Scenario building through a systemic lens: a new perspective on tools and methods to design for sustainability transitions

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Abstract

The connection between sustainability and the future has its roots in the early days of environmental movements. The report 'The Limits to Growth' (Meadows et al., 1974) highlights how sustainable action implies wide-ranging, systemic considerations and forward-looking thinking. This is also reflected in the definition of Sustainable Development provided in the Report 'Our Common Future' (WCED, 1987). Working for sustainability, in fact, usually means taking a long-term approach, which also ties in with radical and socio-technical innovations. In recent times, however, the world has faced complex systemic social, technical, and environmental challenges, which will be increasingly interconnected and interdependent. Systems theory allows us to rethink such phenomena as isolated elements and complex systems made up of many interacting parts (Vargo et al., 2017). Placed in a timeline, it is possible to highlight how changing events are getting closer and vertical, showing us a new vision of time and the future. Scenario Building is a widely used method in design to generate future visions. By applying a systemic lens to this methodology, this paper aims to provide a new awareness through which it can emphasise the relationships that a new future implies and underlies. The analysis has made it possible to define new characteristics of Scenario Building that emphasise its relationships and spatio-temporal connections. These new considerations converge in the Design for Sustainability Transitions perspective, showing how the designer, thanks to the connections capacity and envisioning, plays a crucial role in transforming a socio-technical system (Ceschin & Gaziulusoy, 2019).

Author keywords

Systemic Design; Scenario Building; Design for Sustainability Transitions; Sustainability.

Introduction

In recent years the world has been facing significant systematic complex challenges such as climate change, inequities, and lack of natural resources heightened especially because of the Covid-19 pandemic, the conflict in Ukraine, and the climate crisis. The nature of these problems is multidimensional, and because of this, they will become increasingly inter-

twined and interdependent in the next years. Moreover, when placed on a timeline, these events show a shattering peculiarity that lies on a new vision of time and future that is not spread out linearly but is increasingly rhythmic and vertical, showing shorter and closer time gaps. As a result, many academics and industry professionals are looking at novel models that employ design skills, techniques, and expertise to inspire futuristic ideas and creative solutions. Consequently, in a world where the future is constantly crumbling and getting closer and closer, what are the new parameters to be considered? And yet, what contribution can Systemic Design make in this challenging task to be able to act concretely in the short-term with a long-term impact?

Using a systemic lens, this paper seeks to offer an overview of the tools and processes related to Scenario Building techniques. The paper initially analyse a theoretical background that explores the conceptual pillars of the three topics addressed: Scenario Building, Systemic Design and Design for Sustainability Transitions. Subsequently, the methodology implemented to analyse Scenario Building techniques through a systemic lens is shown. Insights from the analysis are reported in the last part of the paper highlighting a new perspective of Scenario Building, which is more relational, contextual and ecosystemic. Finally, limitations and opportunities are reported to foster further and subsequent research questions.

Theoretical background

Scenario building

Scenario Building is one of the most popular methods for defining possible futures. It is based on the fundamental scenario concept, often considered a synonym for vision (Carella & Marengoni, 2022). Historically, the first text on this methodology dates back to the 19th century, however, they spread from the Second World War onwards, moving from the military to the public and finally into the private sphere (Bradfield et al., 2005; von Reibnitz, 1988). Since they deal with the future, scenarios fall within the discipline of Future Studies (also known as futures field or foresight), i.e. the systematic study of possible, probable and preferable futures (Carella & Marengoni, 2022). Scenarios are considered the archetypal products of the discipline and are condensed representa-

