



D1.2 Techniques of Futuring for the Circular Economy foresight

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1. Introduction

In the ever-evolving panorama of the future, the ability to navigate and understand the intricacies is paramount for individuals, organisations and societies alike. Understanding how to adapt to the dynamic forces shaping the future is a crucial endeavour, as it allows us not only to survive, but to thrive in an increasingly complicated world. Currently, there are a variety of Techniques of Futuring¹ (ToFs) that are used to achieve this goal (see Pinyol Alberich et al., 2023). Some of these techniques facilitate navigation through the possible evolution of the current scenario, while others help to explore alternative scenarios. They differ in their foundations, with some rooted in quantitative methods and others in qualitative approaches. Certain techniques focus on adapting to the future, while others aim to promote specific futures. In addition, some techniques facilitate the involvement of experts, while others allow for the involvement of stakeholders and even the general public. The possibilities in this area are extensive and could continue indefinitely.

Researching ToFs in the context of the circular economy is an interesting endeavour due to the comprehensive and adaptable nature of this sustainability framework. The circular economy as an overarching concept allows for a variety of interpretations and approaches and offers a wealth of possibilities and potential scenarios. For example, the circular economy can be viewed from a capitalist perspective, i.e. with the aim of closing material and energy loops while increasing economic value. This circular economy approach is part of a green growth agenda (Giampietro & Funtowicz, 2020) and is the most widespread discourse within the circular economy. In contrast, critical voices link the circular economy to more transformative agendas, such as the post-growth (Bauwens, 2021) and degrowth (Schröder et al., 2019) agendas. Even new concepts such as the circular society have recently emerged (Calisto Friant et al., 2023). Among these transformative voices, the circular economy goes beyond the circularity of materials and energy, as it also encompasses, for example, the circularity of wealth, care, capital and power. The navigation of such different scenarios, from those that evolve from the status quo to those that revolutionise it, could be very different. With this in mind, it is of paramount importance to improve our understanding of how we can explore alternative views.

By engaging with ToFs, we are exploring the future beyond conventional predictions and looking at different future landscapes characterised by different ideas. This dynamic could allow us to find innovative solutions, anticipate emerging trends, manage uncertainties and find pathways to new societal paradigms. ToFs provide a lens through which we can examine the complex interplay of economic, environmental and social factors within the circular economy, fostering a holistic understanding of its transformative potential. Studying the future in this context not only improves our ability to predict future developments but also empowers us to actively participate in shaping a sustainable and regenerative future.

¹ Techniques of Futuring (ToF) is the name selected by Hajer & Pelzer (2018) to refer to transdisciplinary experiments from different contexts that enable the envisioning of alternative models of economic and social development, hence, suggesting alternative imaginations of the future (Pinyol Alberich et al., 2023).

This document is organised as follows. In Section 2, we look at the adaptability of ToFs. ToFs are characterised by their versatility, as they can be used for different purposes and take different forms. In Section 3, we examine the historical use of ToFs. In this section, we briefly present the results of the Deliverable 1.1 within this project (Pinyol Alberich et al., 2023). In Section 4, we examine the current applications of ToFs in the context of the circular economy. This section enables a comprehensive discussion that encompasses both the existing landscape of alternative visions of the circular economy and the various applications of ToFs within this framework. In Section 5, we conduct an analysis to identify opportunities for scaling up the implementation of these techniques within the circular economy, based on different goals and needs. In Section 6, we summarise critical reflections on the use of ToFs in the context of the circular economy.

2. ToFs as a performative, adaptative concept

In this section, we discuss two important ideas related to ToFs: performativity and adaptability. Both concepts are intertwined and crucial for understanding the interaction between the circular economy and navigating the future. On the one hand, performativity refers to the fact that imagining a certain future can determine the way to get there. Adaptability, on the other hand, refers to the ability of ToFs to be used and adapted for different purposes.

Performativity of ToFs have been assessed by Oomen et al. (2022):

Currently, the ubiquity of forecasts, projections and scenario-modelling in public policy, politics and business planning in modern society creates a particular range of imagined futures, delimited in the ways they can imagine futures. Methodically analysing the practices that enact and produce certain visions and the structures that enable them through the ToF prism may make it possible to reconstitute futuring practices. Perhaps, this can constructively reconstitute constructivist analysis of the future too, in ways that are more fit to solve the crises of the twenty-first century. (Oomen et al., 2022, p. 266)

Alternative future visions, the scope of variables considered in trend analysis, the acknowledgement of potentially disruptive events, the ontological foundation of future visions, the plausibility of various scenarios, etc., collectively shape and strategise a limited set of options for transitioning from the current scenario to a future one. In this context, ToFs emerge as pivotal political instruments, actively influencing and moulding specific ideologies and modes of operation.

Similarly, the circular economy itself is wielded as a political instrument. The technocratic, apolitical, and neutral approach to the concept has been recognized as a distinct political strategy for shaping it (Genovese & Pansera, 2021). This approach often assumes that the current scenario, specifically an eco-modernist, capitalist framework, is a natural state for societies, a notion challenged even by the circular economy literature (Giampietro & Funtowicz, 2020; Pansera et al., 2021). Envisioning the future within the circular economy realm may give rise to specific ToFs or distinct approaches in employing these techniques. Hence, understanding the interplay between future envisioning within the circular economy, the techniques employed, and their method of application provides crucial insights into the

politics inherent in these efforts. Moreover, it sheds light on the performative aspects of such endeavours.

