of by using multi-stakeholder collaborative processes, in which practitioners' perspectives are recorded and analysed, is one of the key recommendation for supporting the transition process

In this paper, we explore a sustainable transition approach to a circular economy with a focus on the practitioners' perspective. Our study seeks to define and integrate conflicting arguments and explanations that practitioners may express regarding socio- technical elements in the transition process, such as investment flows in new infrastructure, cross-sector collaboration and policy incentives. We also intend to define and integrate the narratives regarding transition pathways based on the logic of value creation and emerging circular business models. Our study addresses the lack of alignment between the perspective of practitioners and the key messages of the overall narrative embedded in the current European agenda on Circular Economy. We argue that a different form of messaging and engagement that is more reflexive and inclusive can be applied to overcome this critical limitation, and to facilitate local actions towards pathway creation in emergent environmentally sustainable sectors.

This paper demonstrates the contribution of such inclusive approaches for enabling the transitions to circular economy model. We carried out empirical research based on a triangulation of different sources (i.e. policy documents, reports, participatory processes). The main empirical material examined is a series of multi stakeholder participatory processes run in 2016-2017 in Brussels, Helsinki and Valencia. The codified results of the participatory process are analysed with methodological techniques for content analysis. These are then compared with key messages identified in main policy and industry documents addressing the concept of a circular economy. By defining and mapping these arguments, we can identify main areas of divergence between the perspective of practitioners and the perspective of policy makers.

The structure of the remainder of the paper is as follows: Section 2 provides the conceptual framework of the study, while Section 3 introduces the methodological framework for the mapping exercise. The empirical study (Section 4) is divided into the brief description of the mainstream message and the presentation of results of the mapping exercise based in participatory workshops. Section 5 introduce some preliminary elements for discussion and further steps for the research study.

2. Conceptual framework

2.1. A discussion on circular economy from a sustainability transitions perspective

Due to differences in perspectives, values, and exposure to different theoretical frameworks, stakeholders express different conceptions of 'transitions' and 'circular economy'. Because of this, we could consider whether there are notable differences between the concepts employed in circular economy frameworks and other sustainability transitions frameworks that prevent adoption of a shared vision of the transition process. It is worth investigating what is the vision of the sustainable socio-technical configuration or what are seen as the main driv-

ers that will bring about such a configuration.

The study of socio-technical transitions is the study of the process of change in complex systems consisting of sociological, institutional and technological elements into novel configurations over a long period (Jackson, Lederwasch, & Giurco, 2014). Such transitions involve changes in worldviews, capacities, and attitudes as well as changes in technologies and infrastructure (Jurgilevich et al., 2016).

Within the discipline of sustainability transitions research, four main theoretical frameworks have been popularised (Van den Bergh et al. 2011). These are: Innovation systems approaches (Jacobsson & Bergek, 2011); Multi-level perspective approaches (Geels, 2011); Complex system approaches or Transitions Management (Rotmans & Loorbach, 2009); and Evolutionary systems approaches (Safarzyńska, Frenken, & van den Bergh, 2012). The conceptual framework of the 'circular economy' can be contrasted with these different ways of conceptualizing 'sustainability transitions'.

Amongst 'circular economy' theoretical frameworks, differences in understanding and implementation can be identified. For instance, the implementation of Circular Economy initiatives in China have been construed as a top-down, whereas in the European Union, the Circular Economy appears to be emerging from bottom up initiatives (Ghisellini, Cialani, & Ulgiati, 2016). The Circular Economy is a concept with a complex origin rooted in diverse theoretical frameworks such as industrial ecology, eco-efficiency, cradle-to-cradle and sustainable production consumption (Hobson, Lynch, Lilley, & Smalley, 2017). Diffusion of a particular understanding of the term Circular Economy is attributable to lobbying by NGOs such as the Ellen MacArthur Foundation, and inclusion in regulation and political agendas such as the European Union's Horizon 2020 (Hobson, 2017). In the European Union, the approach outlined by the European Commission (2015) and the Ellen MacArthur Foundation (2013, 2015) can be characterised as the 'mainstream approach'.

Kirchherr, Reike, & Hekkert, (2017) indicate that the connection between the concepts of sustainable development and the circular economy is weak. Contrasts can be determined between the following different aspects of theories of circular economy and in theories of sustainability transitions:

1. Origins: An early formulation of the concept of circular economy was developed by Pearce and Turner (1989) who justified their claim that the structure of the economy would progress towards reduction of waste outputs by expanding on the vision of the economy as a closed and circular system that was defended by Boulding (1966). Core elements of the concept of circular economy also emerge from General Systems Theory which promoted evaluation of elements of the economy in terms of systems, and Industrial ecology which re-oriented descriptions of economic systems to include their physical effects on the biosphere (Ghisellini et al. 2016). The concept of sustainability transitions, on the other hand, developed over the last couple of decades through systemic approaches to analysis of features that enable innovation or produce novel socio-economic systems, and historical analyses of changes in socio-technical regimes and the development of novel socio-technical configurations (Van den Bergh, Truffer, & Kallis, 2011). Sustainability transitions research begins with the recognition that environmental problems cannot be resolved through technological innovation without systemic changes in economic, social, and cultural regimes within which these innovations are developed: The dynamics of interaction between economic and societal institutions, technologies, and the environment must be properly characterized in order to influence the potential paths for socio-technical regimes towards a more sustainable future (Van den Bergh et al., 2011).