tions of possible futures with different plausible paths and endings, told in coherent and engaging forms (Bishop et al., 2007; Buehring & Bishop, 2020). These contain a vast amount of information on a single topic that is useful in defining a historical, social, cultural, manufacturing, technological and environmental context, thus composing the points of view, relationships and flows between the elements (Bistagnino, 2009). Thus, scenarios require a comprehensive look, where the present is a fundamental part, to provide a holistic schematic view of futures that are not only possible but also desirable (Sardesai et al., 2021). The capability of the designer is to use the vast amount of information to create narratives that are open, interpretable, and exciting, yet concrete and palpable. A correct balance of technical feasibility, economic viability, and desirability (Zurlo et al., 2020). This is also thanks to the designer's freedom and ability to observe multiple levels, understood as different dimensional scales (from product to systems) and different times and insights. Design is, therefore, a carrier of values and beliefs, but also tools and methods capable of helping those who make strategic decisions in uncertain times. In particular, Strategic Design can confront this uncertainty, defining strategic directions through scenarios and glimpsing opportunities in the external environment (Zurlo et al., 2020). Here is possible to find a common goal between design disciplines and foresight; both seek to make sense of uncertain futures through scenarios, inspiring and communicating possible (better) futures (Buehring & Bishop, 2020). The role of the designer in scenario building is also to act both as a facilitator in the realisation of scenarios and as a mediator in defining the steps to reach these futures (Gaziulusoy & Ryan, 2017). Scenario development for designers can be a means for both stakeholder engagement, realisation of strategic pathways and alternative systems for sustainable transition (Gaziulusoy & Oztekin, 2019).

Systemic design

In the previous paragraph a strong need emerged for interconnections and relationships between events, people, and phenomena, all essential elements of systems thinking and Systemic Design. The latter stems from the opportunity to integrate systems thinking theory into design through the three levels of sustainability: environmental, social, and economic (Barbero & Pereno, 2020; van der Bijl-Brouwer & Malcolm, 2020). Systems thinking emerged about 100 years ago and is based on the axiom that the *"whole is much more than the sum of its parts"* (van der Bijl-Brouwer & Malcolm, 2020). Systemic Design (or System-Oriented Design) has been formalised by Luigi Bistagnino in 2009 as a local economic model based on networks of relationships capable of exploiting the waste of one production system into resources for another. It is a design approach inspired by natural models, where resources are never wasted, but with a relational and territorial focus typical of industrial ecology (Ceschin & Gaziulusoy, 2019). Because of this, the goal of Systemic Design is not only to design products, but rather complex industrial systems where flows of energy and matter never become waste and damage the environment but are metabolised, reducing environmental impact and creating new economic opportunities (Barbero & Toso, 2010; Bistagnino & Campagnaro, 2014). Although similarities can be made with other design approaches, such as System Design, Service Design or Life-Cycle Design, Systemic Design differs in terms of scale,

complex social systems, and integration (Jones, 2020). The Systemic Design approach, however, calls for capabilities from the designer that are also recurrent in other approaches, such as his strong relational and mediation skills, or his ability to grasp causal relationships between different elements (Barbero & Cozzo, 2009; Bistagnino & Campagnaro, 2014). Visualisation skills are also recurrent, necessary to trace and communicate the flows and relationships between actors and the system context (Mosca et al., 2015). The designer is assisted by methods and tools that have emerged in the last decade to support the practical application of Systemic Design. Namahn, in collaboration with shiftN, SDA, MaRS have developed the Systemic Design toolkit to guide the designer (van Ael et al., 2019). The toolkit consists of several frameworks and templates, which guide the designer step by step, from analysing the system to fostering the transition.