The adaptability of ToFs is intricately linked to their performativity. Since the configuration and application of ToFs inherently carry political implications, their implementation can vary significantly depending on diverse intentions and perspectives. The flexibility of ToFs allows for performativity in multiple directions, fundamentally shaped by their political underpinnings. For instance, in a trend analysis, one could evaluate the evolution of various indicators over time based on known variables. Simultaneously, this analysis could incorporate the consideration of disruptive events, exploring how these events might reshape initial indicators and lead to a distinctly different scenario. There is even the option of considering that (social, economic and political) patterns will remain essentially the same in radically different (social, economic and political) scenarios, in such a way that trend analysis might be used to navigate those revolutionary scenarios. However, it is essential to recognize that while ToFs can be configured and utilized according to different intentions, this does not imply an infinite range of possibilities. Despite the inclusion of disruptive events and exploration of subsequent scenarios in a trend analysis, numerical assessments based on statistical patterns might be constrained in navigating a scenario based on alternative social, economic, and political logic. Essentially, our argument is that while ToFs can be configured and employed for various purposes, they operate, in each case, within a defined range of options.

With all this in mind, this document starts with two main questions: 1) How are ToFs normally set and used to navigate in the future? and 2) How could ToFs be set and used to navigate in the future? The first question aims to capture not only the list of ToFs that are commonly used for navigation in the future, but also the politics underlying their use. Using this question as the guiding question for conducting the overview analysis allows us to take a broader look at the way in which the circular economy is commonly approached. This question is answered in *Section 3. ToF so far* and *Section 4. ToF under the Circular Economy so far*. Having accepted the relationship between politics, circular economy and ToF, the second question aims to explore how to go beyond *business-as-usual*. This includes, for example, an assessment of how different ToFs can be used for different purposes and what different settings might enable different outcomes. This question is answered in *Section 5. Expanding the use of ToFs under the Circular Economy*.

3. ToFs so far

Pinyol Alberich et al. (2023) conducted a comprehensive literature review to identify articles that provided an extensive overview of various techniques employed in *futuring* research. As a result, the authors collected 43 different ToFs² and classified them into 4 relevant categories: paradigm shift, method, control, and participation. To sum up, ToFs might allow us for envisioning evolutionary or revolutionary futures, termed Paradigm shift. ToFs like Trend Impact Analysis usually signify low paradigm shift, tethered to existing frameworks, while Fictive Narratives typically represent high paradigm shift by challenging norms. Methods are classified as quantitative or qualitative, with Computerised Scenario Comparisons as a

² The complete list of ToFs can be found in the Appendix of Pinyol Alberich et al. (2023).

quantitative example, and SWOT (Strengths, Weaknesses, Opportunities, and Threats) analysis as qualitative. Control distinguishes techniques as low (e.g., Visualization) or high (e.g., Backcasting) based on their aim to adapt or shape the future. Mixed methods, like Scenario-based planning, might fall in between. The fourth aspect, Participation, gauges inclusivity towards societal actors, from limited expert involvement (e.g., Trend extrapolation) to broader engagement (e.g., Interactive Scenarios, Fictive narrative techniques). The classification considers typical usage, acknowledging flexibility in application beyond labelled categories, i.e., adaptability.

Additionally, the authors evaluated various categories to understand ToF techniques better, focusing on their capacity for paradigm shift. In comparing Paradigm shift and Method categories, they found quantitative methods often fall short in envisioning scenarios beyond the usual, while qualitative methods, particularly scenario building techniques, enable a high paradigm shift. In the comparison between Paradigm shift and Control categories, they observed a correlation between the level of paradigm shift and control, with most ToFs having low control. Techniques allowing low paradigm shift are often associated with low control, while high-control techniques associated with high paradigm shift. In the Paradigm shift and Participation categories, most techniques involve only experts, with a trend towards broader audience participation, especially in envisioning scenarios beyond the usual.

4. ToFs under the Circular Economy so far

In this section, a systematic literature review was made to find out how ToFs are being used under the Circular Economy. The state-of-the-art was made with papers collected on Scopus database and they were analysed based on the categories established by Pinyol Alberich et al. (2023). These are paradigm shift, method, control and participation.

4.1 Methodology

The systematic literature review was made using the Scopus database. The search query was made applying the keyword to Title-abstract-keywords. The selection of keywords can be seen in table 1. With these keywords, a first process of identification showed 2.730 results of possible papers. In the screening step, three filters were applied: Limit to (Document type: Article), Limit to (Language: English) and Limit to (Source type: Journal); giving 1.519 results. Reading the title and abstract of the papers, a selection of 226 papers was made. It was taken into account that papers show the potentiality of having used ToFs to study Circular Economy in some way. After removing duplicates, the results show 197 papers selected. These were examined in depth to reach a final selection of 92 papers.

Table 1. Keywords used for the literature review.

Keywords	Hits per keyword	Reviews
“foresight techniqu*” and “sustainability”	5	3
“horizon scan*” and “circular economy”	3	1
“horizon scan*” and “sustainability”	31	4
“futuring” and “circular economy”	2	2
“futuring” and “sustainability”	15	6
“futur*” and “circular futur*”	15	10
“futur*” and “ecological transition”	95	9
“futur*” and “sustainability” and “circular economy”	902	99
“developing scenarios” and “sustainability”	8	3
“scenario techniqu*” and “sustainability”	5	3
“foresight exercis*” and “circular economy”	1	0
“foresight exercis*” and “sustainability”	5	3
“foresight method*” and “sustainability”	29	5
“method* of scenario*” and “sustainability”	4	2
“scenario construction” and “sustainability”	14	5
“scenario design” and “circular economy”	3	1
“scenario design” and “sustainability”	35	9
“scenario development” and “circular economy”	6	3
“scenario development” and “sustainability”	106	20
“scenario logics” and “sustainability”	2	1
“scenario method*” and “circular economy”	2	2
“scenario method*” and “sustainability”	51	8
“scenario planning” and “circular futur*”	1	1
“scenario planning” and “circular economy”	7	3
“scenario planning” and “ecological transition”	1	0