2. Goals: the goals of the circular economy can be differentiated from the broader vision in other sustainability approaches, which, by encouraging reflexive reconsideration of what is meant by the definition presented in the Brundtland (1987) report - "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" - resist ultimately defining an end-point for sustainable configurations. By way of contrast, progress towards achieving the goals of the circular economy can be ascertained by identifying energy and material loops that are "closed" or whose waste output and energy leakage has been minimized: This feature lends itself to specific policy targets (Geissdoerfer et al. 2017). However, by looking at another level, the business models' perspective on circular economy emphasise the need of rethinking the process of creating value overtime beyond the product itself. By doing so, business models should define new rational on how organizations create, deliverers an maintain value among the overall system "loops" (Bocken, Schuit, & Kraaijenhagen, 2018) by taking an holistic view on environmental, economic but also social aspect as three dimensions for sustainability (Kirchherr et al., 2017)

3. System Prioritisation: A further contrast can be seen in how the holistic or triple bottom line approach found in many sustainability frameworks is reconfigured for the cir-

cular economy framework. The triple bottom line refers to the analysis of sustainability on the basis of environmental quality, economic outcomes, and social justice (Mori & Christodoulou, 2012). Economic systems are centred in circular economy framework and the effect on social systems is mostly marginalised, or un-examined, even when it appears that adoption of circular economy principles may lead to negative externalities such as reduced opportunity for employment (Geissdoerfer et al. 2017). Hobson (2015), claiming that socio-political implications of the circular economy have been neglected, investigates the effect that adoption of circular economy would have on the configuration of quotidian spaces and practices such as the adoption of different modes of consumption that are made possible once circular economy initiatives have been implemented. Sustainability transitions methodology may posit that such quotidian elements must be accounted for as components of the drivers of changes in socio-technical systems. Indeed, Hobson, does not claim that such elements are insupportable in circular economy frameworks, only that the current discussion has under-explored them (Hobson, 2015).

4. Agency: Conceptions of agency in the circular economy framework centralize the actions of regulation, governments and companies (Geissdoerfer et al. 2017). This is not the case in other sustainability paradigms in which changes occur due to the actions and attitudes of citizens, civil society organizations, and government. One prominent conceptual difference is whether there is the ability for a transition to be managed, planned, or controlled.

5. Responsibilities: In the Circular Economy framework, responsibilities are conceived of as alignment between government, private companies and other stakeholders in the economic system. This can be contrasted with the conception of diffused responsibility that is constantly re-interrogated in sustainability approaches (Geissdoerfer et al. 2017). At the same time, the business models perspectives focus in the dichotomy of corporate responsibility on one side and the role of consumers as the most important enabler of circular business models (Kirchherr et al., 2017). Simultaneously, circular business models are characterised mostly by the collaborative and networks nature of the innovation required (Antikainen & Valkokari, 2016), thereby, responsibility can be redefine for the patterns of relations request in new systems configurations.

6. Timeframe: Sustainability, being concerned with the generation of a socio-technical system that provides economic prosperity, biophysical quality, and social justice as determined by all the relevant stakeholders on an intergenerational level, is a concept that is open to re-contextualization and redefinition over time. On the other hand, the goals defined in circular economy frameworks do not face this potential redefinition and can, theoretically reach an optimal state of accomplishment (Geissdoerfer et al. 2017). Kirchherr et al. (2017) indicate that the concept of intergenerational equity, prevalent in sustainability discourse, is rarely included in definitions of the circular economy, suggesting a diminished role for this goal and a shorter temporal horizon for the paradigm.

The understanding of transitions may influence how stakeholders make sense of the concept "transition to circular economy". Following the literature review we might expect that the mainstream approach manifests an overemphasis on the role of companies and economic drivers, and an under-emphasis on the attitudinal changes or social practices that would accompany such a transition. A way to bring these perspectives together to generate a shared conception of transitions and how discrete projects interact with wider forces is critical in advancing the aims of developing the Circular Economy. A method of achieving such shared construction and bridging these differences may be found through the participation of practitioner to create a collective understanding of the socio-technical system. In the next section, we present some basic elements on the multi-stakeholder collaborative processes that help to integrate practitioners' perspectives to overall process to enable systemic change.

2.2. Participation, social learning and system change

The literature on participation re-emerged in the late 70s as a means to manage complex systems. Systems are a human (re) construction of the complexity that enable our learning. This systemic thinking has provided a new dimension to participation. Despite sometimes applied as "consultation" (Burns, 2007), participation has absorbed concepts from different theories1 and thus, has transformed into a process essential as well as a source of knowledge creation (Nevens, Frantzeskaki, Gorissen, & Loorbach, 2013). While who and what we learn matter (Van de Kerkhof & Wieczorek, 2005), we focus on how the learning process is carried out. Hence, we ask: how does our approach fosters system change?

Action research and experimentation are useful in the understanding of system change and sustainability aspects as allow

the exploration of changing thinking based in collaborative environments (Bocken et al., 2018). In this context, co-creation is an essential process that is at the core of our approach to It has been mainly theorized in the service management field and tailored to the business – costumer relationship (Galvagno & Dalli, 2014). However, from a systemic point of view, the complexity of certain phenomena, i.e. climate change, requires co-created knowledge that is usable, subjective, socially robust and solution-oriented (Salter, Robinson, & Wiek, 2010). Some scholars define the social-spatial dynamics of knowledge creation as "conversations", a concept that will be further analysed in another document (Rutten, 2017)

Engaging in practice favours a rapid and effective sharing of information between peers that improves the effectiveness of the learning (Lave, Wenger, & Wenger, 1991)(and get enlarged when personal experience and competence are linked to community knowledge. 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; Wenger, McDermott, & Snyder, 2002)

Through the interaction of a diverse group of stakeholders, we achieve social learning (Salter et al., 2010). As suggested in the literature, social learning can also arise from monitoring and evaluation or transitions in general (Nevens et al., 2013). 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).

3. Methodological framework for mapping practitioners' perspectives

This empirical research is based on different sources, namely methodological and policy documents, reports, as well as a series of multi stakeholder participatory processes run in 2016-2017. The exploratory study is aimed at identifying patterns of the relationship by comparing on one side, key messages identified in main policy and industry documents addressing the concept of a circular economy and, in the other side, mapping practitioners' perspectives on the transitions to circular economy systems and the main external drivers enabling that process. By doing so, we identify main areas of divergence between the perspective of practitioners and the perspective of policy makers. The study is presented in two steps:

First, key elements of the discussion on the Transitions to Circular Economy systems are presented from the perspective of the EU policy and the main referent in the fields

Second, we present the exercise on mapping practitioners perspectives based in the analysis of a series of multi stakeholder participatory processes run in 2016-2017 in Brussels, Helsinki and Valencia. The codified results of the participatory process are analysed with methodological techniques for content analysis

By following the two-step process, this paper aims to introduce new insights on inclusive approaches for enabling the transitions to circular economy model and fostering more effective dialogue between different actors in the socio-technical system. It then puts the emphasis on alignments and divergences between mainstream messages and practitioners' perspectives by it provides fundamentally open questions in terms of the relationship of the overall objective and performance with the underlying logic of circular economy systems. In the following subsections, the main aspects of the methodological approach regarding participatory action research and knowledge codification are presented while Section 4 introduces the result of the empirical study.