Design for Sustainability Transitions

It is important to emphasise the topic of transition since this represents the meeting point of both Scenario Building and Systemic Design. The former, as previously mentioned, aims to imagine the future to define new products, services, and strategies; the latter triggers a change, a transition from one state to another, of a territory or a community. Design for Sustainability Transitions (DfST) or Transition Design focuses on the transformation of socio-technical systems by promoting technological, social, organisational and institutional innovation (Ceschin & Gaziulusoy, 2019). The transformations that DfST aims to promote are *de facto* systemic changes affecting both production and consumption systems, as well as social systems, through a change in institutions, organisations, socio-cultural constructs and technology (Geels, 2005; Loorbach, 2010). However, technology is not seen as a unique and pre-determined means through which these changes can be achieved, but rather as a system element supporting the transition. Such complexity is often associated with wicked problems, i.e. ill-defined, political and systemic problems (Rittel & Webber, 1973). Designers, and strategic design are used to tackle such problems by analysing them, re-framing, looking ahead and proposing innovative solutions (Zurlo, 2022). Transitions are achieved by promoting long-term visions and transition pathways with step-forwards and step-backs made of materials, products, services, new behaviours and new policies necessary to achieve the imagined futures (Ceschin & Gaziulusoy, 2019). Indeed, transitions need to imagine new futures. Still, they also need new configurations of actors, new systems, but also facilitators of participatory processes and strategic decision-making (Gaziulusoy & Ryan, 2017). We can conclude that DfST frames Scenario Building and Systemic Design in a transformational perspective, giving them a clear direction and not just absorbing their methods and tools. Since DfST is a young approach, it is necessary to consolidate and clarify its theoretical foundations, initiating a dialogue with real experiences in which methods and tools are applied and possibly adapted to different contexts and situations.

Methodology

The aim of this paper is to identify the contribution of Systemic Design in introducing new parameters to lead the Scenario Building methodology toward a sustainable transition perspective. Therefore, an exploratory case study methodol-

ogy was planned, in order to obtain insights from real experiences and best practices.

Empirical setting

Six cases that apply the Scenario Building methodology has been identified to be analysed trough a systemic lens. We selected and identified the cases according to the following parameters:

» Cases with different time horizons (short, mid and long term);
» Cases in which the application of Scenario Building has different objectives (reading a phenomenon, identifying strategic directions, defining project briefs ...)
» Cases that have had a real potential fallout/impact.

The case studies differ in the trigger of the process, but all address concrete problems faced mainly by organization of the secondary and third sector from different industries.

Data collection

We conducted semi-structured interviews to get first-hand data with senior design researchers, responsible and actively involved in the design research and Scenario Building activities of the analysed case studies. Each interview lasted on an average of 1 hour. We applied a research protocol structured in four main sections:

» **General information:** aims at collecting information on the project typology, content, aim, time horizon, people involved (quantity and professional background);
» **Scenario Building process:** aim at understanding activity conducted in the research phase (typologies and relevance in the process), and in the scenario generation phase (format, people involved, output);
» **Results and Impact:** aim at understanding the Scenario results, their usage and impact (realization, adoption and feasibility), if measurable;
» **Self-assessment:** aim at understanding pro and cons of the process adopted and what could be changed.

Data analysis

Based on the interviews, factual elements were examined with the aim of identifying commonalities and differences in the use of Scenario Building. More specifically, data were clustered according to the following variables:

» **Client typology**, to highlight the different sectors and company typologies commissioning the project, if any;
» **Content**, to analyse the territorial, socio-economic and sectoral variables that define the context in which the scenario is to be set;
» **Time**, to identify the time horizon of each case study;
» **Format**, to highlight the different ways in which the process is conducted;
» **Participant typology**, to identify the variety of people involved in the process;
» **Journey**, to analyse the sequence of the different actions performed during the process;
» **Research activities**, to highlight the different research activities conducted and understand their role in the process;
» **Involvement of experts**, if any, to identify when they were involved and in what role;
» **Output**, to examine the variety of formats in which a scenario is delivered;
» **Outcome**, to investigate how the scenario's results are used;
» **Impact**, to verify the impact of the scenarios in terms of fulfilment and feasibility.

Then we searched for regularities and patterns, trying to understand which of the above variables had a greater role and weight in the Scenario Building process and its realisation. Finally, we looked at the variables used to analyse the Scenario Building process through a systemic lens, to understand whether Systemic Design can help turn Scenario Building into a tool for the sustainable transition. To do this, we studied a number of Systemic Design toolkits, in particular the Social Ecosystem Map developed by Namahn and shiftN in 2016, to understand the different levels of an ecosystem and its importance in the systemic approach as opposed to that in the Scenario Building process, where context is usually considered one of the elements to be observed in the definition of a user-centred vision. With the toolkit, we began analysing the Scenario Building process of the selected cases by observing whether the different levels of the ecosystem had been considered within the research phase and whether the impact of the scenarios on the different levels of the ecosystem had been reached.