“scenario planning” and “sustainability”	131	15
“scenario thinking” and “sustainability”	6	1
“scenario typ*” and “sustainability”	4	0
“strateg* foresight*” and “circular economy”	5	4
“strateg* foresight*” and “sustainability”	23	2
“scenario construction” and “ecological transition”	0	0
“scenario construction” and “circular economy”	0	0
“scenario typ*” and “circular economy”	0	0
“foresight method*” and “circular economy”	1	1
“foresight exercis*” and “ecological transition”	1	0
Total	1519	226

Finally, a previous analysis was made to examine if the selected papers were suitable indeed. It was found that some of them were not using ToFs or the topic of the paper was far enough from Circular Economy to not take them into account. Nevertheless, papers using ToFs in fields with the possibility of overlap in some way with Circular Economy were taken into account, reaching a final selection of 66 papers included in the analysis (Fig.1).

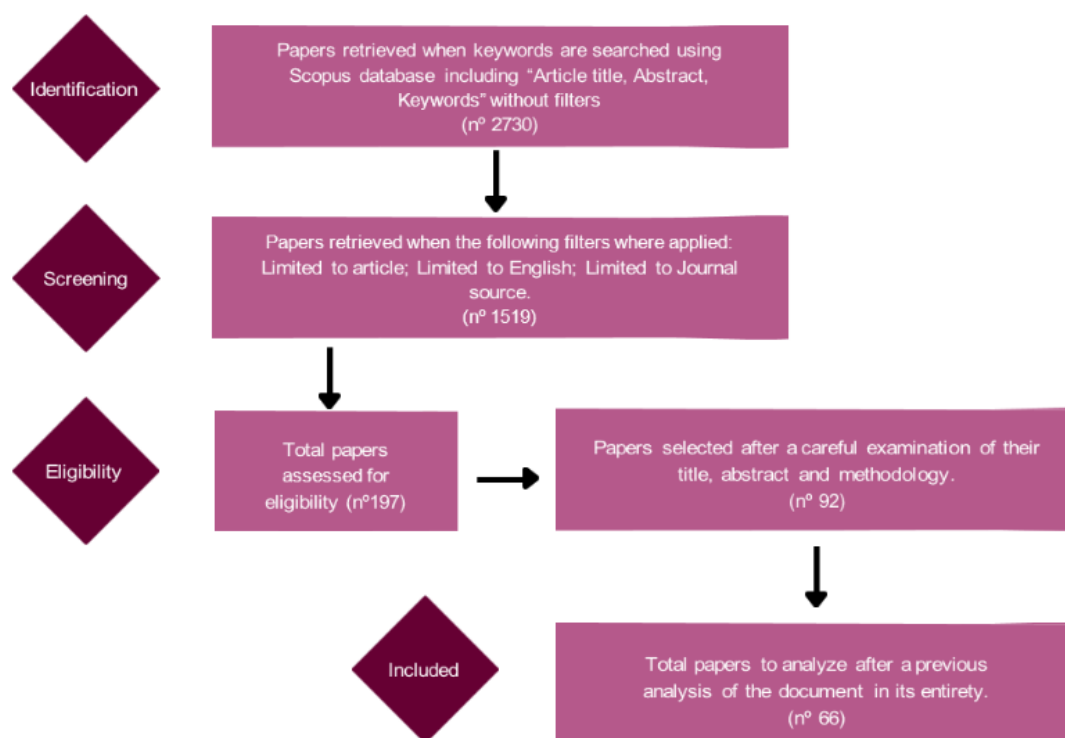


Fig. 1. Methodology process of the systematic literature review. Based on PRISMA flow map.

4.2 Results

First of all, it is important to mention that of these 66 papers analysed, only 20 have a clear reference to the ToFs of the circular economy. The rest touch on the topic in overlaps with other related areas such as sustainability or green economy. Svenfelt et al. (2019), for example, uses the circular economy as a specific scenario with a backcasting method approach to explore sustainability when economic growth is not the main goal of Swedish society. Other works do not project different scenarios of the circular economy, but investigate different possible variants of a specific feature, such as recycling. For example, Kulakovskaya et al. (2023) develop different scenarios using the value chain of expanded polystyrene in Switzerland to propose “a new approach that integrates environmental and economic impact assessments of CS implementation at the value chain level” (p. 8). There are few who actually use ToFs to visualise what the circular economy could look like in the future. Bauwens et al. (2020) provide an example of this by using scenario-based planning to create four different scenarios centred on the circular economy to explore how different the circular economy can be depending on how different factors are set up and managed.