3.1. Participatory action research

Participatory action research is applied as set of methods based in participatory techniques and science-based visual tools. Participatory processes include the application of semantic and visual maps for system analysis through a set of ready-to-use visual tools (Matti, Bauer, Granell Ruiz, & Fernandez, 2017; Matti, Juan Agulló, Hubmann, & Morigi, 2017). A challenge-led approach is applied in the design and implementation of the process by redefining the role of participants, experts and speakers as experts´ role is subtlety shifted to increase the horizontality of the team performance as well as ensuring the closeness to the stakeholder's challenges. It addresses a collaborative construction of knowledge through the active participation of researchers and participants, thus promoting critical and self-awareness that leads to individual, collective and/or social change (McIntyre, 2007). As important as the results is the research process since it allows to build alliances between researchers and participants while developing skills, knowledge and capacities among all the contributors (Kindon, Pain, & Kesby, 2008; McIntyre, 2007)

As part of the entire process, content analysis can be applied to

codify knowledge gathered through the tools. Content analysis is a flexible research method that can be both qualitative and quantitative. It uses rules of inference, or analytical constructs to move from text to response of a research question.

3.1.1. Knowledge gathering, codification and systematization

A key aspect of the process of co-creation is the codification. We codify tacit knowledge to create practice-based and usable knowledge for policy makers, business managers or innovation leaders. For doing so, a critical aspect is the science-based design of the exercises which are based in visual tools or canvas based in the overall logic of System Innovation and multi-level perspective introduced by transitions literature (Elzen, Geels, & Green, 2004; Geels, 2002, 2004).

An innovative mechanism for knowledge management is introduced in this process. It consists in gathering and codifying each piece of information into a data set with a panel data format. Each participant input is then considered a data input guided by a science-based analytical tool (the canvas) and by following discussion that create clusters like affinity maps (Eppler, 2006; Matti & Rietdorf, 2017) those inputs allow the design of proxy variables and components of socio-technical systems. The resulting panel data is then being framed in the different sections of the multiple canvas which allows to assign and distribute information into the different components of a socio technical system. Table 2 presents the canvas applied during the workshops by indicating the level of analysis and the source (See Annex for detailed information about the participatory workshops and canvas).

Canvas	Analysis level	Source
Pentagonal Problem	System	Visual toolbox for System Innovation (De Vicente Lopez & Matti, 2016)
Context Map	System	
Sociotechnical-Roadmap	Macro level (landscape): Challenges, Trends & Drivers	
Circular Economy Sim	System	Circular Economy Mapping tools (Matti, Manshoven, & Nuyts, 2017)
Dynamic Scenarios	Macro level (landscape): Challenges, Trends & Drivers	

Table 1 Canvas applied in participatory process by analysis level

The codification process has two main cycles, the first serves to deconstruct the collected data from the canvas (our unit of analysis) and post-its (our unit of observation); participant's language is transformed in simplified categories (first generic, then principal) and word families to create narratives. The second cycle is an advanced way of reorganizing data and serves to assign categories(Miles, Huberman, & Saldana, 2013). In our case, these are compared to evaluate the existence of patterns of relations in terms of hierarchies among territories, participants and learning processes. Finally, there is another stage where themes are constructed from categories and theoretical assertions are made (Miles et al., 2013). Figure 1 bellows shows a simplified logic of the codification process and the output as a dashboard of bottom-up based indicators.

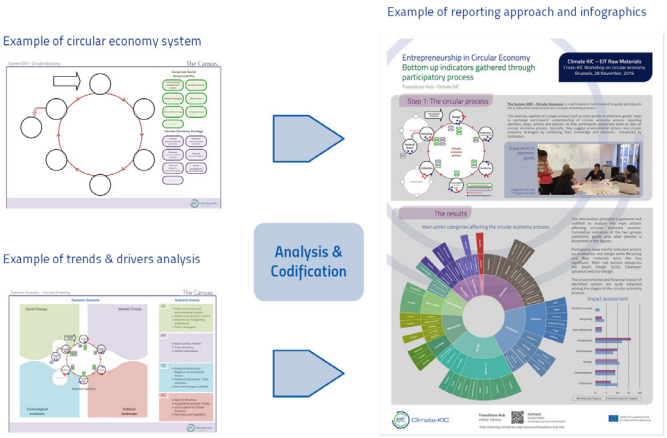


Figure 1 Example of Knowledge codification ant bottom-up indicators
Source: own elaboration based on Matti, Juan Agulló, et al., (2017) and Matti, Manshoven, & Nuyts (2017)

By replicating the process in different locations and with different groups, our community of practice tests grows and at the same time validates the tools (even the approach itself) in a changing environment. From an adaptive management perspective, the participatory processed follows a "learning by managing" logic (Pahl-Wostl, 2009) where mechanisms such as webinars or executive meetings allow in further stages the exchange and communications of results as conversation between experts and stakeholder facilitate a collective understanding of the socio-technical system from a territorial and place-based narratives (Matti, Bauer, Altena, & Tuinenburg, 2016; Matti, Bauer, et al., 2017)

Creation of analytical categories

As part of the knowledge codification process, we have developed a proposal for category reduction coming from a former division of forty-two categories –most of them related due to their Key Word into Context and latter lexicon-clustering process of generation- the aim of the team working at this paper is to reduce this high-detail conception into a more comprehensive division.

The lexicon-based origin of the former categories is useful in order to give a first empirical set-up to the vast amount of differential inputs, albeit generating semantic concomitances between the different labels given to them. In order to solve this potential problem and trying to reach a comprehensive point of descriptive condition, the Theory of Conceptual Fields (Verngaud, 2009) seem to be a suitable frame from where generate a reduced new set of categories.

There are two important notions of this Theory to be considered. Firstly, that at Conceptual Field is "at the same time a set of situations and a set of concepts tied together" where a concept "does not come from one situation only but from a variety of situations and that, reciprocally, a situation cannot be analysed with one concept alone, but rather with several concepts, forming systems" (Vergnaud, 2009). And secondly, the Generative component of the Conceptual Field, coming from the concept of Schemes "and the fact that they contain conceptual components, without which they would be unable to adapt activity to the variety of cases a subject usually meets"(Vergnaud, 2009).