Results & discussion

Thanks to the literature review and the analysis, it was possible to recognise and highlight patterns and reflections with Scenario Building and Systemic Design as their common point (Fig.1). Before exploring the outcomes of this research, it is necessary to cluster the results that emerged into two macro groups, those relating to the process of Scenario Building and those relating to its context. Regarding the former, it was interesting to note how the various research phases are fundamental to creating a solid base of work and envisioning capabilities. It is a common and consolidated practice to perform at the beginning of the Scenario Building methodology an initial research that allows the researchers or designers to grasp the conditions of the context of the users that characterise the background in which the project will be placed. This is done mainly through PEST analysis (political, economic, social, and technological) and user research. The former is that desk research activity that allows the participants to gather data regarding the context by extrapolating socio-cultural and technological trends, giving a snapshot as both a starting and ending point of the market, society, and context. Within this research category, it is possible to find blue sky research, trend, and mega trend research. The exploratory case study analysis showed how those trends, whether inspirational or innovative, strongly linked to the imposed time frame allow the designers or researchers to make the subsequent envisioning work truly feasible. On the other hand, the user research makes it possible to collect qualitative and quantitative data on the user under consideration. In the case studies with the most significant impact, it is possible to see how user research offers a more excellent systemic vision of the context where the analysis focuses not only on the user, but on the entire ecosystem of actors surrounding him. This means identifying, investigating, synthesising, and visualising not only the latent or non-latent needs of the user but the re-

lationships that exist in the context as an ecosystem of actors, actions, and touchpoints.

Figure 1. Pathway of research and analysis of Scenario Building towards sustainable transition through the systemic lens. The contribution of this work of revision, analysis and updating of the Scenario Building methodology, therefore, sees the importance of the research phase not as a critical and superfluous step offering volatile hints without a possibility of concreteness; indeed, it is a fundamental phase, especially if spread throughout the process and not just its initial steps, because it empowers the scenario researcher or designer, creating awareness and helpful knowledge to make the scenario real, be it in the short, medium or long term. Just as the system is increasingly recognised as a living ecology that grows, declines, changes, and evolves (Sevaldson, 2022; Walker et al., 2004) the scenario has indeed similar intrinsic peculiarities. Even more revealing is the fact that a new awareness of Scenario Building towards sustainable transition has emerged from this analysis, namely the realisation that the scenario is not a static snapshot of something to be achieved, but is a dynamic ecosystem of actors, relationships, and actions in constant evolution. In recent years, scholars and practitioners have been able to verify and agree on how reality is increasingly showing its complexity and how systemic and strategic skills are increasingly valuable for visualising, anticipating, and dealing with these complex realities or systems. The complexity lies in the network of relationships between different actors, actions, and touchpoints, which inevitably imply new research and design methods. And it is here that Systemic Design comes into play, the encounter between systems thinking and design thinking, skills that are useful for grasping the nodes and edges of every system, be it micro, meso or macro, ranging from the individual to society to the environment and so on. It is no coincidence that new design trends incite us to think and consider non-humans as well, both for the benefit of humanity and the entire planet. Therefore, it has become necessary to try to grasp those patterns useful for building dynamic ecosystem scenarios, capable of affecting and intervening both the small to the large and vice versa. In order to aspire to a sustainable transition, it is necessary to research, ideate and implement this new awareness that the scenario is a dynamic ecosystem based on two fundamental characteristics and dimensions:

1. **Scenario as a set of contextual relationships:** that considers the entire network of actors and relationships that exist in its given context.
2. **Scenario as a spatio-temporal ecosystem:** that considers its positioning and evolution in a spatio-temporal dimension.