Looking at this portrait, it can be said that research into the future of the circular economy is underdeveloped and represents an interesting field for exploring the future. Nevertheless, we can see a greater interest in these studies nowadays, as 52 out of 66 papers were published from 2019, including this year. Nevertheless, most of the papers analysed do not explore the various possibilities of what the circular economy could look like in the future. They take a particular circular economy as a given and explore different variants or strategies of a particular feature of the circular economy that they understand in a particular way. There are also contributions that consider the circular economy as something that happens in a specific scenario, which in turn understand it as a defined and one-sided concept. Accordingly, 64% of the papers analysed were classified as low-paradigm shift and only 29% as high. An example of the latter can be found in Bauwens et al. (2020) mentioned above. Another example was provided by Niskanen & McLaren (2023). In their paper, they use a scenario-based planning technique to explore possible futures of repair, following the scenarios created by Bauwens. Calisto Friant et al. (2020) gives another example of a high paradigm shift from a different perspective. In their work, they use a scenario-based planning to present different circularity discourses around two axis; the holistic or segmented “approach to social, economic, environmental and political considerations” (p. 11), and the positioning, optimistic or sceptical, around technology and innovation and their capacity to solve the ecological crisis. Lowe & Genovese (2022) use the same method to explore what theories of values fit in each different scenario. On the other hand, providing an example of the low paradigm shift, Luoma et al. (2022) use a Delphi approach to explore “how the use of data could support the construction of sustainability-focused pathways to a circular economy for textiles” (p.1).

The three most frequently used ToFs are scenario-based planning, backcasting and the Delphi method. Almost without exception, these techniques are used with a mixed or qualitative method; only 11 of the analysed works use a purely quantitative method. Gonzalez-Martinez et al. (2021) is one of the few that use a quantitative model with alternative scenarios to explore “the potential impact of different paths that Dutch agriculture could take in this transition” (p. 1). This paper also uses stakeholder participation. Nevertheless, 61% of the participation was found to be focused only on expert participation. Furthermore, public participation falls almost

completely out of the equation, with only three papers using this type of participation in their research. An example of this is Chambers et al. (2019), who rely on a national opinion survey examining Australians' preference between four scenarios for their country in 2050. In terms of the control category, half of the papers only examine the different possibilities without attempting to achieve any of the scenarios created. However, 27% of the papers can be assumed to be highly controlled as they try to know how a certain point can be reached, such as Hamann et al. (2020) using a three-horizon technique to imagine pathways to each of the future scenarios for Southern Africa developed in their paper.

Finally, the boundary between high, medium and low is sometimes ambiguous, so the lack of a clear distinction between the categories is a limitation of this section. However, the importance of this section lies in determining how ToFs are utilised within the circular economy. Having examined the current state of the art, we can say that few papers utilise ToFs to explore different possible circular economies. It is an underdeveloped field where new research can be conducted to design and imagine different futures that enable humanity to live in a sustainable and just world.

5. Expanding the use of ToFs under the Circular Economy

In this pivotal section, we delve into the realm of possibilities, exploring the potential for broadening the application of ToFs within the context of the circular economy. Having established the intricate interplay between politics, ToFs, and the circular economy, our focus now shifts towards addressing the question: How might ToFs be employed to navigate the future within the circular economy? Departing from the understanding that ToFs are characterised by their performativity and adaptability, here we challenge ourselves to reconceptualise the role of ToFs as dynamic tools capable of nurturing innovation, resilience, and sustainable practices within the circular economy.

The adaptability of ToFs, intricately linked to their performativity, becomes a guiding thread as we navigate diverse settings and envision alternative outcomes. Through a nuanced analysis, we aim to uncover the untapped potential of ToFs in steering the circular economy towards a future that surpasses preconceived limitations. This section not only examines various ways ToFs can be configured for diverse purposes but also considers the broader implications of their use. As we navigate through these uncharted territories, the objective is to offer insights and pathways for expanding the scope and impact of ToFs within the sphere of the circular economy.

5.1 Methodology

We have evaluated the potential application of various ToFs within the framework of the circular economy through a workshop, followed by a questionnaire to its participants. During the workshop, we explored and employed diverse ToFs to delve into possible scenarios and strategies pertinent to the circular economy. Subsequently, a questionnaire was administered to gather insights and feedback from the participants, aiming to further refine our

understanding of the applicability and effectiveness of these ToFs in the context of sustainable practices and circular economic models.

5.1.1 Techniques of Futuring

The following is the eight ToFs that have been used in both the workshop and the questionnaire.

Trend impact analysis

Trend impact analysis (TIA) adjusts baseline trends in response to potential future events. It can identify a trend and an event that disrupts its trajectory. Key impact points are determined: when the trend deviates, reaches maximum deviation, and stabilizes. The magnitude of impacts is estimated. A new trend line is calculated and compared to the original. TIA aids understanding of event effects and informs decision-making.

Delphi method

The Delphi method gathers and analyses expert opinions to reach a consensus. It involves iterative rounds where experts respond to a questionnaire. The goal is consensus through diverse perspectives. Experts interact virtually, sharing opinions. Rounds vary based on the desired consensus. Delphi assumes collective consensus is reliable. Results provide insights into timelines, barriers, and importance.

Scenario-based planning

Scenario-based planning involves creating multiple scenarios to explore and understand future possibilities. These scenarios combine creativity with analytical methods to provide diverse perspectives. Constructing four to eight scenarios is typically recommended for a manageable yet comprehensive set. Approaches like axial matrix or theme/technology focus can be used to script scenarios. Scenario-based planning helps decision-makers navigate uncertainty, explore alternative futures, and develop adaptable strategies.

Fictive narratives

Fictive Narratives is a method that combines imagination and reality to explore and evaluate future possibilities. It involves creating narratives that depict life in future scenarios, using collected data and trends as a basis. These narratives serve as a tool for empathizing with the experiences, emotions, and social dynamics of individuals in the envisioned future society. By crafting textual or visual representations, such as zines, drawings, or storyboards, fictive narratives provide a means to assess the coherence of a scenario and offer tangible visualizations of the potential impact of abstract quantitative data and trends.