Having framed this search for a category reduction within the Theory of Conceptual Fields, and again bearing in mind the need behind our objective, we have focused on 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 or, perhaps better, a conceptual streamlining that tries to reduce the cognitive effort in order to maximise the Relevance (Sperber & Wilson, 1987) of this new categorical distribution and make it efficient in communicative terms.

Application to Circular Economy perspectives

Subsequently, the original forty-two categories labelled by the participants have been reduced to eleven plus one (named "Other"). Table 2 shows the distribution of the new categories containing the previous ones is the following. Please note that the numeric sequence does not imply neither chronological nor hierarchical pattern:

	Category	Description
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
12	*Other*	

Table 2 Reduced categories for content analysis and codifications

In some cases, epistemological debates can merge when checking the new distribution. A quite clear example is the original category "Waste Management", which could belong to "Circularity" instead of "Sustainable Processes". To solve some epistemological conflicts like this one, we have tried to check the search impact of the combinations of "source category" + "new category", not forgetting the fact that some terms such as sustainability are older and subsequently have a bigger impact on literature rather than others like Circular Economy (Geissdoerfer, Savaget, Bocken, & Hultink, 2017).

For the empirical study, the analysis was organised at first with a primary macro contrast of each "Category Consolidated" input with its re-distribution into a "Reduced Category", and a latter micro contrast of each "Category Consolidated" distributed by canvas. A qualitative analysis on the prevailing cognitive frames has shed light about the way participants understand theoretical concepts not only separately, but also in relation to other key abstractions.

4. Empirical study

4.1. EU and mainstream message

There are multiple elements that enable or disable the transition to a CE and these also interact with each other. Stimulating this transition from a silo-approach rather than a horizontal approach (e.g. only finance as a driver) does not allow for a whole systemic change. Instead it creates space for random pockets of progress by individual players and fragmented activity. The desired systemic change occurs when a "*change pervades all parts of a system, taking into account the interrelationships and interdependencies among those parts*"[1].

The European Commission, in follow up to the EC Circular Economy Package[2] and Circle Economy Action Plan[3] has now put forward a monitoring framework composed of a set of indicators which capture the main elements of the circular economy. The circular economy monitoring framework was designed to accompany the existing Resource Efficiency Scoreboard and Raw Materials Scoreboard[4], which were also developed in recent years by the Commission.

The monitoring framework aims at measuring progress towards a circular economy in a way that encompasses its various dimensions at all stages of the lifecycle of resources, products and services. Therefore, the monitoring framework has a set of ten indicators which are grouped into four stages and aspects of the circular economy: (1) production and consumption, (2) waste management, (3) secondary raw materials and (4) competitiveness and innovation which is aligned with the circular economy action plan (see table below).

Stage		Objectives	Key actions
1	*Production*	Provide incentives to boost circular product design	Durability, reparability and recyclability of products – eco-design directive, extended producer responsibility
		Innovative and efficient production processes	Best practices for waste management and resource efficiency in industrial sectors - briefs
			Industrial symbiosis, remanufacturing
			More coherent policy framework for products, tools for SMEs
2	*Consumption*	Repair and reuse of products Reliable information to consumers	Better labelling: EU eco-label, environmental footprint
			New forms of consumption – collaborative economy, digital platforms
			Guarantees and action on false green claims
			Independent testing programme to assess possible planned obsolescence
			Circular Economy criteria in Green Public Procurement
3	*Waste management*	Improve waste management in line with the EU waste hierarchy Address existing implementation gaps Provide long-term vision and targets to guide investments	Revised EU targets for recycling 65% of municipal waste and 75% of packaging waste by 2030
			New binding target to reduce landfill to a maximum of 10% of total waste by 2030
			Improve waste management, new investments in recycling capacity, avoid overcapacity in incineration and mechanical biological treatment
			Ensure coherence between waste investments under EU Cohesion Policy and the waste hierarchy
4	*Market for secondary raw materials*	Increase the use of secondary raw materials	EU regulation on fertilisers
		Increase the use of recycled nutrients and water	Legislative proposal on minimum requirements for reused water
		Safely managed chemicals	Quality standards for secondary raw materials
		Improve knowledge of material flows	Analysis on the interface between chemicals, product, and waste legislation
			EU-wide electronic system for cross-border transfers of waste

Table 3 Dimension for measuring progress on circular economy

From our study, it has become clear that to achieve real results when measuring these indicators, only a coordinated transition (i.e. all the systemic elements required are purposefully aligned) drives an accelerated uptake of circular economy from practitioners. Here the role of business as the fundamental core of circular economy transition is unquestionable. Critical market demand can and should spearhead the transition, but a systemic approach that aligns all the elements such as tailored financial support combined with deliberate regulation will fuel an accelerated shift in business.

The scenario in the EU currently sets the challenge of transition to a circle economy within a framework consisting of three main critical enablers: the (i) business models and the role of businesses/promoters, (ii) the economic system and the role of policymakers/regulators and (iii) the financing strategy and the role of financiers.

Enabler 1: Financing strategy and the role of financiers

Financial instruments and mechanisms must demonstrate effective adjustments to financial system or create new, innovative instruments. According to SYSTEMIQ et al. (2017) circular business models remain currently underinvested.

Unlocking barriers to financing the circular economy whilst integrating attractive incentives based on the related risk reduction of circular business models compared to linear ones should be the basis for shaping new circle economy innovation agendas and strategies.

Enabler 2: The economic system and the role of policymakers/regulators

Effective regulation including public authorities cannot be underestimate. Policymakers from regional or national circle economy programme owners need to be shown inspiring examples of how to embed circular transition into new strategies and policies. Systematic capacity building of targeted profiles within regional economies should include peer-to-peer training and insight to the risk of inaction.

When considering market pull, circular economy policy measures can actually stimulate consumer demand for circular products and services in relation to non-circular traditional products (Rizos, Behrens, Drabik, Rinaldi, & Tuokko, 2018). Furthermore, Green Public Procurement (the commitment of public authorities to integrate environmentally friendly goods, services and works into their public tenders) can also enable circular economy transition as it represents a large share of GDP can be a driver for the circular economy and for innovation[5].