An example that can be briefly reported is one carried out in collaboration with a prefab house manufacturer in southern Italy, performed in 2018, with a two-year time horizon. The process saw an initial research phase followed by the brief reframing and then the development of scenarios, presented through cards with visual stimuli, and possible design directions. The scenarios stimulated the company's designers in the realisation of a modular and reusable product, later launched on the market. The analysis phase focused on the ecosystem of actors and stakeholders, looking at their needs, socio-cultural and value context, as well as the market, the brand partner and blue-sky stimuli. As previously mentioned, this information highlighted the network of actors and their relationships, not only understood as exchanges of money, information or goods, bringing out critical points and possibilities (scenario as a set of contextual relationship). It also highlighted possible changes in time and space of the actors, context and relationship giving the possibility to imagine their evolution in an organic sense (scenario a spatio-temporal ecosystem).

The new characteristics presented must be considered throughout the entire scenario process, especially in its implementation. This awareness should therefore contribute to a strategic plan of sense and purpose to make the scenario viable, feasible and sustainable aware.

Conclusion

Through the systemic lens, it was possible to highlight how the scenario is inherently relation-based and a spatio-temporal ecosystem. In this new interpretation, scenarios are seen as dynamic systems, changing in time and space. Scenario analysis and development with this in mind should allow companies, organisations, institutions, and communities to be guided through a sustainable transition, connecting the needs of today with those of tomorrow, avoiding blind spots. Such awareness opens further research opportunities. First of all, it is important to ask whether the skills and capabilities of today's designers are adequate to deal with the complexity that a systemic scenario requires, and if so, which of these
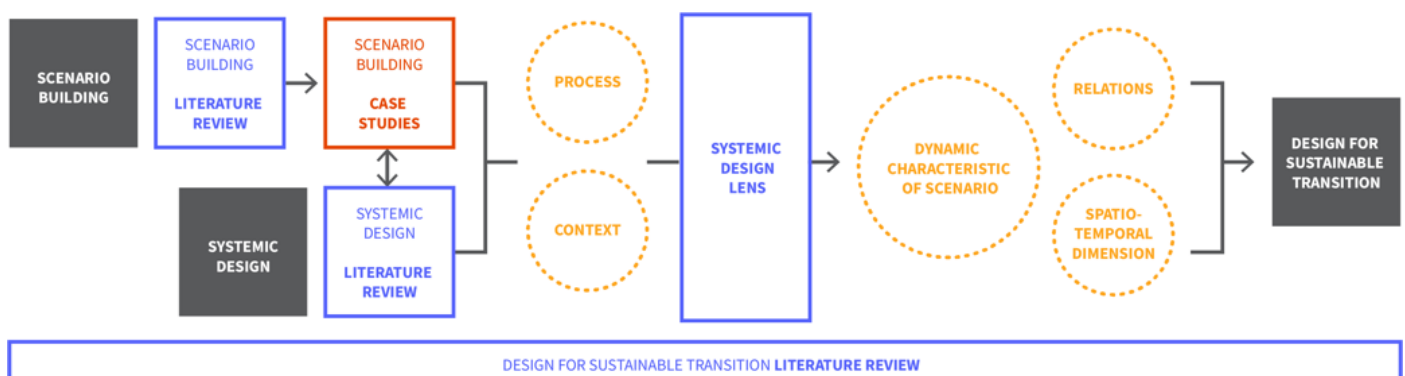

Figure 1. Pathway of research and analysis of Scenario Building towards sustainable transition through the systemic lens.

should be implemented. Furthermore, it would be interesting to understand whether the tools used for Scenario Building support or limit such systemic vision, both in research, scenario development and narration. If necessary, it might be interesting to develop new ones. This aspect can also be interpreted as a limitation of this research, since a systematic analysis of the tools might bring out new considerations. The tools connect us to a more participative and actionable dimension, so a further opportunity could be to test scenario development from a systemic perspective with organisations and company figures. This allows to understand how these concepts fit into organisational strategic and operational terms and how non-academic figures react to such complexity. To conclude, from a field-testing perspective, it would be interesting to understand if and how this perspective allows for the strengthening or creation of new relationships between different stakeholders to foster collaboration and implementation towards increasingly complex objectives and the sustainable transition of socio-technical systems.

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