Genius forecasting

Genius forecasting is an approach that taps into the visionary and intuitive abilities of individuals to anticipate and envision future possibilities. It involves seeking insights and predictions from exceptional individuals who possess unique perspectives, creative thinking,

and a deep understanding of the subject matter. This method recognizes that certain individuals have a heightened ability to perceive trends, patterns, and emerging developments that may not be immediately evident to others. By harnessing their visionary thinking and intuitive insights, genius forecasting aims to uncover novel ideas, innovative solutions, and unconventional perspectives that can shape future outcomes and guide decision-making processes.

SWOT analysis

The SWOT (Strengths, Weaknesses, Opportunities, and Threats) analysis method is a valuable technique employed in the initial stage of strategic foresight, known as "Framing the question." It involves systematically assessing and evaluating the internal strengths and weaknesses of an organization or situation, as well as the external opportunities and threats it faces. By identifying and analysing these factors, SWOT analysis helps to gain a comprehensive understanding of the current state and potential future scenarios. The method enables decision-makers to capitalize on strengths, address weaknesses, exploit opportunities, and mitigate threats, thereby informing strategic planning and decision-making processes.

Backcasting

The Backcasting method is a type of scenario technique that involves envisioning a future state at a specific time horizon. This future state can range from plausible to fantastical. By establishing this future state as a reference point or "beachhead," it becomes easier to trace a path from the present to the future or vice versa, rather than trying to predict the events leading to an unknown future. Backcasting allows for a more systematic and strategic approach to planning and decision-making, as it helps identify the necessary steps and actions required to reach the desired future state. It draws on the definition provided by Robinson (1990) and is considered a valuable tool in the strategic foresight process.

Role-playing

The Role-Playing method involves group participation in simulated future situations, where individuals assume specific roles and make decisions accordingly. Originating from war games in the 1950s, it is now used in diverse domains like emergency preparedness and high-risk technical missions. By immersing participants in realistic scenarios, role-playing enhances understanding of future dynamics and decision-making processes, facilitating strategic thinking and preparedness.

5.1.2 Scenarios

We conducted several rounds of decision-making to select two dichotomous dimensions that yield four scenarios. First, we identified eight potential dichotomous dimensions: 1) governance (bottom-up and top-down), 2) technology (high-tech and low-tech), 3) innovation (market-based and convivial), 4) business models (classic long-life models and sufficiency-based models), 5) scale of production (small/local and large/global), 6) means of production (private and collective), 7) ownership of final products (private and collective), 8) growth (unrestricted and restricted). After several rounds of internal consultation, we decided in favour

of the two dimensions that we consider more important for the purposes of this report, namely the dimensions of governance and growth. The intersection of these two axes resulted in four different scenarios (Fig. 2). Nevertheless, the other dimensions are already included in these four scenarios. The following four scenarios were used both in the workshop and in the questionnaire.

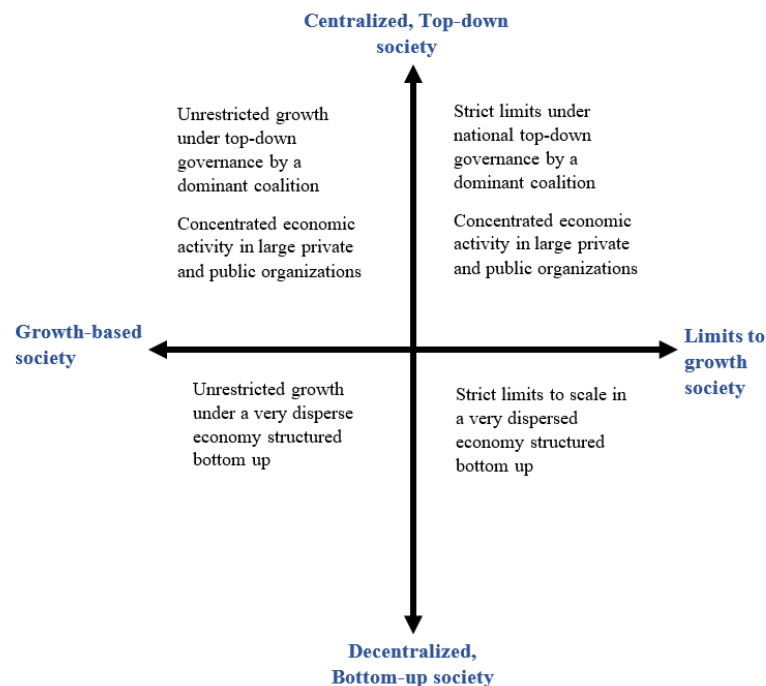


Fig. 2. Dimensions and scenarios selected for this Deliverable.

Scenario 1: Limits to growth and Centralised governance

In this scenario, centralised states, large corporations and international organisations such as the UN work together to create a society of limits to growth through a technocratic and authoritarian regime of decision-making. Economic activity remains in the hands of a few organisations and the benefits are largely distributed among them. The organisations in control produce standard products and distribute them more or less equally to the population. This could include a rationing system, a heavy tax system to centralise large priority investments, and various ways of accessing products such as product-as-a-service models and sharing economy. In this context, the circular economy aims to reduce production and consumption by all means and adapt society's throughput to the limits of nature. As a result, supply chains are shifting to more localised structures due to the escalating costs associated with global supply chains. Circular districts, for example, could be promoted and multiplied. The crucial aspect in this scenario is that decision-making on production and consumption lies in a few hands that aim to adapt societal throughput to the limits of nature.