Enabler 3: Business models and the role of businesses/promoters

Greater importance should be put on the circular economy transition from the point of view of the businesses instead of

the point of view of the financial institutions. The Ellen MacArthur foundation (MacArthur, 2013) presented the RESOLVE six business actions:

Figure 2 Resolve Business action by Ellen MacArthur Foundation
Source: MacArthur (2013)

Better understanding of these business actions will foster a "circular competitive advantage" in new business models and hence can be a driver for practitioner uptake. Again, knowledge transfer of successful case studies as a benchmarking exercise for companies stimulates action. Providing access to free capacity building on "how to integrate circular business models into existing business models" along with better insights in the impact of resource challenges key services that can be effectively managed by business support intermediaries.

4.2. Mapping practitioner's perspective

In this section, the result of the mapping exercise is presented by analysing two main dimensions of the practitioners' perspective transition to circular economy: 1) System Description and 2) Challenge and enablers. In order to visualize the pattern of relations among categories, we applied knowledge visualization techniques through the application of Circos (Krzywinski et al., 2009) data graphics tool for structural studies. The exercise seeks to facilitate the analysis of evidence from patterns in the data.

4.2.1. System description

In this section the results for the mapping exercise are presented for the practitioners' perception on the System description related to transitions to circular economy. Figure 3 bellows present the summary of the patterns of relations between different categories using during content analysis.

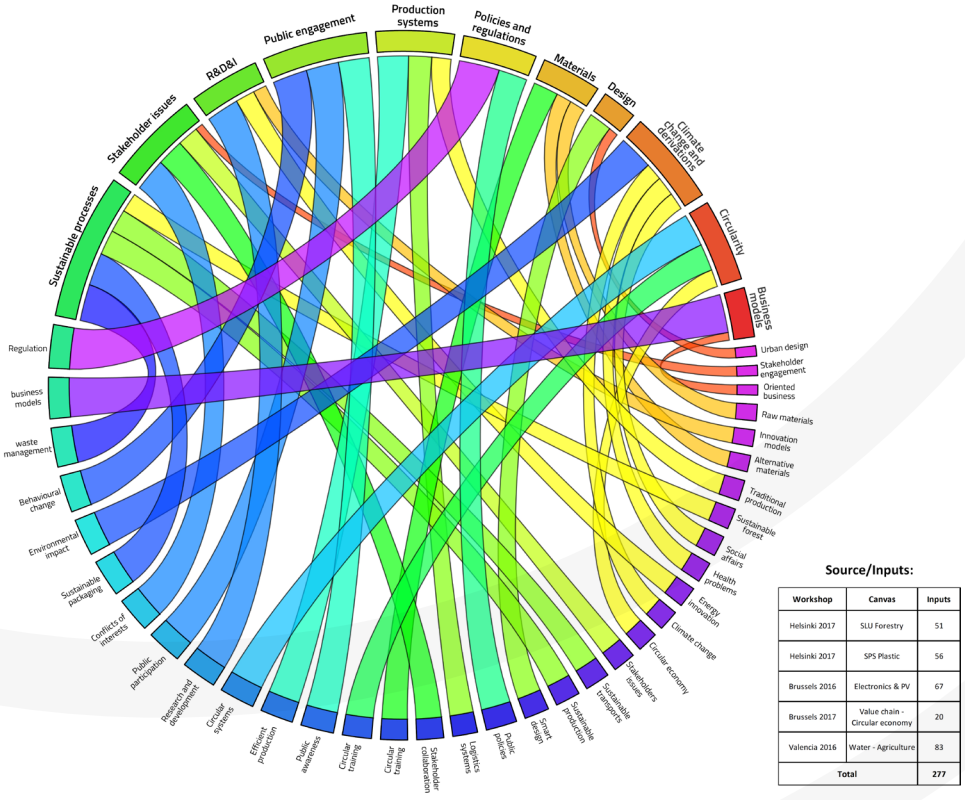


Figure 3 System description - Pattern of relation by categories Source: own elaboration

Most relevant aspect identified by analysis the full integrate panels are indicated as follows.

Business Models: Lack of relation between "innovation" and "business models" in conceptual terms. Businesses are expected to slightly change in terms of orientation and efficiency, but their social engagement is not a relevant question. They are perceived as a profit machines, not as social engagers. There is a lack of mention to corporate responsibility and consumer's role (Kirchherr et al., 2017). The degree of collaboration and the nature of networks to generate innovation (Antikainen and Valkokari, 2016) are not set up in participant's interventions. There are no mentions to negative externalities (Geissdoerfer et al. 2017).

Circularity: Circular Economy is perceived as a solution to mitigate climate change derivations, but it appears to be a kind of "out of the blue" conception of it: it has a kind of own complex logic and it can be perceived as an innovative system rather than a procedural modification of linear capitalism. There seems to appear a perception of "over complexity" and a need of training, which enforces the feeling perceived at "stakeholder issues": there is not a clear awareness of the potential role of some of the actors involved, specially the consumers. There is no clear complex system logic towards waste reduction (Pearce and Turner, 1989). Physical effects of linear economies on the biosphere (Ghisellini et al. 2015) are discursively ignored.

Climate change and derivations: Climate change effects are seen as purely negative consequences, not as opportunities to change, for instance, economical models. Not to mention the possibility of socio-political adjustments or legislative shifts. Main issues are directly related to negative biological topics (diseases and damaged ecosystems) and systemic approaches are not seen as aftermaths. Cause-effect principle is weird here, because one can perceive a poorly disguised disdain when checking the stickers and putting them into categorical context. While ecosystem damages are conceived as a result of waste generation by linear models (Ghisellini et al., 2015), there is no mention to a shift on systemic logic (Mori and Christodoulou, 2011).

Design: Another concept that appears to be strongly framed, in this case between manufacture (to adapt it to circular models) and urban development (to make cities in some way more inhabitable). Absolute lack of framing for this concept within systemic design (therefore, I think, there is no awareness on the concept of economic/social design... perhaps because "social engineering/change" is not a considered option). This lack of framing is accompanied by a lack of mention to an economic or socio-political design (Hobson, 2015).