Scenario 2: Unrestricted growth and Centralised governance

In this scenario, the state and large corporations promote circular innovations and technical solutions for linear production and consumption systems. Their goals are to increase economic

growth and to decouple economic growth from the environmental impact of certain elements (mainly greenhouse gas emissions). Key strategic resources such as critical raw materials for green technologies and artificial intelligence are under their control and are used to maintain the status quo. Circular economy practises aim to improve material efficiency through massive recycling and energy recovery facilities, using recycled materials instead of primary materials. With personalised advertising, citizens are encouraged to consume ever-increasing amounts of environmentally friendly and circular goods for emerging needs. There is no control over planned obsolescence, which is actually used as a tool to stimulate economic growth. Although greenhouse gas emissions are partially decoupled from economic growth, most other impacts and environmental limits are not. As a result, the effects of ecological crises that threaten human existence are worsening.

Scenario 3: Limits to growth and Decentralised governance

In this scenario, citizens rebel against GDP, capitalism and consumerism and demand the introduction of an ecological and just social and political system. Autonomous organisations emerge at local level, using the circular economy as a tool to achieve sufficiency by organising themselves and imposing a maximum consumption of resources through a fair share calculation. The circular economy is understood in a broader sense (energy-material, biogeochemical, supply and energy cycles). Supply chains are shortened and located in close proximity to the places of consumption and production systems adapt in the long term to the resources available nearby. A universal basic income could be promoted, although there are still coordination concerns. Some elected CE committees take responsibility for coordinating production and prices at regional level.

Scenario 4: Unrestricted growth and Decentralised governance

In this scenario, the state does not restrict social throughput and uses subsidies and eco-taxes to change demand in the hope that companies will develop cleaner and more circular innovations and technologies. Society is fighting back against the dominance of large corporations and reclaiming ownership of personal data that tech companies have used to expand their power. Following some anti-monopoly measures, economic activity is becoming much more distributed across society and decentralised within different organisations, revitalising innovation across the economy. The circular economy is incentivised to keep key materials and energy within its economic sphere and improve security of supply and social efficiency. Commoditisation opens up new avenues for economic growth. In the long term, this system struggles to prevent environmental degradation as many negative externalities remain untreated as low-cost transport encourages long, global supply chains with multiple actors. There are also still problems with coordination, especially for larger circular initiatives.

5.2 Results

The workshop was held online on 24 November. 14 participants took part in the workshop, including members from both academic and non-academic partners of the ExPliCit project. The workshop allowed us to harvest a collective understanding of ToFs in the context of the circular economy. During the workshop, we were able to discuss many different topics related to the scenarios for interaction with ToFs in the context of the circular economy, the example

of eight ToFs and their ability to steer the future. The workshop was therefore crucial to improve our collective understanding of the key issues of WP1 in the ExPliCit project, as well as to prepare the terrain for the remaining WPs. Subsequently, the questionnaire was answered by nine individuals who had previously participated in the workshop. The individual responses were crucial to get a clearer picture of the questions that were originally asked during the workshop. The results of the workshop and the questionnaire are explained in detail below.

5.2.1 The current scenario

An important question asked both during the workshop and in the questionnaire related to the current scenario. Understanding the collective perspective of the ExPliCit team in relation to the current scenario is crucial for further argumentation. This is important, for example, to understand what it means for a ToFs to be categorised as a method that enables a major paradigm shift. While the idea of a paradigm shift remains, the needs and implications associated with such a paradigm shift vary depending on the starting point and the desired goal. Essentially, the outcomes of these collective exercises resulted in describing the current scenario mostly as a growth-based society, with a mixed governance that combines elements from a centralised, top-down society and a decentralised, bottom-up society (Fig. 3).

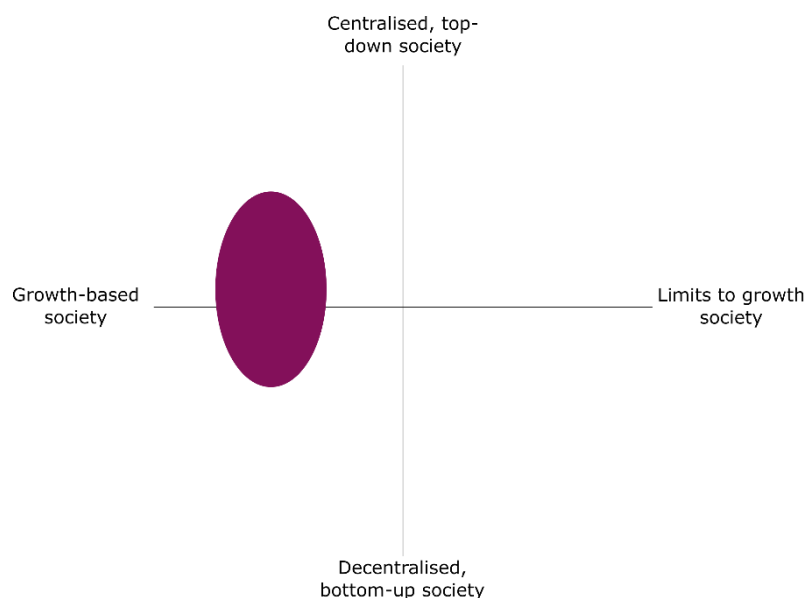


Fig. 3. Mapping the current scenario under the dimensions employed in this Deliverable.

In general, the current scenario could be characterised as one in which companies are driving circular innovation and technology. However, this progress depends to some extent on the influential role of large companies and/or government initiatives such as subsidies and eco-taxes aimed at reshaping demand. Although the concept of limits is present in the discussions, it plays a subordinate role as it does not ultimately lead to a restriction of production and consumption. It is assumed that environmental degradation will be addressed through the development of a market that includes both decentralised initiatives by companies and top-down policy implementation by governments. Furthermore, the decision-making power lies with the large companies that exert considerable influence on this market. It is therefore

essentially a scenario that builds on the logic of unrestricted growth and combines decentralised market forces (e.g. there is only very limited control of planned obsolescence) and centralised decision-making (e.g. the implementation of circular economy policies in the EU and/or the driving forces of large corporations that influence production and consumption).