Materials: Framing is exclusively done on new non-existing materials. There is no redefinition of needs and the reach of an optimal state of accomplishment within a time frame. (Geissdoerfer et al., 2017)

Public engagement: "Think globally" but "act even intimately" could be a good summary for the perception here. Public engagement is contemplated on the private sphere, more as a consumer or a private waste manager. This fact is related with the lack of perception of the consumer as a strategic stakeholder. Trends and habits inherited by means of institutional propaganda in these subjects seem to be relevant, while active roles are limited to reactive responses to them more than to generative behaviours. Public engagement is perceived as a consequence of an institutional/corporative planning and their regulative potential (Geissdoerfer et al., 2017), not as an active or impulsive behaviour.

R&D+I: In some way, innovation is framed within the technological and energy sector. Models of productive innovation are demanded and/or expected to appear, but systemic innovations (for instance, relative to consumption) are not on the table. Therefore, we can estate that innovation is framed within the technological and energy sector as separate niches, ignoring system innovation logic (Hobson, 2015).

Stakeholder issues: Conflicts or agreements between actors are on the equation. But the exclusion of consumer as an active agent is remarkable. And that makes me think that, in some way, people think they are beginning to understand circular economy principles, even when they over consider the complexity of the conceptual model but they ignore they can be an active part of it. That under-exploration of quotidian elements in stakeholder relations (Hobson, 2015) is related, on the other hand, with a feeling of understanding the implications of the original circular economy conceptions (Brundtland, 1987).

Sustainable processes: Clear perception just in part, perhaps due to the general synonymic confusion between "sustainability" and "Circularity" (what is a product of what?). Attending to the texts, I perceive that sustainability is related to circularity because of an expectation of waste reduction or smart use during the process of production (a perception enforced by the appearance of waste and water management), which leads to see that Sustainability is only perceived as the product of a limited chain of Circular processes. This clear confusion between sustainability and circularity (Kirchherr, Reike & Hekkert, 2017)

ends by relating sustainability just to the waste management process within a broader system logic.

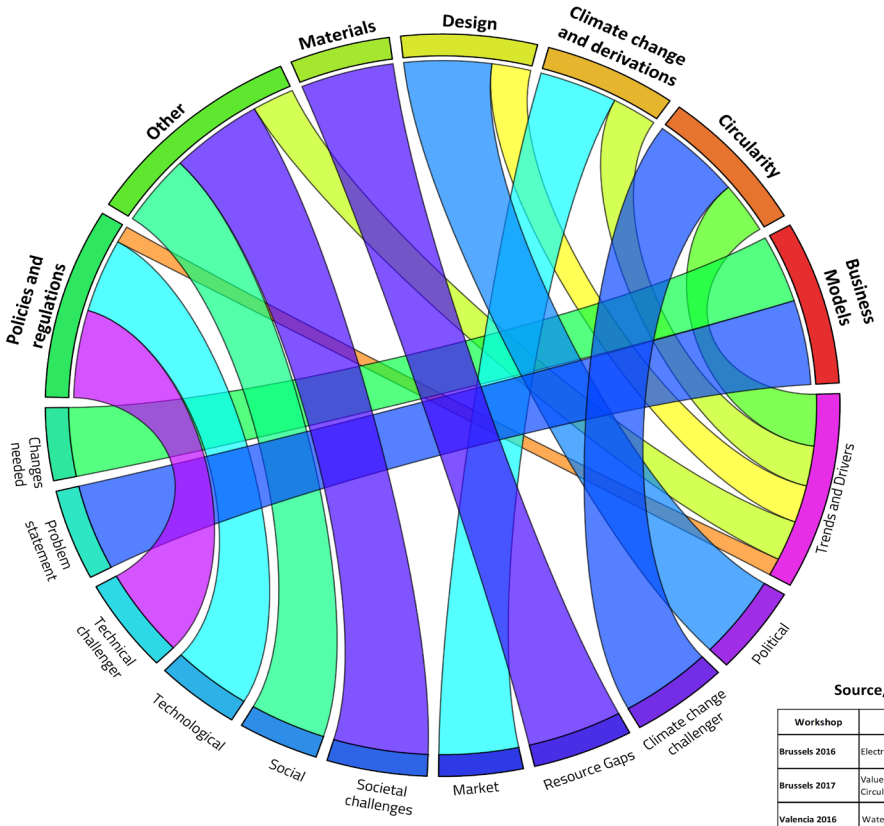
4.2.2 Challenges and enablers

The results for the mapping exercise are presented for the practitioners' perception on Challenges and enablers related to transitions to circular economy. Figure 4 bellows present the summary of the patterns of relations between different categories using during content analysis.

cio-technical level (Mori and Christodoulou, 2011).

Materials: _Framing is not so narrowed as in the SD case. Scarcity of materials and the differences that high costs of raw materials can mean are conceived perspectives of the topics, adding timeframe logic in terms of acquisition and exploitation of raw materials (Geissdoerfer, 2017).

Other_Resources gaps are mainly focused on funding and knowledge management, but they are depicted as unrelated. Knowledge generation and management is not seen as a potential source of value addition to have a quicker access to



Source/Inputs:

Workshop	Canvas	Inputs
Brussels 2016	Electronics and PV	77
Brussels 2017	Value chain - Circular economy	37
Valencia 2016	Water - Agriculture	147
Total		261

Figure 4 Challenge and enablers - Pattern of relation by categories Source: own elaboration

Most relevant aspect identified by analysis the full integrate panels are indicated as follows.

Climate Change and derivations: In approximately the half of the corpus, we perceive the same message than in SD. But there are remarkable differences. By one side, participants consider variations in economic/productive models and improvement/adaptation of service and touristic models. On the other side, social challenges are quantitatively and qualitatively present on the game board. That means variations at a so-

funding, that appears to be a resource coming as a kind of institutional reward for producing green goods.

Policies and regulations: While in the SD case everything is framed on a "restriction-taxation-penalty-incentives" conceptual model, here we see that gaps in governance are even more detailed, adding the frame of geopolitical strategies and changes on supranational structures. System logic is therefore set on the table, linking with the agency concept behind sustainability transitions literature (Geissdoerfer et al. 2017).

Public engagement: Even when the approach is the same than

in SD, a broader criticism is incorporated towards the consumer's role (Kirchherr et al., 2017).

R&D+I: The framing is quite similar to the SD one, but we can find additions related both to water cleaning and to the relation between private and public sector around funding questions. Despite this, we have to admit that these additions are quite scarce in quantitative terms. This seems related to the collaborative factor needed on the innovation sector (Antikainen & Valkokari, 2016).

Stakeholder issues: Framing is as narrowed as in the SD case, but urban/touristic questions merge, adding a frame of socio-political factors (Hobson, 2015) and even a systemic approach based on social justice (Mori and Christodoulou, 2011).

Sustainable processes: While in the SD case there is an underlying relation and often confusion between sustainability and circularity, here we directly see that sustainability is conceived as a product of water and waste management.

4.2.3 Relevant aspects gathered from mapping exercise

Based on an analysis of the above contrasts, we can see a constructive approach to the economic system and the business models. It is remarkable how participants appreciate the need for modifications in that sense, even when system logic frame is still far from the considerations. The perception, based on the corpus analyses of the two previous points, is that it is intended to slightly adapt a number of practices - based on the production and waste management stage - in order to force a higher productivity in the short term. Innovation is not considered further, because there are no signs of problems requiring a high degree of transformation in certain practices.

The lack of clarity regarding system design is evident not only in the type of references to a possible implementation of circular patterns in productive economies. There is also a relative scarcity of mentions to social commitment related to business activity. However, institutional regulation -apparently limited to issues of taxation or prohibition, and more rarely to incentives for more alternative practices- is a key question that is being considered, a fact that is highly positive in terms of a good predisposition to a sustainability transition. On the other hand, the role of the consumer as a stakeholder, detached from individual practice in the private sphere does not appear to be a significant element by the moment, even when a more streamlined tourism and urban models begin to appear on the equation.

The deduced perception also involves the occasional omission of timeframe - with a view, for example, to achieving any kind of planning objectives on issues such as the imposition of alternatives for the exploitation of raw materials - is particularly evident in certain conceptual paradoxes. For example, the same groups that associate - and sometimes confuse - sustainability with circularity do not propose the omission of economic design elements that have a negative impact on the environment, such as externalisation of production. The non-consideration of R&D&I as a differential factor for innovation in productive design is another symptom of often confusing conceptualization within the sphere of the circular economy and sustainability – which is quite common attending to the literature- as well as the use of materials: observing the interventions in contrast with the definitions, it is expected that investment in research and development will serve to contribute new materials and energy sources.

Finally, there is a point that may be very symptomatic of a general misconception: the recognition that knowledge needs to be introduced as a generating asset in the economy while at the same time raising the question of how to raise funds to manage the environmental impact of production systems. The treatment of knowledge as a mere resource, and not as an approach in itself, represents the replication of the possible underlying problem: a perceptive issue close to epistemology.

5. Discussion

The empirical analysis of aggregated perception of participants has revealed some patterns regarding the understanding of the transition to circular economy. Regarding, the System Description, the results indicated that it is implicitly attached concept such as circularity and sustainability, or Innovation and technology, but systematically unties by default the concept of Innovation from systemic design, subsequently conceiving relational affairs between stakeholders putting active behaviours beside. The perception of circular economy and its relationship with real conditioners, in general terms, seem to be still unclear. With respect to Challenges and Enablers, some slight frames appear to be slightly widened, but keeping the same kind of perception about the whole picture. Practical concepts in terms of proposals seem to merge and open the spectrum, specially related with current conflicts (urbanism, tourism, water management, funding), though the conceptual relations between essential abstractions is still narrowed.

The lesson learnt from the implementation of participatory process and the related mapping exercise indicated that to effectively engage practitioners, they firstly must feel empowered and secondly informed. Using a multi-stakeholder collaborative approach to engagement will create the environment for empowerment, as they will better appreciate the value of their commitment to the transition. Providing adequate and simplified communication within this created environment, will allow for improved comprehension of the theoretical, so that the real-world application can more naturally follow suit. For example, knowledge transfer and exchanges on circle economy principles, business model and policies, intermediaries should be more precise and practical to increase at scale circular business adopters. Whenever possible, participatory techniques should be tailored specifically across target audiences to that cross-stakeholder engagement is more tangible.

These results could contribute to emerging policy discussion where blending socio-technical aspects are indicated as a pressing requirement in the policy framework to facilitate transformative change. Considering this, the preliminary results show some insight on the potential of practitioners' perspectives to influence and shape the pull-and-push dynamics, whereby technology design, policy design, education and new emerging business models converge into applied solutions. Methodologically, this paper presents an innovation approach that is applied to generate practice-based knowledge. Further steps include better illustration of the technical and practical aspects of this approach to illustrate the potential of participatory techniques as a method to enable practical action on this matter by facilitating debate on the understanding of large-scale transitions while enabling the consensus on alternative pathways to facilitate transitions towards circular economy models.

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This paper is part of a broad study on transition to circular economy models based in science- practice interface between EIT Climate KIC, EIT Raw Materials and academic institutions. A team of practitioners, managers and researches have directly and indirectly collaborated for this first paper but, we want to specially acknowledge the contribution of Eusebiu Stamate and Edgar Bellver at different stage of this "work in progress" research collaboration. Other members of the team during participatory workshops: Maria Loloni, Joanna Montesinos, Louana Lamer and Edgar Galrao.

1. COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS on a monitoring framework for the circular economy http://ec.europa.eu/environment/circular-economy/pdf/monitoring-framework.pdf
2. See http://ec.europa.eu/environment/circular-economy/index_en.htm
3. COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS Closing the loop - An EU action plan for the Circular Economy http://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:52015DC0614&from=EN)
4. See http://ec.europa.eu/environment/resource_efficiency/targets_indicators/scoreboard/index_en.htm and https://publications.europa.eu/en/publication-detail/-/publication/1ee65e21-9ac4-11e6-868c-01aa75ed71a1
5. See Green Public Procurement guidelines at http://ec.europa.eu/environment/gpp/index_en.htm)

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7. Annex

7.1. Additional info on participatory workshops

The following tables present the distribution of the data gathered in the different participatory workshops: 1) Helsinki (2017), RIS 2016 & RIS 2017(Brussels) and Valencia (2016)

Workshop	Helsinki 2017		Brussels RIS 2016		Brussels RIS 2017		Valencia 2016		Total
Case/Topic	SLU Forestry	SPS Plastic	Electronics and PV		Value chain Circular economy		Agriculture & Water		
Inputs gathered	51	56	67	77	20	37	83	147	**538**
Method/ Canvas	SIM canvas		Scenario Canvas		Roadmap		Context Map	Pentagonal problem	
Canvas sections & analysis dimensions	Stages/ Process		Trends & drivers		Activities& Resources	Trends, drivers and changes needed	Factors and Status quo	Challenges and gaps	
System Description	174				20		83		**277**
Challenges & Enablers			77			37		147	**261**