5.2.2 Navigating the future through the ToFs

Once we have mapped the current scenario, it is now possible to advance our understanding on how to apply different ToFs under the circular economy umbrella. It is important to say in advance that these results are not aimed to be exhaustive, nor definitive, but they just aspire to open up a discussion and advance knowledge on the topic in hands. Fig. 4 presents the key outcomes of the workshop and the questionnaire in relation to the use of diverse ToFs under the circular economy. These outcomes allow us to discuss not only the potential use of different ToFs to explore alternative scenarios, but also to link the use of this techniques and the diverse scenarios to the underlying political views.

In general, all techniques enable the exploration of the development of the current scenario. As a direct consequence, it can be said that the enlargement of the light purple area in Fig. 4 means that a certain technique allows further exploration of alternative scenarios. Trend analysis has the smallest area, which means that while it can be useful to explore the development of the current scenario, it has many limitations to go beyond it. In contrast, scenario-based planning and role-playing offer the widest scope, i.e. they allow to explore both the current scenario and alternative scenarios. Overall, we argue, the extension of the yellow area can be linked to the adaptability of the technique. To return to the example of trend analysis: It can be useful to understand the evolution of the current scenario and to visualise nearby scenarios. In other words, numerical simulations could be used to estimate the transition from one scenario to another. However, the ability of this technique to go beyond the current scenario seems to be limited to some extent. In contrast, scenario-based planning and role-playing techniques seem to have great potential to be adapted to different needs.

The adaptability of techniques is also related to their ability to incorporate different political and philosophical views. Using the example of fictional narratives, it is possible to develop future scenarios in which technology controls humanity, cars fly or trains hover and travel at 500 miles per hour. These futures could be based on the same kind of economic, social, political and cultural orders, even if they contain small variations: an economy based on a mixed market, but with the absolute control of a leading company that has access to political power, a society with authoritarian regimes that control resources and promote technological innovation to overcome the ecological crisis, and so on. Even if a technology can be adapted to different conditions, its final use depends on the philosophical and political views that using it. Thus, to stay with the example of fictional narratives, one could try to create a world based on alternative social relations centred on very different social priorities. The book *The Dispossessed* (Le Guin, 1999) is a good example of such a use of this technique.