Table 4 Inputs gathered by topic, canvas and distribution for analysis

Workshop	RIS2016			RIS2017	Valencia	Grand Total
Section / Topic	Electronics	PV	Total	Value chain - Circular economy	Agriculture - Water	
Changes needed				14		14
Climate change challenger					28	28
Market	9	9	18			18
Political	7	18	25			25
Problem statement					28	28
Resource Gaps					30	30
Social	6	10	16			16
Societal challenges					30	30
Technical challenger					31	31
Technological	6	12	18			18
Trends and Drivers				23		23
Grand Total	28	49	77	37	147	261

Table 5 Inputs gathered on System Description by workshop and category

Workshop	RIS2016			RIS2017	Valencia	Grand Total
Category / Topic	Electronics	PV	Total	Value chain - Circular economy	Agriculture - Water	
Access to finance	1	1	2	1	8	11
Access to knowledge and technology	1	1	2	1	9	12
Business models	6	1	7	6	13	26
Climate change and derivations	1	2	3	5	14	22
Materials	1	4	5	2	2	9
Policies and regulations	4	17	21	10	12	43
Polution and emissions control				1	8	9
Production systems	1	3	4		4	8
Public engagement	5	4	9	4	16	29
R&D&I	8	10	18	1	8	27
Sustainable processes		1	1	4	33	38
Extreme weather and floods				1	14	15
Human capital		3	3	1	3	7
Place-base and urban		2	2		3	5
Grand Total	28	49	77	37	147	261

Table 6 Inputs gathered on Challenges, drivers and enablers by workshop and category

The following pictures are example of the canvas used during some of the workshops, which are based in science-based methods developed by researchers (Matti, Juan Agulló, et al., 2017; Matti, Manshoven, et al., 2017)

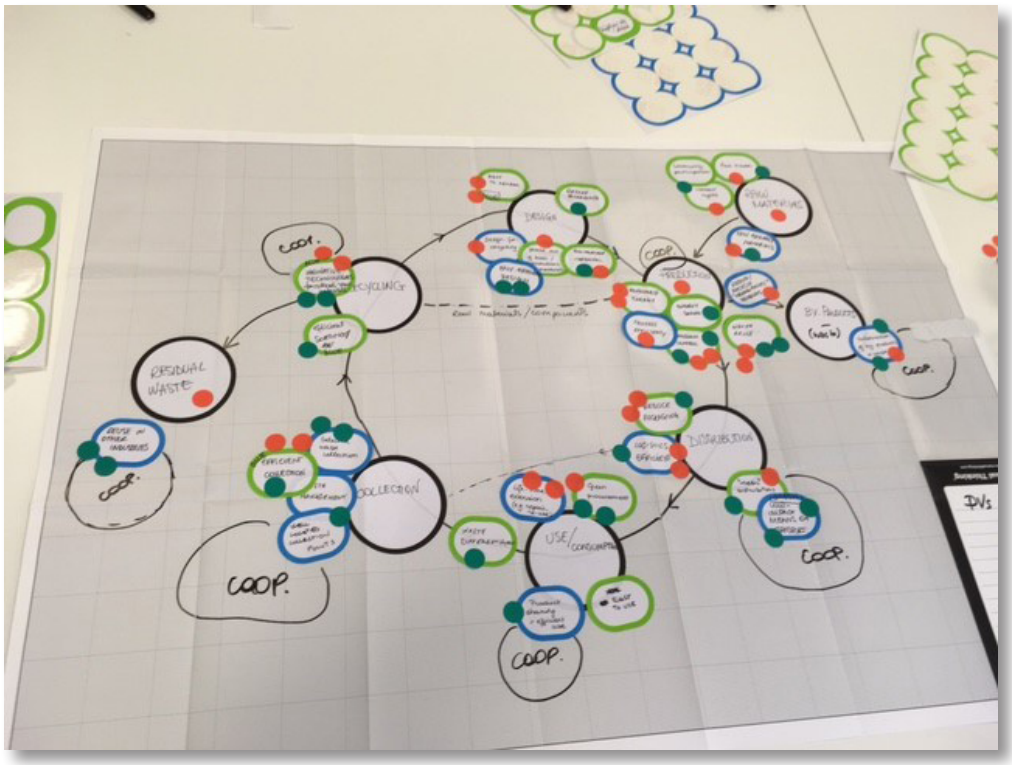

Figure 5 Example of Circular Economy System Simulation
Source: extracted from participatory workshop implemented in Brussels in 2016 (Matti, Manshoven, et al., 2017)

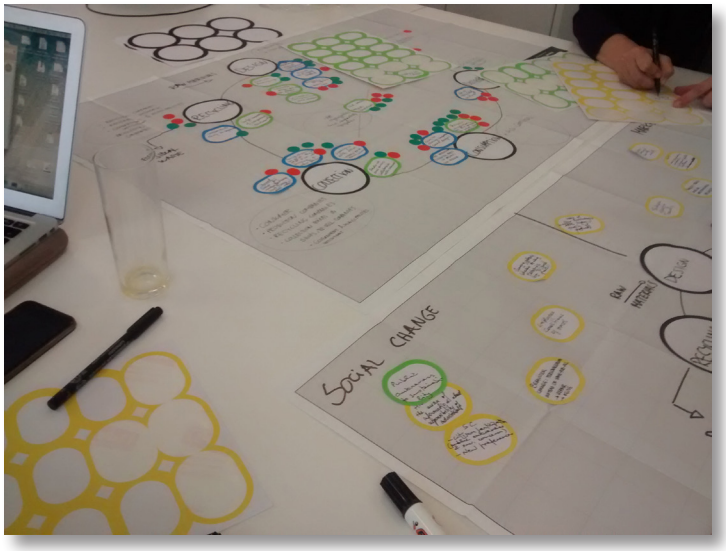

Figure 6 Example of contrasted Canvas: Circular Economy System & Dynamic Scenarios (Trends and Drivers)
Source: extracted from participatory workshop implemented in Brussels in 2016 (Matti, Manshoven, et al., 2017)