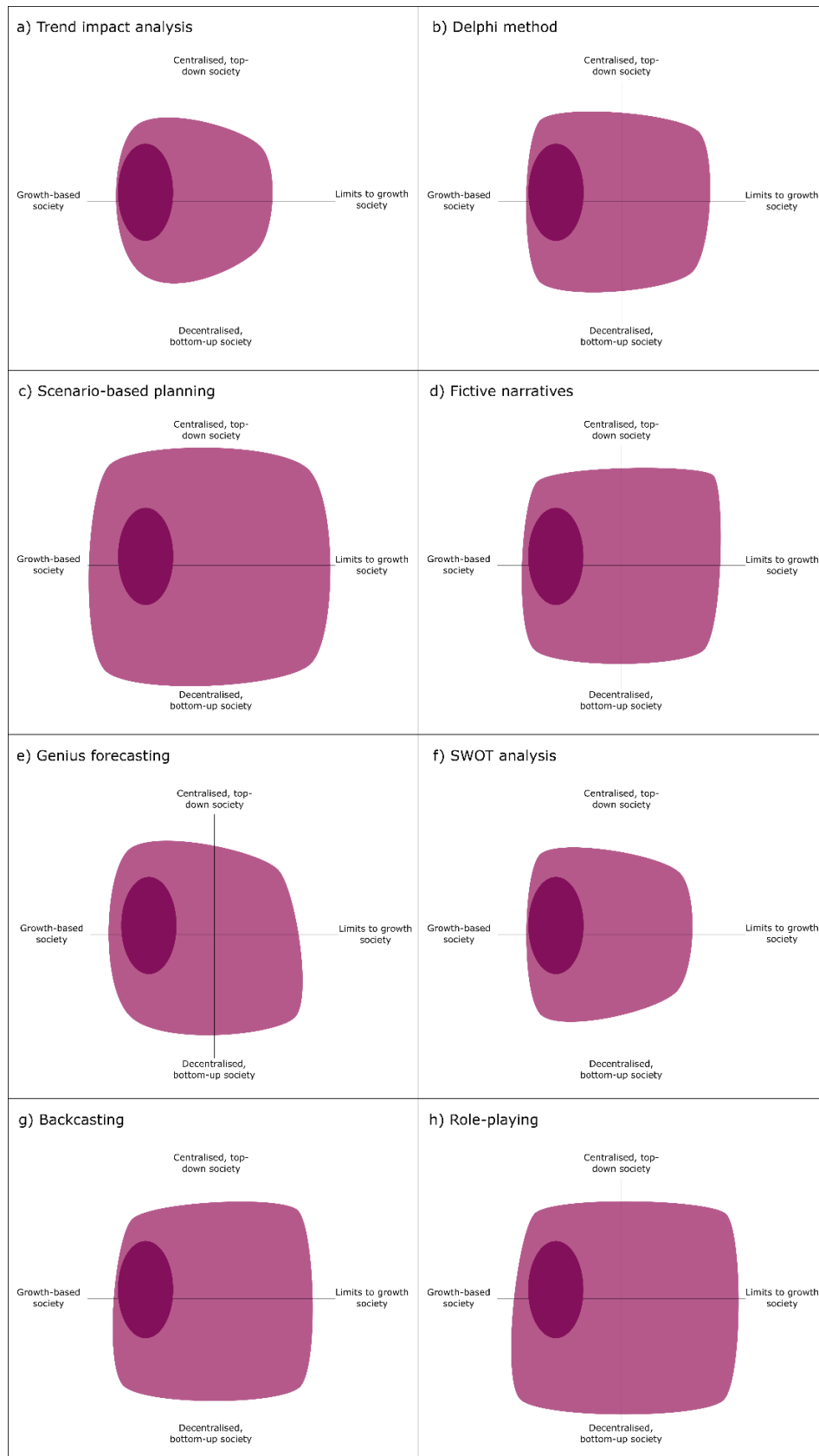


Fig. 4. Capacity of eight ToFs to navigate alternative scenarios. The dark purple area represents the current situation. The light purple area represents the potential capacity of each technique to explore each scenario.

Similarly, the choice of dimensions applied in scenario-based planning will determine the nature of the paradigm shift that this technique ultimately enables. In this respect, the choice of dimensions will depend on the political and philosophical views of the researcher. Continuing this line of reasoning, not only will the choice of dimensions vary according to worldview, but the way in which each scenario is navigated will also be conditioned by the particular philosophical and political view. For example, the decentralised scenario, which is the most distant scenario according to our findings, could be steered based on the current logic (e.g. that people determine what is produced and consumed through their demand and that economic processes can be decoupled from environmental impact) or an alternative logic (e.g. that people participate in an ongoing political discussion based on cooperation and that people limit themselves and live a life based on sufficiency). To summarise, it can be said that the results of the application of the individual techniques are essentially normative.

5.2.3 Circular economy, futures, and ToFs

In section 4, we explained how ToFs are used in the context of the circular economy. The current section builds on the discussion started in Section 4 and deepens the previously identified normative nature of the use of such techniques. In this way, we aim to gain insights into how the use of ToFs can be expanded under the circular economy.

As mentioned before, scenario-based planning, backcasting and the Delphi method are the three most used techniques. These three techniques, although differently, allow to navigate a great range of scenarios, including both the business as usual and alternative ones. The fact remains that, however, most of the papers under scrutiny can be linked pretty much to a positive evolution of the business as usual, particularly when backcasting and the Delphi method are applied. The circular economy is referred to, in most of the articles, as a production-consumption system in which material and energy are recirculated, economic value is created, and growth is decoupled from the use of resources and the generation of waste and emissions.

In contrast, several articles aim to explore alternative narratives, discourses and social orders in which the circular economy could develop. In this regard, scenario-based planning is usually the most revolutionary technique to explore unexplored and unknown futures. Some scenarios can be linked to different perspectives of the circular economy. This is the case, for example, of Calisto Friant et al. (2020), who explore the notion of circular societies and call for a valorisation of elements that are undervalued in the mainstream circular economy approach. The concept of circular societies aims to include not only the cycle of materials and energy, but also the cycle of other important elements such as care, energy and income (Calisto Friant et al., 2023; Leipold et al., 2021). Another example can be found in Lowe & Genovese (2022), who analyse different theories of value and link them to different social orders.

There seems to be some connection between the use of certain ToFs and different worldviews, even if there is some range of flexibility for their use. Could be clearer. Essentially, the previously described mainstream view of the circular economy emerges only in one out of four scenarios (the current scenario), and most of the review articles therefore refer to an evolution of 'business as usual'. In other words, much of the research in this area focuses on how the implementation of circular systems can be adapted or designed, assuming an

economic, social, political and cultural order similar to the current one. In order for futures research to navigate different economic, social, political and cultural orders, research must not only select appropriate ToFs, but also, and more importantly, start from the acceptance of the existence of alternative scenarios and framings of the circular economy.

6. Critical reflections

In this deliverable, we first analysed the performance and adaptability of ToFs and highlighted their normative core. We then conducted a literature review on how ToFs have been used in the context of the circular economy. This gave us an overview of the current status of the topic. We then went beyond the current state of the art by analysing the potential uses of different ToFs in the context of the circular economy. We now present here two critical reflections that summarise the results of this work and also inform future potential lines of research on this topic.

An important finding of this study is that the use of ToFs is essentially normative. This means that ToFs and their application cannot be decoupled from the philosophical and political views underlying the research. This is about the adaptability of a technique: a technique can be used for different goals and scenarios. If a technique makes it possible to control different scenarios, the intentions and worldviews are decisive for how such a technique is applied. At this point, however, it is crucial to consider the performativity of ToFs. When ToFs are used for particular purposes, they create specific images of the future and/or ways of adapting/shaping it. Performativity creates discourses, structures and overall realities that ultimately align with philosophical and political starting points. In relation to the circular economy, different uses of ToFs can reinforce the mainstream conceptualisation of the circular economy based on green growth or promote alternative views such as the idea of circular societies.

A second crucial point is that in the context of the circular economy, we have identified a significant lack of research that applies ToFs to explore scenarios beyond "business as usual". As shown in this report, while some ToFs allow for the exploration of a wide range of scenarios, including those beyond business as usual, they are generally used to guide positivistic developments in business as usual. Exceptions can be found in Bauwens et al. (2020), Calisto Friant et al. (2020), Lowe & Genovese (2022) and Niskanen & McLaren (2021), among others. The current shortage represents an opportunity for future research to address this issue.

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